Commentary to appear in *Neuro-Psychoanalysis*; please do not quote without the authors' permission.

A Behavioral Systems Perspective on Romantic Love

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In this commentary, we consider two pivotal issues in Yovell's (2008) article, examining them through the lens of Bowlby's (1982, 1973, 1980) attachment theory and our own conceptualization of the activation and functioning of what Bowlby (1982) called "behavioral systems" in adulthood (Mikulincer & Shaver, 2003, 2007; Shaver & Mikulincer, 2002, 2007). We begin by questioning the need for a "drive" concept in explanations of human motivation and behavior, and by explaining why we rely instead on Bowlby's (1982) alternative conceptualization of human motives in terms of behavioral systems. Second, we deal with the concept of romantic love and Yovell's question (restated in our terms) about the number of behavioral systems involved in this cross-culturally universal and highly engaging emotional experience. We follow Bowlby (1982) in emphasizing three behavioral systems – attachment, caregiving, and sex – and show how individual differences in the activation and dynamics of these systems result in different cognitive, emotional, and behavioral configurations of romantic love.

We leave to others the task of searching for neural correlates of the kinds of love that can be identified and delineated at the level of mind and behavior. In our opinion (and the opinion of a leading contemporary biologist: Mayr, 2007), there is no way to move unidirectionally from the neural level up to the psychological level. It would be especially difficult to do so if one began with a generic construct like "psychic energy," for which there is not likely to be a neurological analogue or correlate. The so-called "theory of everything" in physics, for which that field is still searching, does not even potentially contain "everything" about genetics or psychology or economics – phenomena that clearly exist at higher conceptual levels. Cross-level integration in science has to proceed largely downward, via reductionism, because phenomena at a higher level of organization cannot generally be predicted, or even imagined, based on phenomena at a lower level. This is why neuroscience is generally looking for and exploring "neural correlates of consciousness" (Koch, 2004; Metzinger, 2000) rather than mental correlates of neurons.

Behavioral Systems Instead of Drives

As Yovell notes, Bowlby was trained as a psychoanalyst but became dissatisfied with the Freudian conception of human motivation based on "drives" and the view of the mind as powered by "psychic energy." In contrast, Bowlby (1982) assumed that behaviors are not usually caused by drives or drive-like "instincts." In his view, a conception of motivation based on thinking first about general drives with no objects, then about intermediate-level drives with vague objects, and then about more specific drives with specific objects – the approach taken by Yovell – is misguided. Questions such as the following are unlikely to yield meaningful answers: "Is there a unique drive for putting your money in a savings account, or is it a product of more primitive drives or instincts?" Or: "Is there a unique drive to sing folk songs, or is singing a product of other drives or instincts?"

When a person wakes up in the morning, his or her behavior is not generally governed by drives, except maybe hunger and the pressure to urinate. And even then, hunger pangs and the pressure to urinate need not be explained in terms of a general source of "energy" that somehow channels itself, through the brainstem, into hunger and urination. Typically a person, awakened by his alarm clock, rambles to the toilet and urinates because of signals from the bladder (or out of habit). He may then eat breakfast either because he is hungry (a feeling based partly on stimuli in the gut and partly on signals from the hypothalamus, as Yovell mentions) or because he has read that a person is healthier and likely to remain thinner if he eats a good breakfast each morning. After breakfast, the person may brush his teeth – another medically advocated health behavior that would not be well conceptualized in terms of a tooth-brushing drive or psychic energy that, while searching for a way to get itself expressed, channels itself into tooth brushing.

According to Bowlby (1982), the working human brain generates goals, cogitates, evaluates, makes decisions, and steers behaviors by its very nature – by its cellular-network structure and its cybernetic organization. It does not need to be powered by libido, a life force, or any such thing; it is powered by glucose, but not by glucose looking for a way to express itself in mentation or behavior. Moreover, the signals that activate goals may come from the body

(Yovell's emphasis) or from the environment or from associative processes within the brain. There is no need to trace every goal to the body or to imagine how the body empowers the brain.

Following the rejection of Freudian metaphors such as drive and psychic energy, Bowlby (1982), who was influenced by scientific and technological developments in the mid-twentieth century – especially control systems theory, cognitive developmental theory, and ethology – created an alternative model of motivation based on the concept of *behavioral systems*. These systems were imagined to be species-universal neural programs that organize an individual's behavior in ways that increase the likelihood of survival and reproduction in the face of environmental threats, demands, and opportunities. Bowlby (1982) viewed these systems as "goal directed" and "goal corrected" – that is, as working like servomechanisms that are turned on by certain internal or environmental demands (such as pain or hearing a scary noise) and terminated by an effective response to these demands (e.g., being held and protected by a sensitive and responsive attachment figure). Responding effectively to these demands – e.g., dealing with threats to life and well-being by relying on what Bowlby (1982) called "stronger, wiser" caregivers, exploring environments and learning how to master them, caring for sexual partners and dependent offspring – resulted in the evolution of distinct but interrelated behavioral systems, each with its own primary functions and characteristic behaviors.

