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The Natural Principles of Love

In this Original Voices article we summarize the past four and a half decades of our work on relationship stability and happiness and explore the theoretical implications of that empirical research. First, we briefly review the laboratory research, clinical work, and the mathematics used to understand our results and build our theory. Then we describe the sound relationship house theory, constructive blueprints for managing conflict, and the three phases of love. We use the term love in the narrow sense of the primary emotions that draw people together to form a lasting, committed relationship between lovers, regardless of sexual orientation. Although we began with no theory at all, we were led by our data and our clinical work at the Gottman Institute.

In 2005, 14 scholars got together to review what the benefits of marriage might be, as determined by social science research (Wilcox, Doherty, Glenn, & Waite, 2005). Their report was cautious and quite lengthy. They wrote that it was happy marriage itself that predicted very positive life outcomes for men, women, and their children. That report was a resounding endorsement of marriage, and yet these conclusions were only part of the story. The results were a small part of a much larger scientific literature linking the quality of people's closest relationships to health, longevity, and well-being. Forty years ago, these findings initially surprised the epidemiologists Leonard Syme and Lisa Berkman, but they have held up over time, and they have

created a vital new field called social epidemiology (see Berkman, Kawachi, & Glymour, 2014). Ignoring what is cause and what is effect, there is no doubt that people in happy, stable, committed relationships—versus people who are alone, in uncommitted relationships, or in unhappy or unstable relationships—live significantly longer, are healthier physically and psychologically, become wealthier, and have children who do better in most aspects of living. Therefore, there is no question that we can precisely identify successful and unsuccessful relationships, and measure the effects of both. Relationship success or failure has enormous consequences for people everywhere on the planet.

We start with the aforementioned history to contextualize our work against so-called poststructural theories of relationships, such as strategic and narrative therapies that reject the idea that some relationships fail and others succeed. Their view is that every relationship is unique and whatever happens is just fine, that it is absurd to talk about success and failure, that everything is relative, and that culture and perception determine everything (see Gurman, Lebow, & Snyder, 2015). These theories lead to therapies that apparently never fail, because they consider every possible outcome fully acceptable. These theories also view a scientific approach to love as if its goals were to paint the entire world gray and claim that everyone is the same everywhere. Our work is based on the opposite premise: Relationships do indeed fail, and that outcome is not what couples hoped for at their wedding or commitment ceremonies. Relationships fail at a great cost to everyone. That is not to conclude that divorce is always unwelcome or that divorce needs to be a lifelong tragedy.

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WHY CARE SO MUCH ABOUT UNDERSTANDING LOVE?

Can science bring clarity where artists have tried so hard and failed? Is there wisdom to be learned at all? Do empirical findings hold? Do they replicate? Can we understand our results? Can we discover truths that may hold everywhere on our planet? After four and a half decades of research on relationship stability and happiness, we believe that the answer to these questions is yes. This article is about our understanding of what makes relationships long lasting and happy. We use the term *love* in the narrow sense, to mean the primary emotions that draw people together to form a lasting, committed relationship between lovers, regardless of sexual orientation.

Data, not theory, are what we brought to this work. In this article we summarize what we have learned through empirical research and therapy on relationships and explore the theoretical implications of that research. We have achieved high levels of prediction of the future of heterosexual and same-sex relationships. We have studied relationships across the entire life course and have been able to predict successful life transitions, such as to parenthood and to retirement. We have also applied these methods successfully to the study of parent–child relationships (Gottman, Katz, & Hooven, 2013; Havighurst, Wilson, Harley, & Prior, 2009). For most of these years John has collaborated with Robert Levenson in basic longitudinal research about relationships. For the past 20 years we have collaborated as a husband–wife team, in clinical work, and in randomized clinical trials that reveal the natural principles derived from basic research and show that these principles lead to interventions that are successful at preventing relationship distress during the major transition to becoming parents (Shapiro & Gottman, 2005) and at healing most ailing relationships (Babcock, Gottman, Ryan, & Gottman, 2013), including very difficult relationship problems such as situational domestic violence (Bradley & Gottman, 2012).

We have also been successful in understanding our predictions and building our theory, using laboratory research, clinical work, and mathematics to understand our results. Mathematics has played a large role in our work. We have employed mathematics in many phases of our work: (a) in finding stable sequential patterns observed in couples' interaction, using the mathematics of information theory and time-series analysis, with Jim Sackett, Roger Bakeman, and James Ringland (see Bakeman & Gottman, 1986/1997; Bakeman & Quera, 2011; Gottman, 1979, 1981; Gottman & Ringland, 1981; Gottman & Roy, 1990); (b) in studying trust and betrayal, using the mathematics of game theory (Gottman, 2002); and (c) in revealing the complex dynamics of interaction using the mathematics of nonlinear differential equations, with the mathematical biologist James Murray and his students (Gottman, 2011, 2015; Gottman, Murray, Swanson, Tyson, & Swanson, 2002). As a wife–husband team we have combined sensitive and intense clinical work—led by Julie—with subsequent randomized clinical trials to test cause–effect relationships, to prevent relationship disasters, and to try to help ailing couples.

This is supposed to be a *theory* article, but when we began this research in the 1970s—contrary to what we all learned in graduate school—Robert Levenson and John adhered to no theory and had absolutely no hypotheses. Their goal was simply to observe, describe, measure, and find patterns that replicated over studies. Robert and John were not limited to studying behavior. They were not behaviorists, nor were they psychoanalysts, nor were they object-relations theorists, nor were they structural theorists, nor were they existentialist theorists, nor were they attachment theorists, nor were they narrative theorists, nor were they solution-focused theorists, nor were they strategic therapists, nor were they systems theorists. In fact, they were not theorists at all. Mostly, they were dust-bowl empiricists studying the role of emotion in relationships. Their first task was simply to describe, looking for a convergence among multiple methods. They included self-reports of experience (through interviews and questionnaires), observed interactive behavior with cameras and computer-assisted observational coding, assessed human physiology, and used video-recall ratings with synchronization to the video time code. They wanted to measure all parts of emotion—behavior, perception, and physiology—all synced together with real-time couples' interaction. Of course, we weren't entirely without ideas of what to study; our work was definitely influenced by the context in which we worked, especially by the development of psychophysiology (e.g., Obrist, 1981), the general systems therapists (e.g., Bateson,

Jackson, Haley, & Weakland, 1956), and the quantitative study of emotions in the human face, particularly by our colleague Paul Ekman (e.g., Ekman, 2015).

Methods

Robert and John designed a lab that synchronized the video time code to physiological measures and to a rating dial that people turned from "Very Negative" to "Very Positive," revealing their perception of their interaction, and we had a computer that did this job of synchronization. We wanted to get samples representative of the demographics of the city where we worked. We also wanted about equal numbers of happy and unhappy couples in our studies, so we oversampled these groups. We learned that couples' interactions over time had as much as 80% stability, and we saw that there were both "masters" and "disasters" of relationships. We have fairly low standards. A "master" couple is stable, and both partners are at or above the mean of 100.0 in relationship satisfaction on the Locke-Wallace (1959) or the Dyadic Adjustment Scale (Spanier, 1976). By a "disaster" couple we mean a couple who either breaks up or stays together unhappily (at least one partner is at or below 85.0, which is one standard deviation below the mean of 100.0). Couples came into this lab after having been apart for at least 8 hours and then talked about their day. They filled out questionnaires measuring their relationship happiness. They talked about their day after we attached the sensors measuring heart rate, respiration, blood velocities to the ear and finger of their nondominant hand, the amount they were sweating from their palms of their hands, and how much they jiggled around in their chairs, and after we had obtained a 5-minute silent baseline. There were two cameras in the lab, each giving us a full-face picture of a partner, and they were electronically merged into one split-screen picture with a running time code. After the 15-minute conversation about the events of the day, they were interviewed about what they argued about and asked to try to resolve the major hot issue in their marriage in the next 15 minutes, after another 5-minute baseline. Then they chose a topic from a list of positive topics to discuss for 15 minutes. They had that positive topic conversation after another 5-minute silent baseline. Then, in another appointment, they viewed their videotape and turned the rating dial, also while hooked

up to the physiological sensors. That was the experiment. We did nothing to help them. After 3 years we recontacted the couples and they again filled out questionnaires measuring their marital happiness.

