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Unmasking Passionate Love: The Face and The Brain

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I. Introduction

For centuries, poets, writers, and balladeers have sung about the nature of love, that “many splendored thing.” They advise us about “the look of love,” point out that “when your heart goes bumpitty-bump, it’s love, love, love,” and advise “lean on Me.” Is there such a “look” that we can deconstruct? Also, does it suggest that love, despite some nay-sayers, really does register as a definable emotion with many splendors and clear markers? In 1845, in *Sonnets to the Portuguese*, Elizabeth Barrett Browning (2007) wrote: “How do I love thee? Let me count the ways.” Let us now register some markers and “count the ways” by which the typical person reveals his or her deepest feelings to the world.

In recent years, social psychologists, neuroscientists, biochemists, and sexologists have conducted a systematic investigation into the nature of passionate love and sexual desire (see Hatfield & Rapson, 1993, 2005, and 2009 for a summary of this research). This research gives us insight into a few of the tell-tale signs by which people reveal how passionately they feel about their beloved. (In this chapter, we will focus on both such macro-cues (as face, voice, and posture) as well as on the micro-cues (such as fMRI reactions) associated

with passionate love. This research also provides a new understanding of the complex emotion we call passionate love.

II. Defining Passionate Love

Passionate love is a powerful emotional state. It has also been called “puppy love,” “romantic love,” “infatuation,” “love-sickness,” and the like. Hatfield and Rapson (1993) have defined it as:

A state of intense longing for union with another. Passionate love is a complex functional whole including appraisals or appreciations, subjective feelings, expressions, patterned physiological processes, action tendencies, and instrumental behaviors. Reciprocated love (union with the other) is associated with fulfillment and ecstasy.

Unrequited love (separation) is associated with feelings of emptiness, anxiety, and despair (p. 5).

The *Passionate Love Scale (PLS)*, which was designed to assess the cognitive, emotional, and behavioral indicants of this type of love (Hatfield & Sprecher, 1986), has been found to be a useful measure for men and women of all ages, in a variety of cultures, and to correlate well with certain well-defined patterns of cognitive and neural activation (see Bartels & Zeki, 2000, 2004; Bianchi-Demicheli, et al., 2007; Hatfield & Rapson, 2009; Langeslag, et al., 2008 a and b; Ortigue, et al., 2007). Sexual desire (the desire to merge sexually) has been found to be a closely related construct.

III. Is Passionate Love an Emotion?

In a seminal article, Kurt W. Fischer and his colleagues (1990) characterized emotions this way:

Emotions are complex functional wholes including appraisals or appreciations, patterned physiological processes, action tendencies, subjective feelings, expressions, and instrumental behaviours (p. 85).

A. Passionate Love *is* an Emotion.

Most social psychologists consider joy, **love**, sadness, fear, and anger to be basic emotions (Berscheid & Meyers, 1996; Fehr & Russell, 1991; Fischer, et al., 1990; Hatfield, et al., 1995; Regan, 1998; Sabini & Silver, 2005; Shaver, et al., 1987, 1991, 1996, 2001).

There is considerable evidence in support of this contention. Scholars have interviewed men and women from a variety of cultures and of different ages. They have utilized prototype analyses, taken a social categorical approach, and conducted surveys and experiments, to order to decide whether or not love should be classified as a basic emotion, and if so, what people mean by the terms “in love” (passionate love) and “love” (companionate love). After reviewing all the evidence, Shaver and his colleagues (1996 and 1991) concluded that love is indeed a basic emotion. In cross-cultural research—in languages as varied as English, Italian, Basque, and Indonesian—people tend to identify five distinct emotions: **love**, joy, anger, sadness, and fear—as prototypic emotions. Generally, passionate love is associated with the terms “arousal,” “desire,” “lust,” “passion,” and “infatuation. Companionate love is

associated with “love,” “affection,” “liking,” “attraction,” and “caring” (Shaver et al., 1987, 2001).

After discussing the criteria that various theorists have used to classify emotions, Shaver and his colleagues (1991) concluded that given these criteria, love (which includes passionate and companionate love) must be classified as an emotion. They observe:

. . . a number of controversies over the status of love can be resolved by distinguishing between the momentary surge form of love, a basic emotion having properties similar to joy, sadness, fear, etc., and relational love, a bond that develops between people, associated with states that include not only surge love, but many other emotions such as distress and anxiety (p. 81)

In another set of studies, Fehr and Russell (1991) utilized a prototype analysis to find out how ordinary people classified emotions. They found that throughout the world, men and women generally assume that happiness, **love**, anger, fear, sadness, and hate are basic emotions. They also found that people tend to draw a sharp distinction between passionate love (i.e., “being in love”) and companionate love (i.e., “loving.”) Similar results were secured by Berscheid & Meyers (1996), Fehr (1994), Hatfield & Rapson (1993), Regan (1998); Regan & Berscheid (1999); Regan et al. (1999), and a host of others.

Social psychologists and evolutionary psychologists, then, generally assume that love (passionate or companionate) is a basic emotion. In fact, Evolutionary psychologists consider love and jealousy to be the “stars” of

emotion, since they are so tightly linked to our ancestors' reproductive interests (see Buss, 2000; Pinker, 1997.)

B. Passionate Love is *Not* an Emotion.

Some scholars have argued that “being in love” and “loving” are *not* emotional experiences. They prefer to call passionate love “a plot” or “script” (as in a story you tell yourself), “a sentiment,” “a feeling,” “a disposition,” a “syndrome,” a “complex,” an “affective commitment,” or “a motivational state.” (For a review of these positions, see Shaver, et al., 1996.)