According to Bowlby (1982), a behavioral system governs the choice, activation, and termination of behavioral sequences aimed at attaining particular "set-goals" – states of the person-environment relationship that have adaptive advantages for individual survival and genetic reproduction. The adaptive behavioral sequences are "activated" by certain kinds of stimuli or situations (e.g., unfamiliar sounds or people, darkness, the presence of a growling predator) that make a particular set-goal salient. These sequences are "deactivated" or "terminated" by other stimuli or outcomes that signal attainment of the desired goal state (emotional support or protection, in the case of the attachment system).

An important corollary within this conceptual framework, which differs considerably from Yovell's analysis of Freudian drives, is that "behavior" is functionally defined in terms of

its set-goal. A particular behavior, such as moving physically or psychologically closer to another person, is defined as an attachment behavior if it is intended to secure comfort, protection, or relief from stress. The same action is defined as sexual if it moves a person toward sexual intercourse, and is viewed as part of caregiving if it occurs in the service of comforting a needy or distraught relationship partner. Similarly, the termination of one kind of behavior and the initiation of another are not defined primarily by particular motor or physical events but rather by the seeking or attainment of a particular set-goal.

In addition, and again in contrast to Yovell's analysis of Freudian drives, Bowlby assumed that a person's mental processes – for example, his or her hierarchy of set-goals and the chronic and contextual accessibility of a particular set-goal – govern the activation and termination of particular behavioral sequences. Moreover, the psychological meaning of a motor or perceptual act is determined by the intrapsychic state that organizes and governs it. However, this does not mean that behavior does not influence mental processes. For example, moving physically closer to a relationship partner and being comforted often feels good, enhances security, reduces the emphasis on security seeking, and allows other goals and mental states to arise and guide behavior. Moreover, repeated failures of intentional actions (such as proximity seeking) to attain their set-goal (e.g., protection and security) changes the attachment system's goal structure, along with the cognitions and emotions that accompany and guide the system's functioning.

In sum, Bowlby's (1982) theory renders unnecessary the Freudian concepts of drive and psychic energy, which were presumably influenced by Freud's understanding of 19th century physics – a common kind of importation of physics (billiard ball causality, "psychic energy," and a "psychic apparatus") into psychology that is no longer necessary, given the huge advances in biology since Freud's time. (Contemporary molecular geneticists do not generally look for sources of "energy" that empower cells except for glucose. And the glucose is used to power genetic machinery; it does not flow around in the body seeking a way to be expressed.)

Bowlby (1982) did not assume that goal-directed and -corrected behaviors are activated by an accumulation of psychic energy or an unconscious desire to reduce the level of psychic energy to zero. Moreover, as conceptualized by attachment theory, a person does not experience, over time, an increasing need for attachment or become subject over time to an increasing drive for attachment. Instead of viewing behavior as forced into expression by fluid drives that must be channeled or repressed, Bowlby (1982) proposed that behavior is activated by conditions within a person or the person's environment that make a certain goal salient. This prominent goal then activates a behavioral system that is organized, or programmed, to seek that goal. The termination of a behavioral sequence is viewed in Bowlby's theory as a result of set-goal attainment or of one behavioral system being overridden by another that has gained priority at a particular time. For example, when an infant encounters what Bowlby (1982) called "natural clues of danger" (e.g., unexpected noises, an approaching stranger, sudden darkness), he or she terminates whatever activity is in progress (e.g., an exploratory activity such as playing with new toys) and attempts to gain physical proximity to a caregiver. If the caregiver provides adequate protection and comfort, the infant typically becomes interested again in exploratory play, in which case he or she may signal, directly or indirectly, to be put down amidst available toys (Ainsworth, Blehar, Waters, & Wall, 1978).

Bretherton (1992) explained as follows the differences between Bowlby's conception of behavioral systems and the Freudian view of instincts:

> Behaviors regulated by such systems need not be rigidly innate, but – depending on the organism – can adapt in greater or lesser degrees to changes in environmental circumstances, provided these do not deviate too much from the organism's environment of evolutionary adaptedness. Such flexible organisms pay a price, however, because adaptable behavioral systems can be more easily subverted from their optimal path of development. For humans, Bowlby speculates, the environment of evolutionary adaptedness probably resembled that of present-day hunter-gatherer societies. (p. 766)

As suggested in this quotation from Bretherton, another feature of Bowlby's conception of behavioral systems, which further distinguishes it from Yovell's analysis of Freudian drives, is that these flexible systems include learned elements that reflect a person's history of behavioral-system activation in particular contexts. Although behavioral systems are initially innate and presumably operate mechanistically at a subcortical level, their ability to achieve desired set-goals depends on the extent to which their operational parameters can be adjusted to fit with contextual affordances and demands. One of Bowlby's (1982) most important observations, which increased his confidence in the notion of "goal-corrected" rather than merely "driven" behavior, is that particular behavioral sequences often get altered to put a person, even an infant, back on the track of goal attainment. Bowlby assumed that actual behaviors and the experiences that result from them can alter both future behaviors and mental states. That is, behavioral systems involve self-regulatory feedback loops that shape the systems' strategies and influence whether a person persists in or disengages from these strategies after discovering that they fail under certain conditions.