Our video-recall rating dial has proved itself, over the years, to be quite valid. It is a good predictor of the future of a relationship, and it gives us a window into the world of perception. John's postdoc William Griffin (2002) applied the technique of looking for sequential patterns using a method called "hidden Markov analysis" and demonstrated its validity by differentiating happily from unhappily married couples. In another study by Robert Levenson and his student Anna Ruef (Levenson & Ruef, 1992), they had couples use the rating dial twice, once to indicate how each person felt during the interaction and a second time to try to guess how their partner felt during the interaction. They discovered that people were accurate at guessing how their partner felt to the extent that they relived their partner's original physiology during the interaction as they watched the video. Therefore, using the rating dial, they discovered what they called "a physiological substrate" for empathy. In our 20-year longitudinal study, the rating dial, coupled with behavioral coding of emotion, could even predict which husbands would die early, if their marital conflict interaction resembled a competitive, win-or-lose zero-sum game, and which would live longer, if their interaction were a more like a cooperative win–win game (Gottman, 2011). In Levenson's lab, Haase, Holley, Bloch, Verstaen, and Levenson (in press) could even predict which type of chronic physical illnesses people would develop from their specific emotional behaviors during marital conflict 20 years prior; angry people developed chronic cardiac illness, and stonewalling people developed chronic musculoskeletal illness.

Predicting the Future of a Relationship

In the early 1970s psychology was actually at somewhat of an impasse. Walter Mischel (1968) wrote an important, challenging book noting that personality psychology had done a poor job of understanding and predicting human behavior, because even the best measures were able to reduce only about 9% of the uncertainty in prediction. Mischel said that was unacceptable. Therefore, after 3 years, as we followed up with our first 30 couples, we were amazed that

we could account for about 80% of the uncertainty in how their marital happiness changed over a 3-year period, even controlling for initial levels. Furthermore, the results were clear. For example, the couples who became unhappier over 3 years were initially significantly more physiologically aroused than the couples that eventually became happier. Their hearts beat faster, their blood flowed faster, they sweat more from their palms, they jiggled around more, they rated their emotions as more negative on the rating dial, and they were far more hostile (more criticism, defensiveness, contempt, and stonewalling) when discussing the events of their day, a conflict, or even a positive topic than were the couples who became happier over time. Now we had some hypotheses.

Over the next 23 years, as we did that study over and over again, across the whole life course, following couples for many years, we replicated and extended these findings. We also spent a dozen years studying committed gay and lesbian couples. We studied couples going through major life transitions, primarily the transition to becoming parents, and—for 20 years—the transition to retirement and old age.

In 1987, at the University of Washington we built an apartment lab that was designed to be like a bed-and-breakfast getaway. It was on the beautiful Montlake Cut of the medical school campus, overlooking a park, with boats traveling between the salt water of the ocean and the freshwater Lake Washington. A full 130 newlywed couples, each just a few months after their wedding, arrived at 9 a.m., usually on a Sunday, to spend 24 hours in the apartment lab (called "the love lab" by the BBC). The only difference between this lab and a usual bed-and-breakfast getaway was that we had three cameras bolted to the walls to follow all their movements, they wore Holter monitors to track two channels of electrocardiogram, when they urinated we took a sample to measure stress hormones, we took blood from them to measure their endocrine and immune systems (in collaboration with immunology professor Dr. Hans Ochs), and people in the control room were coding their emotions. People adapted to the cameras and physiological recording equipment within about 45 minutes. They brought videos and music to listen to; they brought their pets; they read the newspaper; they worked, made telephone calls, prepared and ate meals, cleaned up, walked in the park, and did anything

else they wanted to. They also participated in our standard lab assessment. We followed them and repeatedly assessed them for 6 years, as 17 of them divorced, and many other couples became pregnant. We followed couples through the pregnancy, and then observed them interacting with their 3-month-old babies using a technique called the Lausanne triadic play situation, taken from Swiss psychologist Elisabeth Fivaz-Depeursinge (Fivaz-Depeursinge & Corboz-Warnery, 1999). John learned how to study babies from one of his best friends, the developmental psychologist Edward Tronick (e.g., Gianino & Tronick, 1988). Edward and John had started grad school in the same class at the University of Wisconsin in 1965. Edward spent his professional life working with America's pediatrician T. Berry Brazelton, and no one understands babies better than these two people. In John's lab at the University of Illinois and later at the University of Washington, we began with an interview we called the Oral History Interview, in which couples answered questions about the history of their relationship, their philosophy about relationships, and their parents' relationships. It turned out that couples who had many positive stories and memories to tell about their relationship and their partners' characters were the strongest; they seemed to have accurate "maps" of their partner's inner world as well (which we called love maps). The Oral History Interview was "coded" quantitatively by the "Buehlman coding system," developed in John's lab by Kim Buehlman. In another study, that coding system had 94% accuracy in predicting stability or divorce over a 4-year period (Buehlman, Gottman, & Katz, 1992).

Our 13% rate of breakup of new marriages in 6 years is pretty consistent across labs; as in our other studies, we could predict which couples would divorce and which would not (and the happiness of those who stayed married) with greater than 90% accuracy. We could predict almost perfectly how their marriages would wind up 6 years later just from their 15-minute conflict conversations with about 88% accuracy. Most of these predictions were made from the way the couples discussed a conflict issue.

Having a baby is supposed to be a blissful event. However, within 3 years after the newlyweds' first babies were born, we discovered that an astounding 67% of these couples had begun to plummet in marital happiness and increase

dramatically in hostility toward each other. If our sample is representative, for the majority of couples the arrival of the first baby is a catastrophe for their love relationship. What a huge tragedy this is! Just one-third of the couples sailed through this transition from partners to parents. What was amazing to us is that we could predict almost perfectly from data obtained a few months after the wedding whether a couple would be in the 67% group (Shapiro, Gottman, & Carrere, 2000). Couples in the 67% group also had hostility as they played with their baby, and our research found that, compared with couples in the 33% group, the baby was harmed by that hostility. These prediction levels were not small. From the way a couple in their last trimester of pregnancy talked about a conflict we could account for half the variance in how much their 3-month-old baby would laugh, smile, or cry, and the neurological ability of the baby to self-soothe, known as the baby's "vagal tone." The vagus is the tenth cranial nerve and soothes the heart and mediates the focus of attention (Porges, 2011).

When Julie and John designed a 2-day seminar based on our theory, and based on comparing the unfortunate 67% to the fortunate 33%, in a 10-hour seminar we found that we could reverse the drop in relationship satisfaction for 77% of our last-trimester couples, and we later learned that we could strengthen this effect with a support group (Shapiro & Gottman, 2004). With the Gottman Institute, we now have trained more than 1,000 workshop leaders in 24 countries, and the prevention effects replicate. Hospitals as far afield as Iceland and Australia have adopted our program.