In spite of the fact that Paul Ekman's (1999 and 2003) utilizes an evolutionary paradigm, he contends that love is *not* a basic emotion. (These include anger, fear, sadness, enjoyment, disgust, and surprise). Nor is love one of the 12 candidate basic emotions. (These include contempt, shame, guilt, embarrassment, awe, amusement, excitement, pride in achievement, relief, satisfaction, sensory pleasure, and enjoyment). Ekman (1994 and 1999) proposed 11 criteria to determine whether or not an emotion is classified as a basic or true emotion. Emotions, he contends are “brief and episodic.” Since love can last for months, years, or a lifetime it *cannot* be considered an authentic emotion. The second difference between love and the basic emotions is that love has an “object”—lovers yearn to be with the beloved, while other emotions do not. (Some critics, such as Sabini & Silver, 2005, however, point out that (1) all emotion terms can be understood in both a dispositional and an episodic sense, and (2) emotions like anger also possess an object—furious

people wish to take revenge on their adversaries, for example. They wish to make them “rue the day he messed with me.”)

Neuroscientists, too, are sharply divided as to whether love *is* an emotion (see Bartels & Zeki, 2000; Birbaumer, et al., 1996; Hatfield & Rapson, 2008) or is not an emotion (see Diamond, 2003 and 2004; Gonzaga, et al., 2006; Reis & Aron, 2008).

In sum: only subsequent research can answer the question as to whether or not passionate love is an authentic emotion. In part it seems like a semantic issue. If forced to hazard a guess, however, we would argue that in the future, love in all its varieties *will* be classified as an emotion. When so many scientists and ordinary people classify love as an emotion, insist they feel the “emotion” of love, and behave emotionally when in love, it may be impossible for scientists to generate a paradigm shift—whatever they decide.

IV. The Look of Love

Emotions researchers, influenced by Paul Ekman’s (1982) seminal research, generally accept the notion that we can tell what people are feeling by attending to certain facial and bodily clues. Since Ekman (2003) insists that love is *not* an authentic emotion, scholars have generally spent little time or effort investigating whether or not passionate love is associated with consistent facial, postural, and behavioral cues. The sparse research which we will present in this chapter argues, however, that this is a question well worth investigating.

A. The face of love. The face serves as both the major and the primary system for communicating emotions (Leathers & Emigh, 1980). Thus, it is not

surprising that passionate love and the desire for “closeness” are reflected in several tell-tale visual cues. Hess and Polt (1960) proposed that pupil size may be an index of how attractive people find various visual images.

When people are engaged in conversation, they gaze at one another for short periods. Argyle (1967) found that people normally glance at one another only 30% to 60% of the time. The more people like or love someone, however, the more they tend to sneak little glances at that person. There is some evidence that Americans associate passionate love with a given configuration of facial expressions. In one experiment, Hatfield and her colleagues (1995) asked men and women to read scripts depicting one of the five universal emotions—joy, love, sadness, anger, and fear. Participants were secretly filmed on videotape. (At the end of the experiment, the experimenters secured the participants' permission to view their videos.) If participants had been assigned to read a script in which they declared their passionate love for another, they read the following:

Well, let me tell you. Now that I'm in love, I think about John (Susan) constantly. I can twist any conversation around in my mind so that it's really about him (her). I imagine what he (she) would say to me and how I might tell him (her) things I have never told anyone else before. When I see him (her), POW!, my heart takes a leap, my cheeks flush, and I can't help smiling. At night before I go to bed, I think of how adorable he (she) is and how much I love him (her). (p. 299)

People who read the loving script not only came to feel more loving than those who read any of the other scripts, but judges rated their faces as looking “more loving” than the faces of their peers. One rater observed: “The woman [reading the in-love script] had ‘dreamy, half closed eyes, lips parted’.” The participants’ faces seemed softer, more tender, and more relaxed.

Other scientists agree that love does present a distinct facial display (Keltner & Shiota, 2003). Facial expressions of love include mutual gaze with one’s beloved and smiling (Keltner & Shiota, 2003). People’s faces soften, their head tilts, and a slight, tender smile often plays about their lips as they gaze at the beloved. (Block & Lemignan, 1992; Bloch, Orthous, & Santibanez, 1987; Darwin, 1965; Hatfield, et al., 1995; Lemeignan, Aguilera-Torres, & Bloch, 1992).

Scientists contend that tongue protrusions, lip wipes, and lip licks visually indicate a cognate of passionate love and sexual desire (Keltner & Shiota, 2003). Limited evidence supports the contention that humans can both correctly express and identify facial expressions of love. Thompson and Meltzer (1964) asked participants to display 10 emotions, including love, using only their faces. All participants were able to clearly convey many of the emotions and that judges were able to identify the emotions portrayed by the participants. Love was one of the emotions most often judged correctly. Unfortunately, Thompson and Meltzer (1964) did not supply a description of what specific facial expressions participants used to convey or identify “love.”

If love does spark a characteristic facial pattern in Americans, the next obvious question is: “Is the look of passionate love a cultural universal?” The

sparse cross-cultural evidence suggests that in a variety of cultures people express their passionate feelings in much the same way. Tsai, Chentsova-Dutton, Freire-Bebeau, and Przymus (2002), for example, examined the presence of Duchene (sincere) and non-Duchene (social or fake) smiles in Hmong Americans (an ethnic group originating in Laos) and European Americans. When recalling feelings of love, all the participants (regardless of ethnic background) displayed true Duchene smiles at similar rates (although non-Duchene smiles were produced by a greater percentage of Hmong Americans than European Americans.)

People in different cultures also recognize the same facial expressions as indicating this or that emotion. Research by Hejmadi, Davidson, & Rozin (2000) suggests that both Americans and Indians recognize the same 10 primary Hindu emotions, including love. Both American and Indian participants watched videotaped clips of the *Natyasastra*, a Hindu treatise on both dance and emotion theory dating from the 1st to the 2nd century A.C.E. The *Natyasastra* gives highly intricate descriptions of how dancers should express each primary emotion, especially emphasizing hand movements and facial expressions. Both Indian and American participants demonstrated a high degree of accuracy when identifying each of the Hindu emotion portrayals, including love. Results indicate that basic emotions may be associated with universal and characteristic facial expressions (Hejmadi et al., 2000).