Over time, after operating repeatedly in the same social environment (e.g., in interactions with a primary caregiver or other emotionally significant relationship partners), a person's behavioral systems become molded so that their neural and behavioral subroutines fit better with relational constraints and environmental demands. According to Bowlby (1973), the residues of such experiences are stored in mental representations of person-environment transactions (*working models of self and others)*, which organize memories of behavioral system functioning and guide future attempts to attain a behavioral system's set-goal. These representations, which operate partly unconsciously and partly consciously (Shaver & Mikulincer, 2002), become integral components of a behavioral system's programming and are responsible for both differences between individuals and within-person continuity over time.

The introduction of reciprocal relations between working models, goal-oriented behaviors, and perceptions of the results of behaviors allows us to see how a behavioral system's goals, strategies, and cognitive parameters can result in still more differentiated goals and

strategies and create individual differences in the activation and functioning of behavioral systems. If the primary strategy of a behavioral system repeatedly results in the attainment of its set-goal (e.g., gaining protection and comfort by seeking proximity to a relationship partner), the working models that get constructed correspond well with the normative functioning of the system (e.g., “When I encounter difficulties, I can call on my attachment figure for comfort and support, and I will then feel better and go back to other activities with a renewed sense of confidence”). This kind of working model, or script (Waters & Waters, 2006), helps to activate and organize the primary attachment strategy (optimistic proximity seeking) whenever the system’s set-goal becomes salient.

However, if the primary strategy repeatedly fails to attain its set-goal, the resulting working models will alter the system’s strategies and some of its goals (e.g., “When I try to rely on others, they are unreliable or outright punishing”). For example, a person may become overly vigilant, intrusive, and hysterical (i.e., anxious with respect to attachment) or, in contrast, wary about relying on relationship partners, emotionally closed to them, and rigidly committed to self-sufficiency (i.e., avoidant with respect to attachment). As a result, these changes in strategies and goals can result in different configurations of cognitions, emotions, and behavior in relational contexts and shape the subjective construal of specific emotional bonds, including romantic love.

Taking Bowlby’s theory seriously, and considering its similarity to other contemporary theories of motivation based on the concept of conscious and unconscious goals, goal hierarchies, and goal conflicts (see, for example, many of the chapters in recent anthologies on the psychology of motivation: Elliot & Dweck, 2005; Shah & Gardner, 2007), we conclude that science does not need drives or psychic energy to explain romantic love. Rather, the main question is: “Which behavioral systems are involved in romantic love and how do they combine to create and maintain romantic feelings and, in many cases, an affectional or attachment bond?” One need not ask, with Yovell, ”Is there a unique drive or instinct for romantic love, or is it a product of other drives or instincts, none of which is unique to it?” In the next section, we offer a brief summary of our own conceptualization of romantic love in terms of behavioral systems.

The Dynamics of Romantic Love: Attachment, Caregiving, and Sex

In the late 1980s, Shaver and his coauthors (Hazan & Shaver, 1987; Shaver & Hazan, 1988; Shaver, Hazan, & Bradshaw, 1988) extended Bowlby's theory, which was designed to characterize human infants' love for and attachment to their caregivers, to the study of romantic love and adult couple relationships. According to this extended theory, which has been extensively tested (see Mikulincer & Goodman, 2006, and Mikulincer & Shaver, 2007, for comprehensive reviews), romantic relationships involve a combination or confluence of three behavioral systems: attachment, caregiving, and sex. Each of these behavioral systems has its own evolutionary functions, and although the systems affect each other in various ways, they are conceptualized as functionally distinct. Moreover, individual differences in the functioning of the three systems lead to differing configurations of romantic love experiences and romantic relationships.

Whereas the optimal functioning of the attachment, caregiving, and sexual systems facilitates the formation and maintenance of stable and mutually satisfactory affectional bonds, the malfunctioning of these systems creates relational tensions, conflicts, dissatisfaction, and instability, and often leads to relationship breakup. Shaver et al. (1988) also suggested that relational, social-interactional factors also contribute to the functioning of the three behavioral systems (e.g., signals of a partner's waning interest), and that the dynamic interplay of these behavioral systems within a relationship is crucial for understanding how people experience and construe romantic love.

Because Hazan and Shaver's (1987) initial studies of romantic love focused mainly on the conceptualization and assessment of individual differences in attachment, researchers subsequently conducted many studies focused on these individual differences, without paying much attention to the functioning of the other behavioral systems – sex and caregiving – involved in romantic love. More recently this imbalance has begun to be corrected, and more studies have examined relations between the attachment and caregiving systems and between the attachment and sexual systems (see Mikulincer & Shaver, 2007, for an extensive review; also see

recent experimental studies, such as those by Gillath, Mikulincer, Birnbaum, & Shaver, 2008). In the following sections, we present a brief overview of the operating parameters of the attachment, caregiving, and sexual behavioral systems and review what we have learned so far about the interplay of the three systems within romantic relationships.