It took us only 15 minutes of a couple's conflict discussion data to perform our couple's predictions, and furthermore, even our parameters that described how the 15-minute conflict conversation started in its first 3 minutes—a parameter we called "start-up"—predicted how the conflict discussion itself unfolded 96% of the time (Gottman, 1994). Most of the predictions we made from our initial study held across six separate replication studies, they held for heterosexual as well as same-sex couples, and they held throughout the life course. Why were these predictions so accurate? We think the reason is simple. Our lab numbers actually *underestimate* how negative the conflict interactions of unhappy couples are at home, and

they also underestimate how positive the interactions of happy couples are at home. We found this out by having couples in one study take the recorders home so no one else (except the camera) was present. Small effects cumulate, resulting in divergent accelerating trajectories for different groups of couples. Initial differences between the masters and the disasters are very stable. Levenson and John (Gottman & Levenson, 2002) found that there is more than 80% stability in couples' interaction over even as long a period as 14 years, even if some of the couples got therapy. Not only could we predict the fate of newly married couples over 6 years, but in Levenson's lab our prediction was even possible for couples in midlife and old age.

Let us take a moment and ask a very important question, namely, Is this divorce prediction easy? A few years ago Laurie Abraham (2013) spent an entire chapter criticizing John's methods. She claimed that if one predicted that 100% of the newlyweds in John's study would get divorced, since the U.S. national divorce rate was then 50%, John would be right half the time. So, she argued, a prediction rate of 90% accuracy wasn't that great an accomplishment. A *New York Times* review of her book extolled the virtues of her arguments and exclaimed that she had uncovered the charlatan who had pulled the wool over everyone's eyes (John). However, she had made a logical error. Her error was that the U.S. divorce rate has indeed been estimated by sociologists to be about 50%, but only *after* 40 years of marriage. These high divorce estimates have been successfully challenged by Feldhahn and Whitehead (2014). In just 6 years of marriage, only 13% of the couples in our newlywed sample divorced, so if one guessed they'd *all* divorce, one would be wrong by 87%. Thomas Bradbury at UCLA found a divorce rate of 7.6% over 4 years in his sample of newlyweds (Bradbury & Karney, 1993; Karney & Bradbury, 1995). So if one guessed everyone would divorce in Tom's sample, one would be wrong by 92.4%. In fact, the problem of guessing who divorces and who does not at 90% accuracy (our average accuracy across 6 separate replication longitudinal studies) in our 130 newlywed couples by chance alone is exactly like trying to pick out blindfolded and randomly 15 out of 17 red balls from a bowl that also contains 113 white balls. The probability of picking 15 out of 17 red balls correctly by chance alone can be computed as approximately 2.5 times 10^{15}. To spell that out,

the chance of picking 15 out of 17 divorces out of 130 couples by chance alone, is about 1 in 2,500,000,000,000,000, or 1 in 2.5 quadrillion (a quadrillion is 10^{15}). Not too likely. In fact, the Exploratorium museum in San Francisco created an exhibit based on a Levenson paper in which people had to guess which 5 couples out of 10 divorced just by watching the first 3 minutes of their conflict discussion. Rachel Ebling and Robert Levenson's research discovered that almost everyone (even therapists and marriage experts) are at chance levels (Ebling & Levenson, 2003). To predict, one needs the coding system, the numbers, and the math.

Although we were there early in making these predictions, eventually we were not alone. Rand Conger's lab at Iowa (Elder & Conger, 2014), Ted Huston's in Texas (Huston, Caughlin, Houts, Smith, & George, 2001), and Tom Bradbury's lab in Los Angeles, could also predict which couples would wind up stable or unstable and which stable couples would be happy or unhappy. In 1996 Matthews, Wickrama, and Conger conducted a 5-year study with a sample of 436 long-married couples from rural Iowa. They examined the quality of marital interaction, both as perceived by spouses and as reported by outside observers. Using codes of spousal hostility and warmth, they were able to predict with 80% accuracy which couples would divorce or not divorce within a year. They also were able to predict with 88% accuracy which couples would be in the two most extreme marital groups (most stable and least stable). Bradbury's papers were based on a 4-year longitudinal study of newlywed couples. He followed his couples for as long as 11 years. Bradbury's lab was also able to predict divorce or stability with high accuracy. Bradbury discovered a high level of physical aggression in his sample, and that aggression was predictive of divorce. That somewhat unusual result is entirely consistent with the study John did with the late Neil Jacobson, in which we also found that physical aggression led to very high levels of divorce (Jacobson & Gottman, 2007). Bradbury was also able to predict which newlywed couples would eventually turn out to be stable but unhappily married.

The Importance of Physiology During Conflict

In the Levenson-Gottman lab we discovered that physiological arousal during a conflict discussion predicted changes in marital satisfaction over a 3-year period, even controlling for initial satisfaction. The results were clear. The faster a person's heart beat, the faster a person's blood velocity, the more a person sweat from the palms of the hands, the more a person moved around during a conflict conversation, the faster that person breathed, the more relationship happiness deteriorated. Just as in our lab, merely a couple's physiological responses during a conflict discussion can powerfully predict the future of a marriage. To give you some example of how powerful these effects are in predicting the course of marriages, let us tell you about a landmark study of newlyweds. The psychologist Janice Kiecolt-Glaser and her colleagues at Ohio State University studied newlyweds in their first year of marriage (Kiecolt-Glaser, Bane, Glaser, & Malarkey, 2003). They used a procedure in which they took very small quantities of blood from the couple as they discussed an area of conflict in a hospital setting. They could later measure the couples' hormones and neurotransmitters in their blood in real time, *as they argued*. They then followed these newlyweds for 10 years. They found that those couples who eventually divorced, had—in their first year of marriage during the conflict discussion; that's 10 years prior—secreted 34% more adrenaline during the conflict, 22% more adrenaline during the day, and 16% more adrenaline at night than the couples who remained married. Comparing the happy couples with those they called "the troubled," they found that compared to the eventually happy couples, the ones who turned out 10 years later to be troubled had secreted 34% more adrenaline during the conflict, 24% more adrenaline during the day, and 17% more adrenaline at night. Note that they were predicting the fate of these newlywed couples 10 years later, just by measuring adrenaline and noradrenaline in their blood during their first year of marriage!

They also examined another stress hormone called ACTH, which is responsible for releasing cortisol from the adrenal cortex. Cortisol is a stress hormone that has been related to sadness, depression, excessive rumination, separation panic in babies, resignation, giving up, and helplessness. In the newlywed women, ACTH was twice as high in those women who eventually wound up in troubled marriages. Taken together, the results of these studies about physiology show that the prediction of divorce and happiness over very long periods of time is not

an anomaly but a stable scientific result. It is no wonder that physiology is important. We know that when people are physiologically flooded, they are much less capable of even processing incoming information. Physiologically flooded people have trouble remembering what they ever liked about their partners; it is hard for them to give or receive affection, to be empathetic, and to even be polite and courteous. Positive social skills such as shared humor seem to be inaccessible once people are in fight or flight. This diffuse physiological arousal happens when people's heart rates exceed the "intrinsic pace-maker rhythm" of the heart—with both the vagal slowing of the heart withdrawn and sympathetic activation—which is when adrenaline is secreted into the blood stream, activating alpha and beta receptors, and sympathetic nerves are secreting noradrenaline and getting the heart the heart to contract more forcefully as well as beat faster (Rowell, 1993). With this diffuse physiological arousal, a cascade of automatic physiological events take place in the brain and the nervous system. For example, blood is drawn in from the periphery into the trunk to minimize hemorrhage, blood flow is redirected to vascular beds necessary for fighting or fleeing, nonessential services like digestion shut down, glycogen in the liver is converted to glucose, blood volume is increased (to minimize the damage from potential hemorrhage) through the renin-angiotensin system, there are increases in heart rate and myocardial contractility, and increases in peripheral vasoconstriction and blood pressure.