B. The sounds of love. The words spoken between lovers can convey great meaning. *How* these words are spoken can be as important, and telling, as

what is spoken. The speaker's emotional state and true intent can be suggested by the speaker's vocal hesitations, pitch variations and speech disruptions (Costanzo, Markel, & Costanzo, 1969). Researchers consider said speech characteristics to be significant indicators of the speaker's emotional state. Different emotional expressions have been found to be related to vocal variations; love, specifically, seems to be expressed by speech patterns which emphasize pitch, as opposed to tempo or loudness (Costanzo, Markel, & Costanzo, 1969).

French psychophysicologist Susana Bloch and her colleagues (1987) argued that passionate love ("eroticism") and love in general ("tenderness") are associated with different breathing patterns and sounds. Mothers often coo or croon softly with their mouths held near the infant's head. They speculated that such tender maternal sounds become the forerunners of the breathing patterns and sounds associated with love. Bloch studied the basic emotions of joy, love/eroticism, love/tenderness, fear, anger, and sadness and discovered that the breathing patterns associated with eroticism and tenderness were somewhat different:

In *eroticism*, the principal feature of sexual activation is:
an even breathing pattern which increases in frequency and amplitude depending on the intensity of the emotional engagement; inspiration occurs through a relaxed open mouth. The face muscles are relaxed, and the eyes are closed or semi-closed. In the female version of the erotic pattern, the head is tilted backwards, and the neck is exposed. (p. 6)

On the other hand, in *tenderness*:

The breathing pattern is of low frequency with an even and regular rhythm; the mouth is semi-closed, the relaxed lips forming a slight smile. Facial and antigravitational muscles are very relaxed, eyes are open and relaxed, and the head is slightly tilted to the side.

The postural attitude is one of approach. Vocalization includes a humming type lullaby sound. (p. 6)

Bloch and her colleagues assumed that both tenderness and eroticism are components of passionate love.

C. The postures of love. In 1872, in *The Expression of Emotions in Man and Animals*, Darwin advocated that emotions could be conveyed through facial expression and bodily movement. Since Darwin's day, however, perhaps because of Ekman's influence, research on the emotional correlates of body posture has been ignored (Coulson, 2004; Pitterman & Nowicki, 2004). Nonetheless, there is a small wealth of information about the information transmitted via various bodily postures. Darwin cited specific body movements and postures that he believed indicated specific emotions including contempt, anger/rage, joy, pride, fear/terror/horror, shame, disgust, and sadness (in Wallbott, 1998). More current research suggests that an individual's posture can convey their emotional state (Wallbott, 1998); with women being more likely to accurately identify that individual's emotional state (Pitterman & Nowicki, 2004). Humans can also identify an individual's emotional state (e.g., anger, sadness) by observing an individual's gait (Montepare, Goldstein, & Clausen, 1987).

Unfortunately, these studies were confined to emotions such as happiness, sadness, fear and anger, and have thus far, excluded love. As such, it can only be speculated that love is conveyed to observers in a similar fashion. There are, however, a few studies that have investigated the postures of love.

Desmond Morris (1971) argued that passionate love is intimately linked to one's childhood experiences. He observed:

These, then, are our first real experiences of life—floating in a warm fluid, curling inside a total embrace, swaying to the undulations of the moving body and hearing the beat of the pulsing heart. Our prolonged exposure to these sensations in the absence of other, competing stimuli leaves a lasting impression on our brains, an impression that spells security, comfort and passivity. (p. 12)

After birth, he noted, mothers instinctively try to recreate the security of the womb. They kiss, caress, fondle, and embrace their infants; they cradle them in their arms. In the womb, neonates hear the steady drumbeat of the mothers' heart—beating at 72 beats per minute. After birth, mothers instinctively hold their babies with their heads pressed against their left breasts, closest to the maternal heart. . . . When their infants fret, mothers unconsciously rock them at a rate of between 60 and 70 rocks per minute, the rate that is most calming to infants. Morris (1971) points out: “It appears as if this rhythm, whether heard or felt, is the vital comforter, reminding the baby vividly of the lost paradise of the womb” (p. 14). In adulthood, he argues, these same kisses, tender caresses, and

embraces continue to provide security for men and women—unconscious of their early origins.

There is clear evidence that passionate love's "desire for closeness" is indeed reflected in a person's desire for intimacy with another.

1. One's "inclination" toward another. Sir Francis Galton (1884), a Victorian psychologist, was the first to become intrigued by the realization that a person can assess another's character and personality without the other person realizing it. Galton conceived of an amazing array of schemes for invading privacy. Fortunately for his hapless victims, he never had time to carry out his elaborate ploys. He states:

When two persons have an "inclination to one another, they visibly incline or slope together when sitting side by side, as at a dinner table, and they then throw the stress of their weights on the near legs of their chairs. It does not require much ingenuity to arrange a pressure gauge with an index and dial to indicate changes in stress, but it is difficult to devise an arrangement that shall fulfill the three-fold condition of being effective, not attracting notice, and being applicable to ordinary furniture. I made some rude experiments, but being busy with other matters, have not carried them on, as I had hoped. (pp. 179-185).

More contemporary research supports Galton's notion that posture is a tip-off to our feelings—that we tend to lean toward someone we like and love and away from someone we dislike (Mehrabian, 1968). Forward learning is proposed as part

of the full body model for displaying romantic love, which also includes open postures, mutual gaze and smiling (Keltner & Shiota, 2003).

2. The distance one stands from one another. The more we love and like someone, the closer we wish to get to them.

In a classic study, Donn Byrne and his colleagues (1970) introduced men and women to one another. Half of the time they told couples that they were very similar in personality and attitudes; in fact, they were. Half were warned, in all honesty, that they were very different. Then the couples went out on a 30-minute blind date. Eventually, the couples wandered back to the experimental office. The psychologists asked couples how much they liked one another. They also unobtrusively recorded how close they stood to one another when turning in their questionnaires. (Were they touching one another? Standing at opposite extremes of the desk?) As predicted, the more similar couples were, the more attracted they were to one another and the closer they stood to one another.