The Attachment Behavioral System

As mentioned by Yovell, the presumed biological function of the attachment system is to protect a person from danger by assuring that he or she maintains proximity to caring and supportive others (*attachment figures*). The goal of the system is objective protection or support and the concomitant subjective sense of safety or security. When a person encounters actual or symbolic threats and notices that an attachment figure is not sufficiently near, interested, or responsive, the attachment system is activated and the individual is driven to seek and reestablish actual or symbolic proximity to an external or internalized attachment figure (the system's primary strategy) until the set-goal of felt security is attained. Although the effects of attachment-system activation are most easily observed during infancy, the system continues to function throughout life, as indicated by adults' needs for proximity, support, and security (Hazan & Zeifman, 1999; Zeifman & Hazan, 2008).

Smooth functioning of the attachment system requires that an attachment figure be available in times of need, sensitive and responsive to the individual's bids for proximity, and effective in alleviating the individual's distress. Such positive interactions promote an inner sense of attachment security (based on expectations that key people will be available and supportive in times of need) and lead to the consolidation of optimistic beliefs about distress management; faith in others' goodwill; a sense of being loved, esteemed, understood, and accepted by relationship partners; and a sense of self-efficacy with respect to gaining proximity to a loving partner when support is needed.

When a person's attachment figures are not reliably available and supportive, a sense of attachment security is not attained and the distress that activated the system is compounded by doubts and fears about the feasibility of attaining a sense of security. In addition, emotionally

negative attachment interactions indicate that the primary attachment strategy, proximity and support seeking, have to be replaced by either hyperactivating or deactivating strategies. Hyperactivation of the attachment system is manifested in energetic, insistent attempts to induce a relationship partner, viewed as insufficiently available or responsive, to pay attention and provide care and support. The strategies include clinging and controlling responses, cognitive and behavioral efforts to establish not only physical contact but also perceived self-other similarity and 'oneness', and overdependence on relationship partners as a source of protection (Shaver & Mikulincer, 2002). Hyperactivation keeps the attachment system chronically activated, constantly on the alert for threats, separations, and betrayals, thereby exacerbating relational distress and conflicts (Mikulincer & Shaver, 2003).

Deactivation of the attachment system includes inhibition of proximity seeking and cultivation of what Bowlby (1980) called "compulsive self-reliance" and "detachment." These strategies include denial of attachment needs; avoidance of closeness, intimacy, and dependence in close relationships; maximization of cognitive, emotional, and physical distance from others; and striving for self-reliance and independence (Mikulincer & Shaver, 2007; Shaver & Mikulincer, 2002). They also involve active inattention to threatening events and personal vulnerabilities as well as inhibition and suppression of thoughts and memories that evoke distress and feelings of vulnerability, because such thoughts can cause unwanted activation of the attachment system which the person believes will not result in desirable outcomes (Mikulincer & Shaver, 2007).

These individual differences in the functioning of the attachment system can be operationalized in a two-dimensional space (e.g., Brennan, Clark, & Shaver, 1998; Fraley & Shaver, 2000). The first dimension, attachment-related *avoidance*, reflects the extent to which a person distrusts relationship partners' goodwill, deactivates the attachment system, and strives to maintain behavioral independence and emotional distance from partners. The second dimension, attachment-related *anxiety*, reflects the degree to which a person worries that a partner will not be available in times of need and engages in hyperactivating strategies. People who score low on

both dimensions are said to be secure or securely attached. The two dimensions can be measured with reliable and valid self-report scales, such as the Experiences in Close Relationships inventory (ECR; Brennan et al., 1998), and are associated in theoretically predictable ways with affect regulation, self-esteem, psychological well-being, and interpersonal functioning (see Mikulincer & Shaver, 2007, 2008, for reviews).

As Yovell explained, the attachment system is an integral part of romantic love and one of the core components of romantic relationships. Whereas in infancy, the main sources of support and protection are the primary caregivers, romantic partners typically become the most important attachment figures in adulthood, such that proximity maintenance to these partners in times of need becomes a crucial source of support, comfort, and reassurance (e.g., Fraley & Davis, 1997; Hazan & Zeifman, 1999; Zeifman & Hazan, 2008). However, not every romantic partner immediately becomes a major attachment figure. In fact, the transformation of a romantic partner into an attachment figure is a gradual process that depends on the extent to which the person functions as (a) a target for proximity seeking; (b) a source of protection, comfort, support, and relief in times of need (a "*safe haven*" in attachment theory's terms*)*; and (c) a "*secure base*," encouraging the individual pursue his or her goals in a safe relational context (e.g., Ainsworth, 1991; Hazan & Shaver, 1994; Zeifman & Hazan, 2008). These three functions are mainly found in long-lasting, highly committed dyadic relationships.