Other psychological effects of fight-or-flight cascade were also severe. We get tunnel vision, our perception becomes distorted so that everything seems dangerous, our lover becomes the enemy, and everything said by our partner seems like an attack. Therefore, staying calm during conflict is a great idea. We've done this experiment in our lab: interrupting conflict and having couples silently read magazines for 20 minutes. Then we have them talk about the conflict again. When we compared the last 5 minutes of the first conversation to the first 5 minutes of the second conversation, it was like these people had a brain transplant. Suddenly in the second conversation, they were reasonable, rational, had their sense of humor back, could listen, and could be affectionate and empathetic one again. Yet, remarkably, *our* couples' therapy is the only one on the planet that actually measures people's physiology in therapy sessions, using inexpensive but accurate fingertip pulse oximeters. If chronic physiological arousal and inadequate self-soothing is an issue, we treat it directly with the HeartMath emwave2 biofeedback device that teaches self-soothing and increase the tone of the vagus nerve. By the way, this chronic physiological flooding is a major issue for couples experiencing situational domestic violence.

What Predicts Divorce?

Interactive behavior matters a great deal. We discovered that the "masters" of relationships (couples that stayed together happily) were much gentler with one another than the "disasters" of relationships. The ratio of the number of seconds of positive-to-negative emotions *during conflict* for the disasters averaged 0.8, and for the masters averaged 5.0. There was far more positive than negative affect even during a conflict discussion for the masters. That 5-to-1 ratio of positive to negative emotions in a conflict discussion jumped out of the pages of our statistical analyses. The natural principle here we call "the triumph of negative over positive affect," which determined the influence functions in our math model. That principle works very well in mathematically modeling couples' interactions (Gottman et al., 2002). Then we asked the data, Are all negatives equally corrosive? The answer was no. The disaster couples during conflict used what John called "the Four Horsemen of the Apocalypse." These Four Horsemen during conflict were our best predictors of early divorce. They co-occurred (though not in a fixed order) in the conflict of the disaster couples. These attack–defend behaviors were criticism, defensiveness, contempt, and stonewalling. They have been documented and described elsewhere (Gottman & Silver, 2016).

When we did our sequential analyses, we discovered an overall robust summary of what the disasters do in conflict discussions. We divided our emotion codes into three emotion states: positive, neutral, and negative. We examined the probabilities that a couple stays in a state or makes a transition from one state to another. When we compared happy with unhappy couples (even just a few months after their wedding), we found that, for unhappy couples, negative affect was what mathematicians call a "Markov absorbing state." A Markov absorbing state is one that is easy to enter and hard to exit. So,

the natural principle here was this: Compared to happily married couples, during conflict discussions, a negative absorbing Markov state of negative emotions existed for unhappily married couples. For unhappily married couples it was easy to enter a state of negative emotions and hard to exit it. This means that for *only* unhappily married newlyweds, encountering negative affect during conflict was like stepping into a quicksand bog. No matter how hard they tried, they only sank deeper and deeper into negativity, eventually escalating to the Four Horsemen. Nan Silver and John (Gottman & Silver, 2016) wound up calling this the roach-motel model of unhappy marriage because it resembled the advertisement for a cockroach-poison "hotel" that read, "They check in but they don't check out." This is how negative affect begins to pervade the lives of unhappily married couples as they move down what John and Robert called the "distance and isolation cascade," in which they withdraw from one another and become lonely. The master couples also enter the negative affect state (but less often), and they can repair and exit negativity more easily. By identifying these sequences of interaction, we were led by our data to become systems theory therapists.

Later, when we had 14-year longitudinal data, Levenson and John discovered another group of couples that divorced an average of 16.2 years after the wedding (instead of an average of 5.6 years for the "Four Horsemen" couples). These couples weren't negatively hostile at all. They were just sad and mildly angry, but mostly they were detached and disengaged; the best identifier was that they showed very little positive emotions at all during their conflict discussions. There was no shared humor, no laughter, no playfulness, no silliness, no curiosity, no shared excitement, no affection, and no empathy; Cuber and Harroff (1965) had called these marriages "devitalized." Apparently, these emotionally detached couples can last longer than the Four Horsemen couples; they can raise children together, but they tend to divorce in midlife. Now we could not just predict if a couple would divorce, but roughly when they would divorce. This leads to the natural principle: Over time, a negative Markov absorbing state leads to early divorce. Low positive affect also leads to divorce, but much later.

From Predicting to Understanding

So far the news of this article is that we can bring love into a laboratory and predict the future. However, now we had to build a theory of love relationships that helped us understand these predictions, and it needed to be a disconfirmable theory in which we made causal hypotheses. If we didn't build such a theory, we wouldn't be able to help prevent serious love problems or know how to treat those problems once they developed. For example, we discovered that the newlyweds who eventually stayed married laughed together more often than the couples who eventually divorced. Without understanding that relationship, we don't know what it means or how humor operates. Then we discovered that shared humor reduces physiological arousal.

OK, but how do we get couples to laugh together more during a conflict discussion? That knowledge came from coding small moments of newlyweds making attempts to connect emotionally. These tiny moments of emotional connection form a kind of emotional bank account that gets built over time and provides a buffer against momentary irritability or emotional distance. Here are some examples: "There's a pretty boat." No partner response—that's turning away. Or a crabby response, "There's a pretty boat." "Will you be quiet? I am trying to read!" That's turning against. All these moments build, or fail to build, an emotional bank account. The newlyweds who divorced 6 years after the wedding averaged 33% turning toward, whereas the couples still together after 6 years averaged 86% turning toward. John's former student Janice Driver discovered that turning toward bids is correlated with humor during the conflict discussion. When our 2-day seminar for couples increased turning toward, humor also increased during the conflict discussion, especially for men. We could do brief experiments to create proximal change in conflict discussions, and in that way we could build our interventions empirically.

Understanding our predictions also came from a unique 15-year collaboration. John teamed up with world-famous biomathematician Dr. James Murray to build the "love equations" that would fully explain our predictions. We succeeded in deriving two nonlinear differential equations that described and explained our predictions. Therefore, we were able to both predict and understand.

There is no magic here. Mathematics is the ultimate language for making sense of data and for creating natural principles from raw data. Mathematics is the best, most succinct way of summarizing our understanding of why our predictions were so accurate. We published those findings for researchers in 2002 in a book titled *The Mathematics of Marriage* and for therapists in John's 2015 book *Principia Amoris: The New Science of Love* (see also Tung, 2007). Math and therapy do go together.

The Sound Relationship House Theory

We call the theory we built the sound relationship house theory, and it is the basis of all our clinical work (Figure 1); to ease communication of this theory to clinicians, each level of the theory is formulated as advice. What is unusual about this theory is that we can measure every concept in the theory precisely in our lab. Because of that, we know how to build each process that we have identified as important. From the start of our research we knew we could predict the nature of the conflict discussion from the amount of positive affect during the events-of-the-day discussion. So we had a clue that friendship must be intrinsically related to conflict.

We learned from our other data that there are three primary parts of friendship: The first part is building love maps. From our Oral History Interview we learned that love maps were important. We defined a love map as a road map one makes of one's partner's inner psychological world. Love maps are about the partner's emotion of interest, about feeling known, and about feeling like one's partner is interested in continuing to know one. We measured love mapping with the Oral History Interview scales. The fundamental processes in creating love maps are asking open-ended questions and remembering the answers. We now have examples of these love-map questions as a smartphone or iPhone application (11 such apps come up when you type *Gottman* into the Apple Store). In our book and on our website (http://www.gottsex.com), we also have an exercise for building an erotic love map for one's partner.

The second part is nurturing the fondness and admiration system. This part of friendship is about communicating affection and respect. Here we ask couples to develop a habit of mind that scans their world for things their partner is

Figure 1. The Sound Relationship House Theory.

doing right and to admire and appreciate specific qualities in their partner. One can then avoid being like the Swedish farmer who loved his wife so much that one day he almost told her.