Theorists argue then, that a tip-off that people are passionately in love with others can be found in their facial expressions, voices, and postures. Nonetheless, whether or not observers identify said behaviors with passionate love seems to be moderated by who the lovers are. Schwartz, Foa, and Foa (1983) showed participants movie clips where a male actor displayed, toward a partially seen second actor, relaxed posture, high eye contact, and decreased distance, the combination of behaviors that research indicates signals love. Against expectations, participants were unable, or unwilling, to identify this behavior as indicating love. The authors speculated that participants couldn't (or

wouldn't) label this behavior as "love" since the loving display involved two men (and implied a homosexual relationship).

D. The Touch of Love. People possess a strong desire to touch the beloved and/or clasp them in their arms (Bloch, Orthous, & Santibanez, 1987; Hatfield, et al., 1995.)

At birth, touch is an infant's most developed sensory modality and factors heavily in development through childhood (Hertenstein, Keltner, App, Bulleit, & Jaskolka, 2006). Touch is believed to both convey either pain/discomfort or intimacy/warmth and to intensify emotions shown in other ways (i.e., via vocal expression). To test these notions, Hertenstein and his colleagues (2006) asked participants to attempt to convey a variety of emotions through touch alone. Participants were isolated from one another; the encoder, who did the touching, had only physical, but not visual, contact with the hand and arm of the decoder, who received the touching. The encoder attempted to convey one of six emotions, including love. The most common ways encoders conveyed love included (in order of prevalence) stroking, finger interlocking and rubbing. The study's findings indicate that people can convey love through touch at least as accurately as people can convey love through facial and vocal expressions. In addition, observers, who were neither encoders nor decoders, were also able to accurately identify the emotions being conveyed (Hertenstein et al., 2006).

V. The Neuropsychology of Passionate Love

In 2000, two neuroscientists, Andreas Bartels and Semir Zeki (2000), began to wonder if there were any brain regions specifically associated with

passionate love. They decided to find out. They stuck up posters around London, advertising for men and women who were “truly, deeply, and madly in love.” The young men and women who answered their call were a diverse lot (they came from 11 countries and several ethnic groups). Seventeen men and women, ranging in age from 21-37 years of age, were selected for the study. All scored high on the *Passionate Love Scale (PLS)*. Participants were placed in an fMRI (functional magnetic resonance imagery) scanner. This high-tech scanner constructs an image of the brain, in which changes in blood flow (induced by brain activity) are represented as color-coded pixels. Bartels and Zeki (2000) asked each participant to take a look at color photos of their beloved and a trio of casual friends. They then digitally compared the scans taken while the participants viewed the various kinds of pictures, creating images that represented the brain regions that became more (or less) active when viewing friends and lovers. These images, the researchers argued, identified the brain regions ignited when a person experiences passionate love and/or sexual desire versus mere friendly feelings.

Bartels and Zeki discovered that passion sparked increased activity in the brain areas associated with euphoria and reward, and decreased activity in the areas associated with sadness, anxiety, and fear. Activity seemed to be restricted to foci in the *medial insula* and the *anterior cingulate cortex* and, subcortically, in the *caudate nucleus*, and the *putamen*, all bilaterally. Most of the regions that were activated during the experience of romantic love were identical to those that are active when people are under the influence of euphoria-inducing

drugs such as opiates or cocaine. Apparently, both passionate love and mood-enhancing drugs activate a “blissed-out” circuit in the brain. The *anterior cingulate cortex* is also active when people view sexually arousing material. This makes sense since passionate love and sexual desire are generally assumed to be tightly linked constructs.

Among the regions where activity decreased during the experience of love, were areas of the brain involved in controlling critical thoughts (i.e., the sort of mental activity involved when people are asked to make social judgments or to “mentalize”—that is, to assess other people’s intentions and emotions.) These brain areas are also activated when people experience painful emotions such as sadness, anger and fear. The authors argue that once we fall in love with someone, we feel little need to assess critically their character and personality. (In that sense, love may indeed be “blind.”) Deactivations were also observed in the posterior cingulate gyrus and in the amygdala and were right-lateralized in the prefrontal, parietal, and middle temporal cortices. In other words, the authors found passionate love to be tightly linked with sexual arousal.

Not surprisingly, the Bartels and Zeki (2000, 2004) discovery sparked a cascade of fMRI research into the nature of love. In *Why We Love*, Helen Fisher (2004) argued that people possess a trio of primary brain systems designed to deal with close, intimate relationships. These are: attraction (passionate love), lust (sexual desire), and attachment (companionate love). Presumably, this trio of systems evolved during humankind’s long evolutionary history; each is designed to play a critical role in courtship, mating, and parenting. In theory,

attraction evolved to motivate our ancestors to focus attention on a single favored courtship partner. Sexual desire evolved to predispose young people to seek a *wide range* of sexual partners. Attachment evolved to insure that devoted parents would remain together during the crucial first four years of a child's life.

According to Fisher (2004) attraction (passionate love) is characterized by a yearning to win a preferred mating partner. She speculated that three chemicals—dopamine, norepinephrine, and serotonin—play a crucial role in romantic passion. *Sexual desire* (lust), on the other hand, is typified by a *general* craving for sexual gratification and may be directed toward any number of appealing partners. In men and women, she observed, the androgens, particularly testosterone, are central to sparking sexual desire. Attachment (companionate love) is comprised of feelings of calm, social comfort, emotional union, and the security felt in the presence of a long-term mate. It sparks affiliative behaviors, the maintenance of close proximity, separation anxiety when closeness disappears, and a willingness to participate in shared parental chores. Animal studies suggest that this brain system is primarily associated with oxytocin and vasopressin in the nucleus accumbens and ventral pallidum.

A. The Joys of Love

In focusing in on passionate love, Fisher (January 19, 2000) observed: I speculated that the feelings of euphoria, sleeplessness and loss of appetite as well as the lover's intense energy, focused attention and increased passion in the face of adversity might all be caused in part by heightened levels of dopamine or norepinephrine in the brain. Similarly, I

believed that the lover's obsessive thinking about the beloved might be due to decreased brain activity of some type of serotonin. I also knew these three compounds were much more prevalent in some brain regions than in others. If I could establish which regions of the brain become active while one is feeling romantic rapture, that might confirm which primary chemicals are involved (p. 77).