Moreover, Shaver et al. (1988) proposed that romantic love in adulthood is conceptually parallel to infants' emotional bonds with their primary caregivers. Love in both infancy and adulthood includes prolonged, intense eye contact, holding, touching, caressing, smiling, crying, clinging; a desire to be comforted by the relationship partner when distressed; the experience of anger, anxiety, and sorrow following separation or loss; and the experience of happiness and joy upon reunion. Moreover, formation of a secure relationship with either a primary caregiver or a romantic partner depends on the caregiver/partner's sensitivity and responsiveness to the increasingly attached person's proximity bids, and this responsiveness causes the person to feel more confident and safe, happier, more outgoing, and kinder to others. Furthermore, in both

kinds of relationships, when the partner is not available and not responsive to the person's proximity bids, the person can become anxious, preoccupied, and hypersensitive to signs of love or its absence, to approval or rejection. Separations or non-responsiveness up to a point can increase the intensity of both an infant's and an adult's proximity-seeking behavior, but beyond some point they can lead to defensive distancing from the partner so as to avoid the pain and distress caused by the frustrating relationship. All of these parallels led Shaver et al. (1988) to conclude that infants' bonds with parents and romantic love in adulthood are variants of the activation of the attachment behavioral system.

When one person "falls in love" with another, in cases where secure attachment is the main or most salient goal, the process of "falling" usually includes fantasies about being taken care of, becoming less lonely and needy, having someone to rely on, and so forth. This feeling may or may not be tinged with sexuality, and may or may not require the "attachment figure's" actual presence (it can happen, for example, with imagined religious figures [Granqvist & Kirkpatrick, 2008] and media celebrities [e.g., Giles & Maltby, 2004]). In a classic and still very interesting study, Bell (1902; see also Hatfield, Schmitz, Cornelius, & Rapson, 1988) found that many children had crushes on their teachers or peers that seemed to be more motivated by a desire for proximity to and responsive treatment by the partner than by anything that a modern-day psychologist would call "libido." Hatfield, Brinton, and Cornelius (1989) found that anxiety is related to this kind of love, as we would expect if the attachment system and an anxious orientation to attachment are involved.

The Caregiving Behavioral System

Yovell views the formation of intimate emotional bonds within romantic relationships as a function of the activation of the attachment behavioral system. However, these bonds also depend on the activation and functioning of what Bowlby (1982) called the caregiving behavioral system, something Yovell does not consider. According to Bowlby (1982), the caregiving system evolved biologically to provide protection and support to others who are either chronically dependent or temporarily in need. When functioning optimally, its goal is altruistic,

and it responds to signals of need emitted by another person's attachment system. The set-goal of the caregiving system is the reduction of another person's suffering or the fostering of another person's exploration, growth, and development. The primary strategy for achieving these goals is to adopt what Batson (1991, in press) called an empathic attitude – for example, taking the perspective of a relationship partner in order to sensitively and effectively help the partner reduce distress or encourage positive growth and development. The caregiving system is focused on another person's welfare and therefore directs attention to the other's needs, wishes, emotions, and intentions.

In the realm of romantic relationships, one partner's caregiving system can be automatically activated by the other partner's attachment behaviors or signals of need, and the goal is to alter the needy partner's condition until signs of increased safety, well-being, and security are evident. Therefore, if the attachment system is active within romantic relationships and crucial for the formation of romantic love, the caregiving system should also be active within romantic bonds and contribute to the formation and maintenance of satisfying relationships, as has been shown in numerous empirical studies (Collins, Guichard, Ford, Kane, & Feeney, in press). That is, when one's romantic partner is in need, one tends to become a source of security for him or her and a provider of care, support, and comfort. In these moments, the activation and appropriate functioning of the caregiving behavioral system is important for the quality of the relationship and the further consolidation of romantic love. Moreover, one aspect of "falling in love" can be wishing intensely to nurture a particular potential partner, soothe the partner's distress, and promote the partner's attainment of personally important goals. This feeling is a natural part of mentoring and psychotherapy, and for this reason most professionals need to be taught not to allow it to become full-blown romantic love for a student or therapy client.

Smooth functioning of the caregiving system depends on an individual's ability and willingness to help a needy partner empathically and effectively, but also on the partner's responsiveness to the individual's caregiving bids. These positive interactions promote in the caregiver an inner sense of what Erikson (1950) called "generativity" – a sense that one is more

than an encapsulated self and is able to contribute importantly to others' welfare. It is a truly altruistic, compassionate form of love aimed at alleviating distress and benefiting others. The sense of generativity includes good feelings about oneself as having good qualities and being able to perform good deeds; strong feelings of self-efficacy for being helpful when needed; confidence in one's interpersonal skills; and heightened feelings of love, communion, and connectedness with respect to a relationship partner. It is rewarded by the other person's affection and gratitude, and endorsement and celebration of one's caring qualities.