The third part of friendship is turning toward bids for connection, rather than away or against. When people were in the love lab, often they were letting their needs be known to each other either nonverbally or verbally. They were making what we called bids for emotional connection. A bid is part of a fundamental unit of connection, which begins with one person expressing a need for connection; for example, a bid might ask for a partner's attention, or interest, or a desire for a conversation, or for shared humor, or for affection, or for sexual contact, or for warmth, for empathy, for help and assistance, for support, and so on. The second part of the unit is some response from the partner; turning away is when there is no response, turning toward is a minimal response or more, and turning against is a negative response. What is needed here is increasing awareness and mindfulness about how one's partner expresses needs for connection and a desire to turn toward. Turning toward is about meeting needs for emotional connection. The fundamental natural principle of bids and turning toward is positive feedback: Turning toward leads to more turning toward. Therefore, one need not have very high standards for expecting turning toward from one's partner.

Implications of Friendship in Love

What tests a good theory? First of all, it ought to be disconfirmable; therefore, every part of the theory needs to be measurable. Second, the theory's cause–effect hypotheses ought to be supported by experiment. Third, a good theory ought to make unexpected new predictions that turn out to be true. We tested the theory empirically in a randomized clinical trial, dismantling our 2-day seminar for couples (Babcock et al., 2013), so we know that an intervention based on this theory does work. We were very surprised to discover that love maps, fondness and admiration, and turning toward were also significantly correlated with the quality of romance, passion, and sex. To convince yourself of this latter finding, begin by asking yourself, "How would you make your relationship more romantic in the next 2 weeks? What would you do?" There's a book called *1001 Ways to Be Romantic*, by Gregory Godek (2010). Number 24 is addressed to guys: "What could be more romantic than getting your wife a golden locket with your picture in it?" Now imagine this: (a) John hasn't asked Julie a question in 10 years, so John fails love maps—first strike. (b) Last night we were out to a dinner party and as she was telling a story and John said, "Don't tell that story. You don't know how to tell a story. Let me tell it." That's contempt, and so John fails fondness and admiration—second strike. (3) John hardly ever notices Julie's bids, so John fails at turning toward—third strike, he's out. Then John follows romantic advice Number 24 and gets Julie a golden locket with his picture in it. We now ask, Is that going to be a romantic event? We don't think so.

We made a further discovery about repair during conflict. These first three levels of the sound relationship house are the basis for effective repair when a couple tries to process a fight or regrettable incident. This is true because the basis for effective repair is not just how one makes the repair but also how much "emotional money" a couple has in the bank, which predicts how the repair will be received. We recently published a study analyzing repair (Gottman, Driver, & Tabares, 2014). In summary, these three components of friendship and intimacy affect way people are when they disagree.

Positive and Negative Sentiment Override

What happens when friendship isn't working? We hypothesized that people would be in negative sentiment override, an idea proposed by Robert Weiss (1980). If a couple is in the state of positive sentiment override, then the positive sentiments they have about the relationship and the partner override negative things the partner does. People then do not take their partner's negativity as personally, but merely as evidence that the partner may be stressed. The theory claims that when we are in positive sentiment override, repair is effective, and we start repairing earlier, before the interaction gets too negative. In negative sentiment override, the negative sentiments one has about the relationship and the partner override anything positive the partner might do to repair. People are then hypervigilant for put-downs. They tend not to notice positive events. Robinson and Price (1980) discovered that unhappy couples don't see 50% of the positive things that objective observers see. In negative sentiment override we tend to distort and to see even neutral—sometimes even positive—things as negative; we are overly sensitive about negative affect; and in our cost–benefit analysis of the relationship and our partner's character, the balance is heavily on the cost side. In negative sentiment override people react quickly even to messages that seem quite neutral or even positive to an outside observer. Our theory claims that people are in negative sentiment override for good reason, because friendship and intimacy are not working. When that happens, we tend to see our partner as our adversary, not as our currently annoying friend. Therefore—and this is confirmed by our math model parameters—not only will we have negative start-up and high emotional inertia, but also repair will not work very well, and negativity during conflict will be an absorbing Markov state. The natural principle here is that sentiment overrides control the effectiveness of repair during conflict, and sentiment overrides are controlled by the quality of friendship. In those predictions we were partly wrong because we discovered from intervention research that sentiment overrides are also controlled by the nature of the conflict interactions. The Four Horsemen and the positive-to-negative affect ratio also significantly affect sentiment overrides. So we had to modify our theory accordingly.

Manage Conflict Constructively

We use the term *manage* conflict rather than *resolve* conflict. It is not our goal to eliminate conflict, because our data show that conflict is natural and inevitable, and it has functional, positive aspects. For example, conflict helps us to better understand our partner's emotional world, to deal with change, and to renew courtship over time. There are five skills we teach for managing conflict. Yet all these skills—as we noted earlier—are inaccessible once people are physiologically flooded. We use inexpensive pulse oximeters with alarms that fit on an index finger to measure heart rate and percentage of oxygen in the blood as people discuss conflicts in therapy. For most of us, the intrinsic pacemaker heart rhythm for healthy adults is between 100 and 105 beats per minute (bpm); the vagus nerve slows the heart down to its usual baseline of around 76 bpm for men and 82 bpm for women (rough averages). When our heart rate first increases, it is due primarily to vagal inhibition. However, sympathetic drive will thereafter increase heart rate, and after the heart exceeds the heart's intrinsic rhythm, we begin secreting adrenaline (Rowell, 1993), which leads to a more diffuse physiological arousal. Peter Katona (Katona, Mclean, Dighton, & Guz, 1982) found that Olympic rowers have a decreased intrinsic rhythm of 80 bpm. Surprisingly, being in fabulous shape thus reduces the rate at which the pacemaker cells fire. So for people with a low resting heart rate (60 bpm or lower), 80 bpm is where we set our pulse oximeters when we assess flooding in a couple during assessment in a conflict discussion. For people who we find are easily flooded, we use HeartMath's emwave2 biofeedback device to increase vagal tone, because it gives feedback about vagally controlled respiratory sinus arrhythmia (how much respiration influences the heart rate), not heart rate. We teach all couples how to take effective breaks when they become flooded. The natural principle here is that conflict is easier to manage when people are physiologically calm. There are three conflict blueprints that make conflict more constructive:

- *Conflict Blueprint 1: Current conflicts.* This constructive blueprint is based on the groundbreaking game theory work of Anatol Rapoport (1960) on how to increase human cooperation. The Gottman-Rapoport blueprint requires both people to postpone persuasion until each person can state his or her partner's position to the satisfaction of the other. They take turns as speaker and listener. This is like Guerney's (Guerney & Ortwein, 2008) active listening, except that, following Dan Wile (1995), we also down-regulate the speaker so the speaker is in "self-disclosure mode" instead of "attack-defend mode." Very few people can empathize with an attacking partner. We have the listener take notes on a clipboard and yellow pad. The listener isn't the only one responsible for good communication in the Gottman-Rapoport blueprint. The speaker must use softened start-up, talking about feelings and positive needs, wants, or preferences. A positive need is what one does want rather than what one does not want. It is the speaker's recipe for success for that partner. Instead of pointing one's index finger at the partner and becoming critical, the finger is pointed at one's self. Then the couple can problem solve and compromise using our two-oval method.