To test these notions, Fisher (2004) and her colleagues Arthur Aron and Lucy Brown (along with graduate students Deborah Mashek and Greg Strong) conducted a series of fMRI studies. "Have you just fallen madly in love?" asked an announcement posted on a bulletin board on the SUNY Stony Brook campus. She received a flood of replies. On the basis of interviews, Fisher selected 17 young lovers. All scored high on the *Passionate Love Scale*.

Fisher and her colleagues followed the prototype described by Bartels and Zeki (2000). They asked lovesick men and women to view pictures of their beloved and "a boring acquaintance," while an fMRI imager recorded the activity (blood flow) in the their brains.

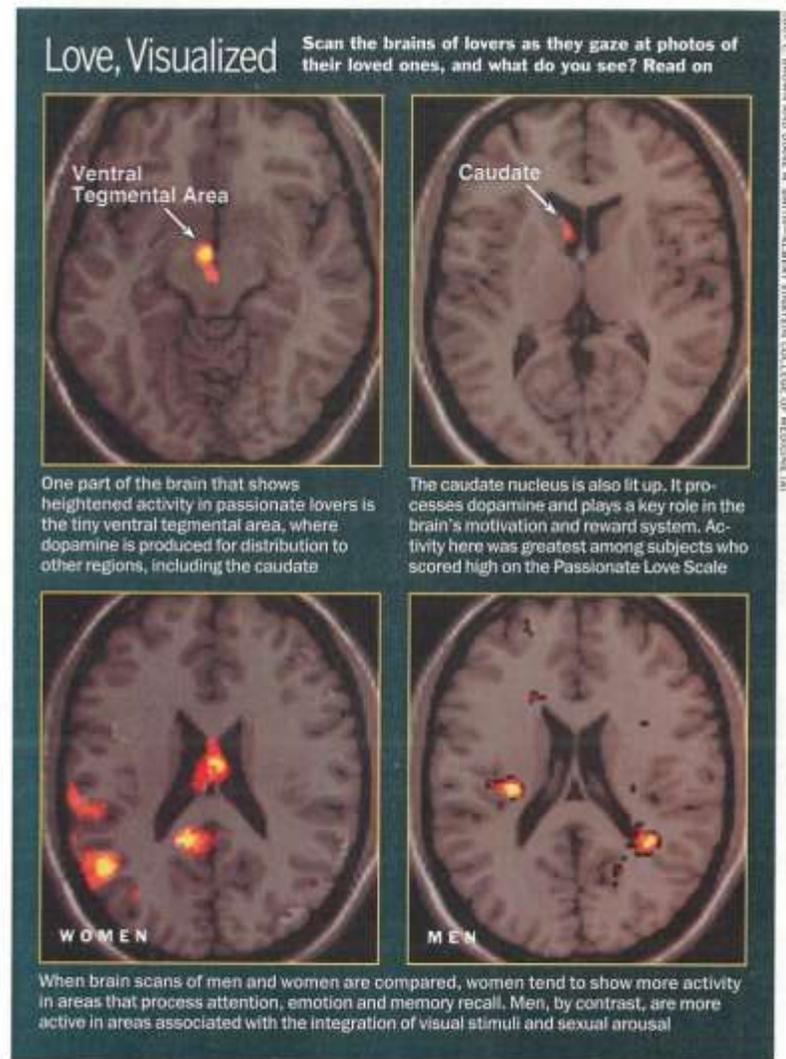
Fisher (January 19, 2004) found that when lovesick men and women gazed at their beloved, activity was sparked in *many* brain areas. (This should come as no surprise since as Acevedo, et al., 2008; and Carlson & Hatfield, 1992, noted, passionate love is associated with a wider array of related feelings and emotions [guilt, sadness, anger, jealousy, sexual desire, etc.] than is any other basic emotion.) Two areas, were found to be critically important: the caudate nucleus (a large, C-shaped region deep in the center of the brain) and

the ventral tegmental area (VTA), a group of neurons at the very center of the brain. “I was astonished,” Fisher said. The caudate is “a key part of the brain’s ‘reward system,’ the mind’s network for general arousal, sensations of pleasure and the motivation to acquire rewards” (p. 79). The VTA is a central part of the reward circuitry of the brain. Fisher observed:

I had hypothesized that romantic love is associated with elevated levels of dopamine or norepinephrine. The VTA is a mother lode for dopamine-making cells. With their tentacle-like axons, these nerve cells distribute dopamine to many brain regions, including the caudate nucleus. And as this sprinkler system sends dopamine to various parts of the brain, it produces focused attention as well as fierce energy, concentrated motivation to attain a reward, and feelings of elation—even mania—the core feelings of romantic love.

No wonder lovers talk all night or walk till dawn, write extravagant poetry and self-revealing e-mails, cross continents or oceans to hug for just a weekend, change jobs or lifestyles, even die for one another. Drenched in chemicals that bestow focus, stamina and vigor, and driven by the motivating engine of the brain, lovers succumb to a Herculean courting urge (p. 79).

Lucy Brown added: “That’s the area that’s also active when a cocaine addict gets an IV injection of cocaine. It’s not a craving. It’s a high” (Quoted in Blink, 2007, p. 3.)



fMRI pictures of “The Brain in Love.”

Blink (2007) observes:

You see someone, you click, and you're euphoric. And in response, your ventral tegmental area uses chemical messengers such as dopamine, serotonin, and oxytocin to send signals racing to a part of the brain called the nucleus accumbens with the good news, telling it to start craving. [Certain regions] are deactivated—areas as within the amygdala, associated with fear (p. 3).

(For more detailed descriptions of this research, see Aron, et al, 2005; and Fisher, et al, 2005). Fisher (2004) concluded by observing that the chemistry of romantic attraction generally elevates sexual motivation.