As in the case of the attachment system, dysfunctions of the caregiving system can trigger either hyperactivating or deactivating strategies. Hyperactivated caregiving strategies are intrusive, poorly timed, and effortful; they are intended to make oneself indispensable to a partner and to assuage one's doubts about being a competent caregiver. These goals can be achieved by exaggerating appraisals of others' needs, adopting a hypervigilant attitude toward others' distress, performing actions aimed at coercing others to accept one's caregiving bids, and focusing on others' needs to the neglect of one's own. Deactivating strategies result in inhibition of empathy and effective caregiving combined with increased interpersonal distance precisely when a partner seeks proximity. In this case, a person is less sensitive and responsive to others' needs, dismiss or downplay others' distress, suppress thoughts related to others' needs and vulnerability, and inhibit sympathy and compassion (for examples see Mikulincer, Shaver, Gillath, & Nitzberg, 2005).

The Sexual Behavioral System

Yovell notes that full-blown romantic love cannot be understood without taking into account the activation and functioning of the sexual behavioral system. From an evolutionary perspective, the major function of the sexual system is to pass one's genes to the next generation by having sexual intercourse with an opposite-sex partner. However, sexual intercourse and impregnation are effortful, goal-oriented activities that demand coordination of two partners' motives and responses. Accordingly, in the course of human evolution, selection pressures have produced subordinate functional behaviors and psychological mechanisms that solve particular

adaptive problems associated with reproduction and reproductive success (Buss & Kenrick, 1998; Gillath et al., 2008). These behaviors and mechanisms are the primary strategies of the sexual behavioral system.

The set-goal of the sexual behavioral system in males is to impregnate an opposite-sex partner in order to pass one's genes to the next generation. The set-goal for females is to attract a sexual partner and achieve impregnation. The key mechanisms for achieving this set-goal include approaching a potential partner, persuading him or her to have sex, and engaging in genital intercourse. That is, the primary strategies of the sexual system consist of being attracted to potentially fertile partners, which requires being sensitive to signals of fertility in opposite-sex partners, increasing one's attractiveness as a potential sexual partner, and using effective persuasive techniques to seduce a potential partner. Viewed from this perspective, sexual attraction is a motivating force that drives individuals to look for either short-term or long-term mating opportunities with a potential sexual partner (Buss, 1999). Of course, its biological set-goal can be blocked by deliberate efforts to avoid conception, just as some of the goals of attachment and caregiving can be blocked by professional training to avoid "counter-transference" and falling in love with therapy clients.

In our view, the sexual system is, at its base, functionally independent of the attachment system. Although long-term romantic relationships typically integrate attachment and sexual feelings and behaviors, the systems themselves have distinct origins, functions, and underpinnings. As noted by Yovell, recent studies of the brain substrates of sexuality and attachment confirm this distinctness. Moreover, sexual relations often occur without affectional bonds; sexual partners do not necessarily function as attachment figures; affectional bonding between adults is not always accompanied by sexual desire (Diamond, 2004, 2008); and the search for safety and security provided by a relationship partner does not automatically transform him or her into a sexual partner. Still, the formation of an affectional bond in long-term romantic relationships is frequently initiated by infatuation and sexual attraction (e.g., Hazan & Zeifman, 1999; Sprecher & Regan, 1998). Moreover, studies of long-term dating and married couples have

shown that either attachment dysfunction or sexual dysfunction can have a powerful effect on the other behavioral system (see Sprecher & Cate, 2004, for a review). In other words, although sexual and attachment behaviors are governed by functionally different systems, the systems still influence each other and contribute jointly to relationship quality and stability, and a natural part of sexual reproduction, in the environments of evolutionary adaptation in which the two behavioral systems arose, might include becoming sufficiently attached so that many sexual partners remained affectionate toward and interested in each other long enough for this to contribute to their offspring's development through the stages of growing teeth and learning to walk and talk (Gillath et al., 2008).

Yovell raises a question about the choice of a specific romantic partner and discusses Fisher, Aron, Mashek, Li, and Brown's (2002) idea that a different behavioral system – attraction – is responsible for this choice. In our view, the explanation of mating choices does not require another construct or imagined behavioral system. Attraction to a specific relationship partner results from the extent to which this partner facilitates the smooth functioning and attainment of the goals of the attachment, sex, and caregiving systems. In other words, human beings feel attracted to partners who can facilitate the attainment of a sense of security, a sense of generativity, and/or a sense of sexual attractiveness, potency, and release. Of course, in choosing partners for short-term relationships, the extent to which a partner is fertile, attractive, and interested in having sex are likely to be important determinants of attraction and mate choice. However, in choosing a partner for a long-term relationship, the extent to which he or she might be a source of security and protection, or an appropriate and rewarding target of caregiving, could also be determinants of attraction. That is, attraction can be understood as a blend of the goals and forces associated with attachment, caregiving, and sex.

Yovell also discusses Fisher et al.'s (2002) idea about the importance of the sexual system in the initial stages of romantic love. However, as we have already mentioned, children can "fall in love" with a teacher or peer without sexuality (at least genital sexuality) having much to do with it, and in long-term adult relationships the sexual system often continues to be an

important part of attraction, accommodation, and satisfaction. There is growing empirical evidence that sexual interactions in which both partners gratify their sexual needs, or achieve their sexual goals, foster positive emotional reactions (love, excitement, vitality, gratitude, and relaxation) and contribute to relationship satisfaction and stability (see Sprecher & Cate, 2004, for a review). In contrast, dysfunctions of the sexual system are major sources of relational conflict which can raise doubts about being loved and loving one's partner, heighten worries and concerns about one's relationship, increase one's interest in alternative sexual partners, and ultimately erode the affectional bond and destroy the relationship (Sprecher & Cate, 2004).