- *Conflict Blueprint 2: Reprocessing past emotional injuries.* There is also a need for a blueprint to reprocess emotional injuries from the past, so that they do not fester. Emotional injuries that are not "processed" become like a stone in the shoe. Over time they hurt the relationship more and more. By *processed*, we mean being able to talk about the miscommunications in the regrettable incident without getting back into the processes. William Faulkner wrote in *Requiem for a Nun*, "The past is never dead. In fact, it isn't even past." Because of this truth, it's still possible to revisit past emotional injuries and reprocess them. Most of these emotional injuries are major failed bids for connection, a failure of one person to "be there" for another. These regrettable incidents are often breaches in trust. Sue Johnson (2013) brilliantly discovered these past attachment injury events as explaining some of her failure with clients, until she added this component to her therapy. So, therefore, the data require us to become attachment theorists. The assumptions of this blueprint are to talk only when calm and to agree that there are always two very different, but equally valid, perceptions of the regrettable incident—or, as Dan Siegel once said, "There is no immaculate perception." The goal of processing is to understand each other's perceptions in that unfortunate incident. The natural

principle here is that regrettable incidents are inevitable, but that the past can be healed. Our *Aftermath of a Fight or Regrettable Incident* is a small booklet for guiding a couple in processing past regrettable incidents. It has proved itself to be remarkably effective. The booklet guides a couple through five steps: (a) feelings they had (b) subjective realities (c) triggers that uncover what Thomas Bradbury called "enduring vulnerabilities," (d) taking responsibility and apologizing, and (e) constructive plans. Because of our clinical work we *had* to include triggers, which were past traumas, often going back to childhood, that partly explained the reasons that conflict had escalated and revealed their defenses. Therefore, to understand these triggers, we were compelled by the data and clinical experience to become psychodynamic therapists.

- *Conflict Blueprint 3: Dreams within conflict.* This conflict blueprint comes from a detailed analysis of 960 lab conflicts, which led us to conclude that not all conflicts are the same. Our longitudinal research involved bringing couples in every 3 years, 6 years, 9 years, and so on, and interviewing them about their relationship conflicts. This longitudinal work revealed that 69% of the time when couples were asked to talk about an area of continuing disagreement, what they discussed was a perpetual issue we had heard before in the same lab. These perpetual problems concerned fundamental differences between a couple, differences in personality, or needs that are fundamental to their core definitions of self. These are conflicts that the couple has often been dealing with for many years. This conflict discussion was an attempt to establish a dialogue with the problem, which, admittedly, will never go away or be fully resolved. The natural principle we arrived at here is that not all relationship conflict is the same; most relationship conflict arises from personality difference between partners, so it is perpetual, not resolvable. Couples in our studies were either "gridlocked" or in "dialogue" about these issues. Being in dialogue is very much like what the eminent behavior therapist Andrew Christensen (Christensen, Doss, & Jacobson, 2014) calls acceptance-based couples' therapy; these couples have learned to accept their differences, although they still have some relatively minor conflicts about

them (i.e., they are still in peaceful dialogue). Hence, we claim that for the majority of a couple's conflicts, the therapeutic goal is not about reaching resolution but about reaching enduring, peaceful dialogue. Thus, the data required us to become Christensen-type behavior therapists.

But why are these perpetual conflicts so difficult? The answer lies in interviewing couples about these gridlocked issues. The couples told us that in gridlocked conflict about a perpetual issue, compromise feels unthinkable because it feels like having to give up some part of one's personality or core needs just for the sake of peace with the partner. Therefore, in gridlocked conflict, compromise feels like selling one's self out just for the sake of peace. Therefore, we discovered that in gridlocked conflict each person's position has a deeper purpose in it, a "dream" of how he or she wanted the world to be with respect to this issue. Thus, in our theory the basis for moving a couple from gridlock to dialogue formed our "dreams within conflict" intervention, which examines the *meaning* of each person's position and finds ways to honor each person's dreams and core needs with respect to his or her position on the issue. A prescient, brilliant clinician, Dan Wile, foresaw the need for this third blueprint. In his book, *After the Honeymoon* Wile (1995) wrote that "choosing a partner is choosing a set of problems" (p. 12). He noted that problems would be a part of any relationship, and that a particular person would have some set of problems no matter who that person married. Wile wrote: "There is value, when choosing a long-term partner, in realizing that you will inevitably be choosing a particular set of unsolvable problems that you'll be grappling with for the next ten, twenty, or fifty years" (p. 13) That conclusion fits our data that 69% of all relationship conflicts are about perpetual issues, lasting differences in personality or preferences that never change. The natural principle here is that relationships will work to the extent that one has selected a partner with a set of perpetual problems one can learn to live with. Our conclusion is that the masters of relationship (couples who stay together and are not unhappy) know how to move from gridlock to dialogue on their perpetual problems because they are able to both (a) express a fundamental acceptance of their partners' personality and (b) discuss and understand the existential hidden agendas, the dreams in their partner's position

on the issue. The data, not our theoretical orientation, therefore compelled us to also become existential therapists.

Make Life Dreams Come True

Dreams therefore enter into relationships even at the level of what we mostly vehemently argue about. They also enter more directly. We are all dreamers, meaning makers; we are all story tellers; all searching for meaning, for adventure, for playfulness, for having our lives fulfill our own personal dreams that give life meaning and make it worth living. A crucial aspect of any relationship is to create an atmosphere that encourages each person to talk honestly about his or her dreams, values, convictions, and aspirations, and to feel that the relationship supports those life dreams. Our Oral History Interview led us to add this level of the sound relationship house. To save money, we had eliminated that interview from our longitudinal 20-year study, but the couples actually demanded that we let them come back and tell us their story. The eminent sociologist Andrew Cherlin (2010) recently concluded that marriages are in a new phase in which the criterion of the self-actualization of partners' life dreams has become an additional requirement for the success or failure of today's marriages. In our experience this is especially true for anyone who wants to be close to a woman today; women are being empowered in most parts of the world after millennia of oppression. It is high time to honor their dreams. In a sense, we are back to love maps in a deeper way here. One of our favorite films is *Don Juan DeMarco.* In that film Johnny Depp plays a mental patient who thinks he is Don Juan. He transforms Marlon Brando's life. Brando is about to retire. One day, after Depp talks to him about women, Brando converses with his wife, Faye Dunaway, in their garden. He asks her what her life dreams are. After a silence she says, "I thought you'd never ask." And so we were also driven by our data to become narrative therapists.

Create Shared Meaning

A relationship is about building a life together, a life that has a sense of shared purpose and meaning. It's not just about being happy. Victor Frankl wrote that the pursuit of happiness is empty, and instead he suggested that we find happiness along the way, as we pursue deeper meaning in life and fill the "existential vacuum." We come to "the attic" of the sound relationship house, where couples build a sense of shared purpose and meaning. Mirra Komarovsky (1987) recognized the importance of shared meaning in her classic book *Blue Collar Marriage.* So did Studs Terkel (1997). Everyone is a storyteller and a philosopher, trying to make some sense out of this brief journey we have through life. Even 4-year-olds are asking questions about whether they have to die, why they were born, where they go when they die, and what life is for, what it's all about. This is part of what our species is all about, making meaning. In this sense every marriage is a cross-cultural experience, since culture is about how we create meaning, and we do that in the values and symbols we have, the rituals of connection, the shared life goals, and shared philosophies of life. The family therapist William Doherty (1997) spelled out the importance of meaningful formal and informal rituals of connection in his classic book *The Intentional Family.* We create meaning by loving the same children, we believe in similar things, and we create meaning beyond ourselves. We build community. Here we return once again to build love maps, but at an existential level. Therefore, the data compel us to become existential and cultural anthropologists and sociologists to understand how people create meaning. The data also compel us to recognize the importance of how people create narratives that include the creation of shared purposes, such as shared ethics, shared values, shared philosophy, shared community, and shared spirituality.

Build Trust Instead of Distrust

One of the weight-bearing walls of our sound relationship house is trust. Trust may be defined precisely within the Levenson-Gottman research paradigm using the mathematics of game theory (see Gottman et al., 2002) as a metric in which each person acts to maximize the partner's (as well as one's own) rating-dial scores, that is, behaving so as to maximize the sum of their payoffs; then each person "has the other's back," the other's welfare, at heart. People build trust in their relationship by raising many forms of the following question: Will you be there for me when I need you? The trust metric assesses whether one's partner is acting (behaving, not just thinking) for the partner's welfare, also acting to maximize the partner's payoffs. We

measure payoffs with the rating dial, but this partner's benefits is a general idea because the rating-dial metric is valid. John's former student Dan Yoshimoto discovered that building trust is correlated with his attunement interview. The variable he derived from interviewing people about whether they can calmly talk to their partner about their emotions (particularly anger and sadness), attunement measures listening nondefensively, when emotions are regulated, with calm understanding and empathy to one's partner's negative emotions (even if oneself is the target). The finding is that if one can connect emotionally about everyday feelings, conflicts do not escalate.