Unfortunately, the neuroscientists who study the fMRI responses of joyous lovers, secure different results and come to different conclusions on the basis of their data. Bartels & Zeki, (2000 and 2004), for example, consider (1) passion to be an emotion [while Fisher, 2004 does not.] and (2) found a close connection between passionate love and sexual desire [which Fisher, 2004, contends are two separate systems]. Fisher speculates that such differences are probably due to the fact that while she and her colleagues studied young people who are in the first throes of love of love, her critics have focused on men and women who fell in love some time ago. (Fisher's participants had been in love for an average of seven months; Bartels and Zeki's participants for 2.3 years.) In addition, Fisher studied a homogeneous group of SUNY students, while Bartels and Zeki studied men and women, who varied in age, and who came from a variety of cultural backgrounds. Whether or not these differences adequately account for these differing results is as yet unknown. This fMRI research is, of course, still in its infancy.

B. The Dark Side of Love: Anger, Sadness, and Misery

Joyous passionate love is only one-half of the equation, of course. Love is often unrequited. What kind of brain activity occurs when passionate lovers are rejected?

In a second study, Fisher and her colleagues (2004) studied 15 men and women who had just been jilted by their beloved. First, they hung a flyer on the SUNY at Stony Brook bulletin board. “Have you just been rejected in love. But can’t let go?” Rejected sweethearts were quick to respond. In initial interviews, Fisher found that heartbroken men and women were caught in a swirl of conflicting emotions—they were still wildly in love, yet felt abandoned, depressed, angry, and in despair.

But what was going on in their brains? To find out, Fisher and her colleagues (2004) followed the standard protocol they’d utilized in testing men and women who were happily-in-love—i.e., they asked them to view a photographs of their one-time beloved and a familiar, but emotionally neutral, individual. When contemplating their beloved, rejected lovers displayed greater activity in the right nucleus accumbens/ventral putamen/pallidum, lateral orbitofrontal cortex and anterior insular/operculum cortex than they did when contemplating neutral images. In short, jilted lovers’ brains “lit up” in the areas associated with anxiety, pain, and attempts at controlling anger as well as addiction, risk taking, and obsessive/compulsive behaviors. Jilted lovers did, indeed, appear to experience a storm of passion—passionate love, sexual desire, plus anguish, rejection, rage, emptiness, and despair.

Alas, other neuroscientists who have studied the fMRI responses of lovers who are actively grieving over a recent romantic breakup, have secured somewhat different results than those secured by Fisher and her colleagues (see Najib, et al., 2004). Fisher (2004) speculates that her critics may have focused

on men and women who broke up some time ago and thus may have adapted to their losses. Instead of grieving, they may have been at a subsequent stage in the grieving process—experiencing resignation and despair.

To sum up these fMRI studies, psychologists' opinions may differ on whether romantic and passionate love are emotions (Bartels & Zeki, 2000; Bierbaumer, et al., 1993; Fischer, et al., 1990; Shaver, Morgan, & Wu, 1996;) or are not emotions (Diamond, 2004; Reis & Aron, 2008) and whether passionate love, sexual desire, and sexual motivation are closely related constructs (psychologically, neurobiologically, and physiologically) (Fehr & Russell, 1991; Hatfield & Rapson, 2009; Hendrick & Hendrick, 1987a; Regan, 1998, 2004) or very different in their nature (Diamond, 2003, 2004; Reis & Aron, 2008). In addition, scientists have sharply criticized the widespread use of fMRI techniques to study the nature of love, claiming that currently the fMRI studies track only superficial changes and lack reliability and validity (Cacioppo, et al., 2003; Movshon, 2006; Panksepp, 2007; Wade, cited in Wargo, 2005). One critic, for example, observed: "It's like the Wild West out there. Scientists are working in uncharted territory; there hasn't been time for the development of adequate critical standards; and fMRI research has such status, that everything gets published!" (We might also note that although in TV shows like *House*, the administration of fMRIs is an eerily silent procedure, in fact a real fMRI is a ear-splitting and bone shattering process. Participants staggering out the experimental room often complain: "I thought I was going crazy!" "In spite of my earplugs, the noise was unbelievable." "I tried to think of love, but in fact I kept

thinking ‘Get me the hell outta here!’” Then too, the fMRI room is cold, 50⁰ degrees F. at best, and patients are strapped down to the table. These technological problems may make the interpretation of fMRI studies somewhat problematic! Nonetheless, this path-breaking research has the potential (as it grows ever more sophisticated) to answer age-old questions about the nature of culture, love, and human sexuality.

VI. In Conclusion

Were we to put Sherlock Holmes on the trail of “The Missing Emotion—Passionate Love,” we suspect the Master Detective may well have concluded that the phenomenon bears looking into, and that the “game’s afoot.”

As we have seen in the preceding chapter, there is strong evidence that most scholars and people in general assume passionate love does belong in Ekman’s pantheon of “basic emotions.” Admittedly, scholars can not yet provide conclusive evidence there is a definitive “look of love” or that passionate love and sexual desire are writ in our genes and measurable with calipers and flashing lights. Nonetheless, scholars do offer us some promising hints as to internal and external clues (the facial, vocal, postural cues) that indicate that a man or woman is indeed caught up in the throes of love. The song-writing duo of Burt Bacharach and Hal David (1967) may have had it right in their tune from that old James Bond movie, *Casino Royale*.

The look of love

Is in your eyes

The look your smile can’t disguise.

The look of love

Is saying so much more

Than just words could ever say

And what my heart has heard

Well it takes my breath away . . .

You've got the look of love it's on your face.

A look that time can't erase.

Scholars' pioneering research clearly suggests that passionate love and sexual desire are phenomena well worth studying.