Dysfunctions of the sexual behavioral system, like dysfunctions of the other behavioral systems involved in romantic love, can be conceptualized in terms of hyperactivating and deactivating strategies. Hyperactivating strategies involve effortful, mentally preoccupying, sometimes intrusive, and even coercive attempts to persuade a partner to have sex. In the process, a person can overemphasize the importance of sexual activities within a relationship, exaggerate or bias appraisals of a partner's sexual needs, and adopt a hypervigilant stance toward a partner's signals of sexual arousal, attraction, or rejection. In contrast, deactivating strategies are characterized either by inhibition of sexual desire and an erotophobic, avoidant attitude toward sex or a superficial approach to sex that divorces it from other considerations, such as kindness and intimacy. Deactivating sexual strategies include dismissal of sexual needs, distancing from or disparaging a partner when he or she expresses interest in sex, suppression of sex-related thoughts and fantasies, repression of sex-related memories, and inhibition of sexual arousal and orgasmic joy.

Attachment, Caregiving, and Sex within Romantic Relationships

In our view, individual differences in the attachment, caregiving, and sexual systems are important for understanding romantic love, because their smooth functioning brings relationship partners together, increases physical and emotional closeness, heightens feelings of love and gratitude toward the partner as well as feelings of being loved and esteemed by the partner. Borrowing from Yovell's discussion of Sternberg's (1986) triangular theory of love, optimal

functioning of the three behavioral systems enlarges the area of the "love triangle" by increasing the intensity of its three components – passion, intimacy, and commitment. (This was discussed early in modern theorizing about love by Shaver et al., 1988.) Smooth functioning of the three behavioral systems tends to create feelings of communion, connectedness, and togetherness with a relationship partner, thereby sustaining the "intimacy" component of romantic love. The attachment and caregiving systems strengthen the "commitment" component of romantic love. Positive interactions with a partner who is available and responsive in times of need generate, not only a sense of security but also feelings of gratitude and love toward this sensitive and responsive person, which in turn motivates the secure person to stay in the relationship and commit him- or herself to maintain it and promote the partner's welfare. Moreover, positive interactions in which a person is effective in promoting a partner's welfare strengthen the caregiver's emotional involvement in the relationship as well as his or her feelings of responsibility for the partner's condition, thereby sustaining the "commitment" component of romantic love. The "passion" component of romantic love is closely related to the activation and functioning of the sexual behavioral system, which creates feelings of attraction, arousal, vitality, and excitement within the relationship.

Attachment researchers have been successful in generating a large body of theory-consistent research findings showing that secure attachment is associated with higher levels of relationship stability and satisfaction in both dating and marital relationships (see Mikulincer & Shaver, 2007, for a review). Studies have also linked secure attachment with higher scores on measures of relationship intimacy and commitment as well as relationship-enhancing patterns of emotional reactions to partner behaviors and adaptive strategies of conflict resolution. In the domain of caregiving, evidence is rapidly accumulating that relational episodes in which an individual sensitively attends to and empathically responds to a romantic partner's attachment behaviors and signals of need lead to heightened feelings of intimacy and love and enhanced relationship satisfaction in both the caregiver and his or her partner (e.g., Collins & Feeney, 2000; Feeney & Collins, 2003). There is also growing evidence that sexual interactions in which

both partners gratify their sexual needs contribute to relationship satisfaction and stability and heighten feelings of love (see Sprecher & Cate, 2004).

Dysfunctions of the attachment, caregiving, and sexual systems, viewed in terms of hyperactivation and deactivation, are crucial for understanding pathologies of romantic love, relational tensions and conflicts, and erosion of affectional bonds. For example, in the domain of attachment, hyperactivating strategies lead anxiously attached people to feel chronically frustrated due to their unfulfilled need for demonstrations of their partner's love and support, to catastrophically appraise interpersonal conflicts, to exaggerate relational worries and doubts about a partner's goodwill, and to intensify emotional and behavioral reactions to even minimal signs of a partner's unavailability or disinterest. In the domain of caregiving, failure to respond empathically to a partner's needs and refusal to help the partner alleviate distress can also create relational tensions and conflicts, which can reduce intimacy and commitment and provoke a host of relationship-damaging worries, attitudes, and behaviors. Hyperactivation of the sexual system within a romantic relationship can also have negative effects on romantic love and relationship satisfaction and stability. Chronic sexual-system activation is accompanied by heightened anxieties and worries about one's sexual attractiveness, the extent to which one is able to gratify one's partner, and the partner's responses to one's sexual advances (e.g., Birnbaum & Laser-Brandt, 2002). These anxieties and worries may encourage intrusive or aggressive responses aimed at coercing the partner to have sex, which in turn can heighten the frequency of sex-related conflicts, thereby leading to relationship dissatisfaction, weakening attachment, and reduced caregiving (e.g., Long, Cate, Fehsenfeld, & Williams, 1996).