Over time, when trust is established in Phase 2 of love, the relationship becomes what Susan Johnson calls a "safe haven." Our therapy as well as the emotionally focused attachment couples' therapy of Susan Johnson seeks to accomplish this very important goal. And so the data compelled us to become emotionally focused attachment therapists. However, the emotional connection necessary is about being friends, touching base on an everyday basis, being able to calmly discuss emotions. This revealed to us the importance of the skills of intimate conversation as a basis for connection. These skills turn out to also be the basis of a great sex life. Northrup, Schwartz, and Witte (2012) discovered that everywhere on the planet, whenever people say they have a great sex life, they do the same things: They say "I love you" every day and mean it, they express compliments, they give surprise gifts, they have a weekly date, they take romantic vacations, they cuddle often (only 6% of noncuddlers had a satisfying sex life), they kiss each other passionately for no reason, they display affection in public, and they make sex a priority. In her book *The Science of Kissing*, Kirshenbaum (2011) reviewed a German study that found that men who kiss their wives good-bye as they leave for work live 5 years longer than men who do not. What makes those lips seem so kissable is trust.

Build Commitment and Loyalty Instead of Betrayal

Building commitment and loyalty is the second weight-bearing wall of our sound relationship house. The "betrayal metric" John defined and validated was the existence of a negative correlation in the rating-dial time series, which measured the extent to which an interaction was like a zero-sum game (each person's gain is the other's loss). John found that his betrayal metric was significantly related to the fundamental variable first measured by the late, eminent social psychologist Caryl Rusbult. That fundamental variable is making negative comparisons between one's partner and real or imagined alternative relationships. Negative comparisons begin the cascade toward betrayal. Rusbult's model is called the investment and commitment model (Rusbult, Martz, & Agnew, 1998). Her work is the only research that has been able to predict sexual infidelity (Rusbult, Johnson, & Morrow, 1986). In her model of commitment, people do not make these negative comparisons between their partner and real or imagined other relationships. Instead, they invest more in the relationship, sacrifice for it, nurture pro-relationship thoughts, turn to the partner to get their needs met, put a wide fence between themselves and other potential relationships, and they speak highly of their relationship.

In our study, using our own and Rusbult's measures, we found that cherishing one's partner and nurturing gratitude for what one has, minimizing the partner's shortcomings, and maximizing the partner's positive qualities is part of this process of building commitment. This is opposed to what could be called "trashing" one's partner, and nurturing resentment for what is missing, minimizing the partner's positive qualities, and maximizing the partner's shortcomings is part of this process of building betrayal. The betrayal metric assess the extent to which interactions in conflict are a zero-sum game in which one partner's benefit is the other's loss; that is, the betrayal metric assesses the extent to which couples have a win–lose power struggle in the relationship. In a zero-sum relationship both partners negotiate to get what they want, regardless of the costs to the other. Commitment, as the late, insightful Shirley Glass suggested in her book *Not Just Friends* (Glass & Staeheli, 2004), also means that the wide fence between self and other potential relationships is a decision that this relationship is one's final life journey. The natural principle here is that loyalty is built in a love relationship through commitment and cherishing that person as unique and irreplaceable.

THREE PHASES OF LOVE IN A LIFETIME

One of the big questions we often get from therapists is, "What do I do if I love my partner,

but I'm no longer *in love* with my partner?" Most people feel that love is just one thing and that it shouldn't change or transform over time. Let us provide a best answer, one based on our longitudinal research that has spanned the lifetime.

Phase 1: Falling in Love—Limerence

Dorothy Tennov (1998) coined the term *limerence* for the stage of falling in love. Limerence is characterized by physical symptoms (e.g., flushing, trembling, palpitations), excitement, intrusive thinking, obsession, fantasy, sexual excitement, lust, hope, and fear of rejection. We now know a great deal about the first phase of love. Even in countries that arrange marriages, there is actually a great deal of selection and choice. Of course, in a great deal of the world, marriages are arranged by two families or by a matchmaker. Yet even in many of these cases, anthropological research has shown that the families really allow their children a considerable amount of choice, and Helen Fisher (2016) has found that many couples in arranged marriages also fall in love. In physician Theresa Crenshaw's (1997) revealing book *The Alchemy of Love and Lust*, it is very clear that not just anyone can set off the cascade of hormones and neurotransmitters that accompanies the exciting first phase of love. The person we select has to smell right, feel right, look right, taste right, and feel just right in our arms. The first phase of being "in love" is thrilling. We can't stop thinking about this person, we ruminate happily, we are filled with potential stories of how great our life with this person might be. We connect, we have so much in common, we feel intense attraction, we are obsessed. We can't keep our hands off this person when we're together. Those lips are the best. We are in love at last.

There is a cascade of hormones and neurotransmitters in Phase 1. These hormones and neurotransmitter include the following: phenylethylamine (PEA), "the molecule of love," which is a natural form of amphetamine our bodies produce; pheromones; dehydroepiandrosterone (DHEA); oxytocin, which has been called "the cuddle hormone"; vasopressin, related to mate guarding in males; testosterone, the steroid "hormone of lust"; dopamine, which is inspirational, motivational, exciting, anticipatory, and joyful—when activated, it is accompanied by the feeling that

something big and wonderful is about to happen; estrogen, which generates a willing availability; luteinizing-hormone-releasing hormone, or LHRH; and the reverse sex gear involving prolactin and progesterone (in women, not men). We can see that from the very differentiated effects of this cascade of hormones that the experience of love in Phase 1 is a complex mix of affection, soft receptivity, calm sociability, comfort in cuddling, unbridled excitement, the thrill of falling in love, obsessive thinking about the loved one, heightened eagerness and desire, compulsion, electrifying exhilaration, anticipation that something wonderful is happening or about to happen, seeking intense pleasure, dreaming about the future together, growing comfort and familiarity, an ease in relating and talking, delight, playfulness, silliness, humor and laughter, aggressive lust, passive and open receptivity, sexual arousal and orgasm, adventure, a desire to deepen one's relationship and stay at home, intense interest and absorption with love itself, a feeling that you can really be yourself, acceptance of the partner, ferment, secure bonding and attachment, friendship, fear of rejection and loss, and restlessness, all mixed with poor judgment and clouded reasoning. Wow!

Oxytocin is responsible for attachment, but it is also responsible for shutting down the fear system in the brain and the resulting potential bad judgment that happens during limerence. Because of oxytocin, we become attached, and also because of oxytocin we do not see the red flags that this new person is also showing us. We ignore negative signs that this may not really be such a good match. Research with oxytocin nasal spray—compared to saline nasal spray—has shown that it does heighten positive feelings in couples' interaction and reduce cortisol secretion (Ditzen et al., 2009). Reducing fear through oxytocin also clouds good judgment (Kosfeld, Heinrichs, Zak, Fishbacher, & Fehr, 2005). In one experiment comparing spraying oxytocin with spraying saline up people's noses, they gave subjects a lot of money. Then a person pretending to be a well-dressed Swiss banker came in and offered to take the subject's money and either quadruple it for the subject or just keep it for himself. The people who had saline sprayed up their noses they said no to this offer. The people who had oxytocin sprayed up their noses dreamily agreed. Limerence requires suspending good judgment. The oxytocin haze is

also generally accompanied by poor judgment, so that many people ignore the red flags that they will inevitably confront in Phase 2 of love. How long does this limerence phase last? Some claim that it ends naturally within 18 months. However, Fisher (2016) has put people in an fMRI machine and shown them pictures of the person they are in love with versus a picture of a stranger. With the loved one's picture the whole septal area of the brain, the dopaminergic reward center, lights up. For some married couples the septal area still lights up after 21 years of being together. Therefore, perhaps limerence can last forever.