VII. References

- Argyle, M. (1967). *The psychology of interpersonal behaviour*. Baltimore: Penguin.
- Aron, A., Fisher, H. E., Mashek, D. J., Strong, G., Li, H-F, & Brown, L. L. (2005). Reward, motivation, and emotion systems associated with early-stage intense romantic love. *Journal Neurophysiology*, *94*, 327-337.
- Bartels, A. & Zeki, S. (November 27, 2000). The neural basis of romantic love. *Neuroreport*, *11*, 3829-3834.
- Bartels, A. & Zeki, S. (2004). The neural correlates of maternal and romantic love. *Neuroimage*, *21*, 1155-1166.
- Berscheid, E., & Meyers, S. A. (1996). A social categorical approach to a question about love. *Personal Relationships*, *3*, 19-43.
- Bianchi-Demicheli, F., Grafton, S. T., & Ortigue, S. (2006). The power of love on the human brain. *Social Neuroscience*, *1*, 90-103.
- Birbaumer, N., Lutzenberger, W., Elbert, T., Flor, H., & Rockstroh, B. (1993) Imagery and brain processes. In Niels Birbaumer and Arne Öhman (Eds.) *The structure of emotion* (pp. 132-134). Göttingen, Germany: Hogrefe & Huber Publishers.
- Blink, S. (July 30, 2007). This is your brain on love. *Los Angeles Times* latimes.com. <http://www.latimes.com/features/health/la-he-attraction30jul30.1.68965446.story?coll=la-headlines-health&ctrack=1&cset>.
- Bloch, S., Orthous, P., & Santibanez-H, G. (1987). Effector patterns of basic emotions: a psychophysiological method for training actors. *Journal of Social and Biological Structures*, *10*, 1–19.
- Bloch, S., Lemeignan, M., & Aguilera-Torres, N. (1991). Specific respiratory patterns distinguish among human basic emotions. *International Journal of Psychophysiology*, *11*, 141-154.
- Browning, E. B. (2007). Sonnet #43. *Sonnets from the Portuguese: A celebration of love*, New York: St. Martin's Press, p. 51.
- Buss, D. M. (2000). *The dangerous passion: why jealousy is as necessary as love and sex*. New York: Free Press.
- Byrne, D., Ervin, C. R., and Lamberth, J. (1970). Continuity between the experimental study of attraction and "real life" computer dating. *Journal of personality and Social Psychology*, *16*, 157-165.
- Cacioppo, J. T., Berntson, G. G., Lorig, T. S., Norris, C. J., & Nusbaum, H. (2003). Just because you're imaging the brain doesn't mean you can stop using your head: A primer and set of first principles. *Journal of personality and Social Psychology*, *85*, 650-661.
- Costanzo, F. S., Markel, N. N., & Costanzo, P. R. (1969). Voice quality profile and perceived emotion. *Journal of Counseling Psychology*, *16*, 267-270.

- Coulson, M. (2004). Attributing emotion to static body postures: Recognition accuracy, confusions, and viewpoint dependence. *Journal of Nonverbal Behavior*, *28*, 117-139.
- Darwin, C. (1965). *The expression of the emotions in man and animals*. Chicago: The University of Chicago Press.
- Diamond, L. M. (2003). What does sexual orientation orient? A biobehavioral model distinguishing romantic love and sexual desire. *Psychological Review*, *110*, 73-192.
- Diamond, L. M. (2004). Emerging perspectives on distinctions between romantic love and sexual desire. *Current Directions in Psychological Science*, *13*, 116-119.
- Ekman, P. (1994). All emotions are basic. In P. Ekman & R. J. Davidson (Eds.). *The nature of emotion: Fundamental questions*. New York: Oxford University Press (pp. 15-19.).
- Ekman, P. (1999). Basic emotions. In T. Dalgleish & M. Power (Eds.). *Handbook of cognition and emotion*. New York: Wiley.
- Ekman, P. (2003). *Emotions revealed*. New York: Henry Holt.
- Ekman, P., Levenson, R. W., & Friesen, W. V. (1983). Autonomic nervous system activity distinguishes among emotions. *Science*, *221*, 1208-1210.
- Fehr, B. (1994). Prototype-based assessment of laypeople's views of love. *Personal Relationships*, *1*, 309-331.
- Fehr, B., & Russell, J. A. (1991). Concept of love viewed from a prototype perspective. *Journal of Personality and Social Psychology*, *60*, 425-438.
- Fischer, K. W., Shaver, P. R., & Carnochan, P. (1990). How emotions develop and how they organize development. *Cognition and Emotion*, *4*, 81-127.
- Fisher, H. E. (2004). *Why we love: The nature and chemistry of romantic love*. New York: Henry Holt.
- Fisher, H. E. (January 19, 2004). Your brain in love. *Time Magazine*, p. 77.
- Fisher, H., Aron, A., & Brown, L. L. (2005). Romantic love: an fMRI study of a neural mechanism for mate choice. *The Journal of Comparative Neurology*, *493*, 58-62.
- Galton, F. (1884). Measurement of character. *Fornightly Review*, *36*, 179-185.
- Gonzaga, G. C., Turner, R. A., Keltner, D., Campos, B., & Altemus, M. (2006). Romantic love and sexual desire in close relationships, *Emotion*, *6*, 163-179.
- Hatfield, E., Hsee, C. K., Costello, J., Weisman, M. S., & Denney, C. (1995). The impact of vocal feedback on emotional experience and expression. *Journal of Social Behavior and Personality*, *10*, 293-312.
- Hatfield, E., & Rapson, R. L. (1993). *Love, sex, and intimacy: Their psychology, biology, and history*. New York: HarperCollins.
- Hatfield, E., & Rapson, R. (2005). *Love and sex: Cross-cultural perspectives*. Needham Heights, Lanham, MD: University Press of America.
- Hatfield, E. & Rapson, R. L. (2009). The neuropsychology of passionate love and sexual desire. In E. Cuyler and M. Ackhart (Eds.). *Psychology of social relationships*. Hauppauge, NY: Nova Science.