Dysfunctions in one system can interfere with the smooth operation of the other two systems. For example, high levels of attachment anxiety or avoidance can lead to problems in providing care to needy romantic partners. Specifically, avoidant people, who distance themselves from emotional partners and dismiss signals of need, are less able and willing to feel compassion for a needy partner and less willing to provide care. Anxiously attached people, who seek closeness to romantic partners and are often preoccupied with their own needs, often react

to others' suffering with personal distress rather than empathy, which is likely to produce insensitive, intrusive, ineffective care. Several self-report and observational studies have provided extensive support to these ideas (Mikulincer & Shaver, 2007, in press).

Evidence is also accumulating which shows that attachment processes shape sexual motives, experiences, and behaviors. As compared with insecure people, secure ones (i.e., those who score low on measures of attachment-related anxiety and avoidance) are more motivated to show love for their partner during sex, more open to sexual exploration, more likely to have a positive sexual self-schema, and less likely to experience negative emotions during sexual encounters (Mikulincer & Shaver, 2007). There is also evidence that people scoring high on avoidance are less likely to have and enjoy mutually intimate sex, and are more likely to engage in sex to manipulate or control their partner, protect themselves from the partners' negative feelings, or achieve other non-romantic goals, such as reducing stress or increasing their prestige among their peers. Anxiously attached people tend to use sex as a means of achieving personal reassurance and avoiding abandonment, even when particular sex acts are otherwise unwanted (see Mikulincer & Shaver, 2007, for a review).

Concluding Remarks

We have deliberately steered clear of detailed discussions of neural correlates of attachment, caregiving, and sex, even though there are many relevant studies that could be cited (e.g., studies of the neural correlates of empathy, for example [Hein & Singer, in press]; studies of neural correlates of anxious hyperactivation of attachment-related processes [Gillath, Bunge, Shaver, & Mikulincer, 2005]). In our view, attempting to link neural circuits identified mainly in studies of rodents with kinds of love identified by questionnaires, interviews, and behavioral observation of humans is premature. Many of the circuits identified in this way (e.g., Panksepp's, 1998, SEEKING system) are also involved in other forms of human behavior (curiosity, hunting, gambling), which means that we cannot learn much about human romantic love from beginning with the rodent or human SEEKING system. More work needs to be done at the psychological and behavioral levels so that neuroscientists who use neural imaging techniques with humans (as

reviewed, for example, by Coan, 2008) have identifiable psychological processes for which neural correlates can be sought.

Because human love involves many cognitive as well as limbic processes (e.g., cultural ideals regarding sexually attractive partners; working models of past secure and insecure attachment relationships), and because there are many relevant differences between individuals in what they find attractive, what they fear in close relationships, what they are seeking in the way of opportunities for passion, intimacy, and commitment, it will be difficult to find clear neural correlates of love-related states unless types of love and major individual differences related to love are taken into account. Current neuroimaging studies require very specific research designs in which one variable is manipulated at a time, often using fairly artificial stimuli and situations (while a person reclines in a noisy scanner). These studies can reveal correlates of, say, cognitive perspective taking as distinct from empathic concern (Hein & Singer, in press) or anxious as distinct from non-anxious attachment (Gillath et al., 2005) or successful as distinct from unsuccessful attempts to calm a romantic partner by holding her hand (Coan, Schaefer, & Davidson, 2006), but assembling these findings into an overall conception of love is quite difficult.

Progress along these lines will definitely occur, and we do not mean to disparage early efforts. But we are confident that as progress is made, much of it will require top-down searching, from the psychological to the neurological level, and none of it will entail or benefit from concepts like psychic energy or drives that begin without objects and work to find their way, through increasingly specific channels, into behavioral expression. The mind/brain generates goals, thoughts, images, and feelings by nature. It does not have to be driven by the body or powered by energy other than oxidized glucose. If one chooses to view it as a “psychic apparatus” (Freud’s choice) or cybernetic servomechanism (Bowlby’s choice) it should not hark back to a 19th-century steam engine. Whatever kind of “machine” it turns out to be, it will be unlike any we have so far assembled from gears and computer chips (Searle, 2005). In order to understand it, we will have to continue to make astute observations at the psychological and

behavioral level, with modern biology in mind, and only when we have established clear and empirically justifiable concepts and distinctions at that level can we hope to look with precision at their neural correlates. There is nothing wrong with developing hunches based on brain studies of nonhuman animals and preliminary neuroimaging studies of humans, but it will not be possible to build an adequate understanding of love from the neural level up. The neural correlates of mental processes (and not just *conscious* mental processes, contrary to the popular phrase “neural correlates of consciousness”) will not be understood until the mental processes are sufficiently well delineated so that their neural correlates can be discerned.

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