Phase 2: Building Trust

There is a less well-known second phase of love relationships, after an initial commitment, after she or he has moved in, or after the two of us marry. The couple has some buyer's remorse. Then they wonder, "Did I make a mistake?" "Did I rush into this too fast?" "Who is this person I love really?" "Can I really trust her?" "Will he or she be faithful?" "Will I come first?" "Am I more important to him than his friends, or his mother?" "Why does she act so thoughtlessly?" "Why does she hurt me so much?" "Will she never be happy with anything I do, ever?" "Why doesn't he listen?" And, above all, "Can I really trust this person?" This leads us to another natural principle: The big question of Phase 2 of love is, "Will you be there for me? Can I trust you?" That is the basis of all the conflicts newlyweds had in the love lab. The answer to this question is the basis of secure or insecure attachment to the romantic partner. In this second phase of love, sometimes the very same qualities that at first blush were so charming and endearing become irritating and annoying. The vivacious and vital extrovert who was so charming now seems flighty, impetuous, and impulsive. The solid and thoughtful introvert now seems aloof, remote, cold, and unreachable. "Why can't he or she be more like me?" "Why can't she be happy with me the way I am?" Love in Phase 2 becomes punctuated by frustration, exasperation, disappointment, sadness, and fury. The most fighting in a relationship happens in the first 2 years.

What's going on here? Why are they hurting each other? Why do they fall so quickly from anger to despair? Why all this sudden chaos? Well, turns out that there is actually an order to all this Phase 2 fighting, and there is indeed a purpose to the madness. What we discovered is that this second phase of love is all about establishing trust. Most of this fighting comes from failed bids for connection that reveal trust issues. We suggest (but have no data to show) that building trust is as highly selective as limerence. Trust either is established or, if the couple fails to build trust, they will usually divorce. All the arguments that our newlyweds in the love lab had were about trust. The question is, Can they create a safe haven in this relationship in which they can count on their partner's being there for them?

But, what was trust? As noted earlier, John developed a trust metric by putting together the rating dial with John's specific affect (SPAFF) coding of the couple's interaction. Then John used the mathematics of game theory. Game theory isn't just about games, parlor games like poker or chess. Game theory is a general approach toward understanding all of social interaction (Thibaut & Kelley, 1959; Von Neumann & Morgenstern, 1949). It relies on the very simple idea that as we interact, we generally automatically evaluate the positivity or negativity of the "exchange." A great deal of social research has borne out that basic assumption. If John smiles at Julie and John gets a return smile, he may react happily as if the sun just came out of the clouds. Or he might think, "That's not a very real smile. She hasn't really smiled at me in a heartfelt way in a long time." He may not be very conscious of his evaluation, but it's there, guiding his thoughts, emotions, and actions. In other words, with game theory we can define a metric that indexes trust.

Phase 3: Building Commitment and Loyalty

For many people who write about trust, the erosion of trust is the same process as betrayal. As apparently sensible as that may sound, we think it is wrong. The processes of building trust versus distrust are entirely distinct from the processes of building loyalty and commitment versus betrayal. That's part of the news in John's work on defining the trust and loyalty metrics. Therefore, we suggest that there is a third phase of love, which comes after building trust. That third phase is about building commitment and loyalty. We suggest again, without data, that building commitment is also highly selective. As noted earlier, to understand that phase John created a betrayal metric, which we also validated, a metric that could apply to any interaction for

which had the rating dial data. The natural principle here is this: To the extent that a couple's interaction is like a zero-sum game, versus a win–win cooperation, they will be nurturing a betrayal metric in their relationship.

In a study that combined this betrayal metric with the work of the late social psychologist Caryl Rusbult, we could describe this third phase of love. We could describe how couples systematically built either loyalty and commitment, or a lack of commitment and betrayal. The mathematics of game theory helped again. Just as it helped to define a trust metric, and to understand what processes built trust, John could define and validate the betrayal metric. Combining the new betrayal metric with the three decades of research by Caryl Rusbult, we could understand the precise processes that either built loyalty or built betrayal. Husbands in marriages that had the betrayal metric in their conflict interaction were much more likely to die during Robert Levenson's 20-year study of couples initially in their 40s or 60s than were husbands in marriages that had a cooperative metric in their conflict interaction. In a second study we discovered that a betrayal metric correlated with these husbands having faster baseline myocardial contractility, and therefore chronically higher blood pressure. The betrayal metric was not only valid; it had life-threatening consequences.

Why do so many relationships end with an affair? There is a score of books about how to help couples recover from this betrayal. None is based on any data. What was the betrayal exactly, and was it limited to only sexual infidelity? What predicted infidelity? What predicted fidelity? What were the dynamics of betrayal or of loyalty? We discovered that there is a new fork in the road for relationships in Phase 3. This third phase of love is about a couple either cherishing each other and nurturing gratitude for what they have with their partner or nurturing resentment for what they think is missing. This third phase is about making a deeper love last a lifetime, or slowly nurturing betrayal.

Caryl Rusbult found that people's comparison level for alternative (real or imagined) other relationships was central in understanding commitment or betrayal. Negative comparisons (i.e., negative comps) are most important when one's partner experiences a negative emotion, is in pain, and makes a bid with a need to connect, and *then* the partner turns away, with the emotion-dismissing negative comp "Who

needs this demand? Who needs this negativity? I can do better." We can summarize this natural principle as follows: Negative comps begin the cascade toward betrayal. Starting with negative comps, an entire cascade can be described that leads eventually to actual betrayal. In this third phase of love couples then either systematically build commitment and loyalty or systematically build the basis for eventual betrayal.

The third phase of love is about cherishing what one has and nurturing gratitude, or trashing what one has and nurturing resentment for what is missing. In the first case, one tries to get one's needs met in this relationship, and to meet the partner's needs as well, and the couple moves toward commitment and loyalty. Romance and sex become very personal because they are cherishing and loving this person, with commitment and loyalty. This very personal romance is the opposite of pornography, which can be defined as the ultimate impersonal sex (anyone can be plugged in or out of the porn images; it's not personal). In personal sex no one else will do; romance is about making love to that person rather than just having sex. In personal sex one is excited by the partner's passion, not just working for the orgasm as if it were a field goal. In the second case of nurturing negative comps and the betrayal metric, one begins thinking that one can do better, that there is some real or imagined relationship out there in which one would be happier. Negative comps become par for the course. People believe that there must be a better match out there somewhere, and they then invest less in the relationship and sacrifice less for the relationship. They work to get the best deal for themselves in negotiating any conflict. They avoid self-disclosing their needs to the partner, and they start avoiding conflict as well.

Conflict becomes the roach-motel model of negativity. The couple starts avoiding conflict and avoiding self-disclosure of their needs. Secrets are naturally kept in the interests of maintaining peace with the partner. People start substituting for what they think is missing in the relationship. They vilify and trash their partner in their minds, and then to confidants. Surprisingly, they begin seeing their partners as untrustworthy and are more likely to leave them. They begin forming liaisons as they substitute for what is missing in their relationship, giving themselves permission to cross small boundaries, and eventually to cross bigger ones. This third phase was also entirely predictable.

CONCLUSION

Our sound relationship house theory was created by both research and clinical work. We began with no theory at all, but we were led by our data and our clinical work to become systems therapists, to become behavior therapists, to become emotionally focused therapists, to become psychodynamic therapists, to become narrative therapists, and to become existential therapists. We began with none of these theories, but we were forced by the data to adopt parts of them all. The sound relationship house theory is simply one eclectic way of integrating them all. It works.

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