- Hatfield, E., Rapson, R. L., & Martel, L. D. (2007). Passionate love and sexual desire. In S. Kitayama & D. Cohen (Eds.), *Handbook of cultural psychology*, (pp. 760-779). New York: Guilford Press.
- Hatfield, E., & Sprecher, S. (1986). Measuring passionate love in intimate relations. *Journal of Adolescence*, *9*, 383-410.
- Hejmadi, A., Davidson, R.J., & Rozin, P. (2000). Exploring Hindu Indian emotions expressions: Evidence for accurate recognition by Americans and Indians. *Psychological Science*, *11*, 183-187.
- Hendrick, S. S., & Hendrick, C. (1987a). Love and sex attitudes: A close relationship. In W. H. Jones & D. Perlman (Eds.), *Advances in personal relationships*, *1*, (pp. 141-169). Greenwich, CT: JAI.
- Hertenstein, M. J., Keltner, D., App, B., Bulleit, B. A., & Jaskolka, A. R. (2006). Touch communicates distinct emotions. *Emotion*, *6*, 528-533.
- Hess, E. W., & Polt, J. M. (1960). Pupil size as related to interest value of visual stimuli. *Science*, *132*, 349-350.
- Hoon, P. W., Wincze, J. P., & Hoon, E. F. (1977). A test of reciprocal inhibition: Are anxiety and sexual arousal in women mutually inhibitory? *Journal of Abnormal Psychology*, *86*, 65-74.
- Keltner, D. & Shiota, M. N. (2003). New displays and new emotions: A commentary on Rozin and Cohen. *Emotion*, *3*, 86-91.
- Langeslag, J. E., Franken, I. H. A., & Van Strien, J. W. (2008, submitted.). Dissociating love-related attention from task-related attention: An Event-Related Potential oddball study.
- Langeslag, S. J. E., Jansma, B. M., Franken, I. H. A., Van Strien, J. W. (2008a; submitted.) Event-related potential responses to love-related facial stimuli.
- Leathers, D. G. & Emigh, T. H. (1980). Decoding facial expressions: A new test with decoding norms. *Quarterly Journal of Speech*, *66*, 418-436.
- Lemeignan, M., Aguilera-Torres, N., & Bloch, S. (1992). Emotional effector patterns: Recognition of expressions. *European Bulletin of Cognitive Psychology*, *12*, 173-188.
- Mehrabian, A. (1968). Relationship of attitude to seated posture, orientation, and distance. *Journal of Personality and Social Psychology*, *10*, 26-30.
- Montepare, J. M., Goldstein, S. B., & Clausen, A. (1987). The identification of emotions from gait information. *Journal of Nonverbal Behavior*, *11*, 33-42.
- Morris, D. (1971). *Intimate behaviour*. London: Triad Grafton Books.
- Movshon, J. A. (February 5, 2006). Searching for the person in the brain. *The New York Times. Week in Review*. pp. 1-4.
- Najib, A., Loberbaum, J. P., Kose, S., Bohning, D. E., & George, M. S. Regional brain activity in women grieving a romantic relationship breakup. *American Journal of Psychiatry*, *161*, 2245-2256.
- Ortigue, S. O., Bianchi-Demicheli, F., Hamilton, A. F. de C., & Grafton, S. T. (2007). The neural basis of love as a subliminal prime: An event-related functional magnetic resonance imaging study. *Journal of Cognitive Neuroscience*, *19*, 1218-1230.

- Panksepp, J. (2007). Neurologizing the psychology of affects: How appraisal-based constructivism and basic emotion theory can coexist. *Perspectives on Psychological Science*, 2, 281-312.
- Pinker, S. (1997). *How the mind works*. New York: Noton.
- Pitterman, H. & Nowicki, S. Jr. (2004). A test of the ability to identify emotion in human standing and sitting postures: The Diagnostic Analysis of Nonverbal Accuracy-2 Posture Test (DANVA2-POS). *Genetic, Social, and General Psychology Monographs*, 130, 146-162.
- Regan, P. C. (1998). Of lust and love: Beliefs about the role of sexual desire in romantic relationships. *Personal Relationships*, 5, 139-157.
- Regan, P. C. (2004). Sex and the attraction process: Lessons from science (and Shakespeare) on lust, love, chastity, and fidelity. In J. H. Harvey, A. Wenzel, & S. Sprecher (Eds.) *The handbook of sexuality in close relationships*. (pp. 115-133). Mahwah, NJ: Lawrence Erlbaum.
- Regan, P. C. & Berscheid, E. (1999). *Lust: what we know about human sexual desire*. London: Sage.
- Regan, P. C., Kocan, E. R. & Whitlock, T. (1999). Ain't love grand! A prototype analysis of the concept of romantic love. *Journal of Social and Personal Relationships*, 15, 411-420.
- Reis, H. T. & Aron, A. (2008). Love: What is it, why does it matter, and how does it operate? *Psychological Science*, 3, 79-86.
- Sabini, J. & Silver, M. (2005). Ekman's basic emotions: Why not love and jealousy? *Cognition and Emotion*, 19, 693-712.
- Schwartz, L. M., Foa, U. G., & Foa, E. B. (1983). Multichannel nonverbal communication: Evidence for combinatory rules. *Journal of Personality and Social Psychology*, 45, 274-281.
- Shaver, P. R., Morgan, H. J., & Wu, S. (1996). Is love a "basic" emotion? *Personal Relationships*, 3, 81-96.
- Shaver, P. R., Murdaya, U., & Fraley, R. C. (2001). Structure of the Indonesian emotion lexicon. *Journal of Social Psychology*, 4, 201-224.
- Shaver, P., Schwartz, J., Kirson, D., & O'Connor, C. (1987). Emotion knowledge: Further exploration of a prototype approach. *Journal of Personality and Social Psychology*, 52, 1061-1087.
- Shaver, P. R., Wu, S., & Schwartz, J. C. (1991). Cross-cultural similarities and differences in emotion and its representation: A prototype approach. In M. S. Clark (Ed.), *Review of Personality and Social Psychology*, (Vol.13) (pp. 175-212). Newbury Park, CA: Sage.
- Thompson, D. F. & Meltzer, L. (1964). Communication of emotional intent by facial expression. *The Journal of Abnormal and Social Psychology*, 68, 129-135.
- Tsai, J. L., Chentsova-Dutton, Y., Freire-Bebeau, L., & Przymus, D. E. (2002). Emotional expression and physiology in European Americans and Hmong Americans. *Emotion*, 2, 380-397.
- Wallbott, H. G. (1998). Bodily expression of emotion. *European Journal of Social Psychology*, 28, 879-896.

Wargo, E. (2005). With the brain, is seeing believing? *American Psychological Society, 18*, p. 33.