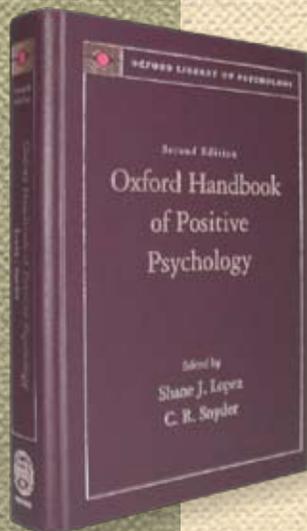


The Central Role of the Heart in Generating and Sustaining Positive Emotions

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The Institute of HeartMath



From the Oxford Handbook of Positive Psychology
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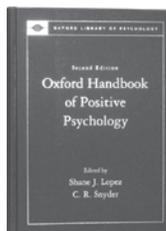
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The Central Role of the Heart in Generating and Sustaining Positive Emotions

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Abstract:

Scientific research has established a significant, complex, and highly sophisticated connection between the human heart and brain. The heart directly influences the activity of higher brain centers involved in perceptual and cognitive processing and in the creation of emotional experience. An important tool that provides a window into the activity occurring between the heart and brain is heart rate variability (HRV), an analytic tool that measures the beat-to-beat changes in heart rate. HRV is generated largely by interaction between the heart and brain via the neural signals flowing through the afferent (ascending) and efferent (descending) pathways of the sympathetic and parasympathetic branches of the ANS.

Research has shown that sustained positive emotions facilitate an emergent global shift in psychophysiological functioning, which is marked by a distinct change in the rhythm of heart activity. This global shift generates a state of optimal functioning, characterized by increased synchronization, harmony, and efficiency in the interactions within and among the physiological, cognitive, and emotional systems. This state is called psychophysiological coherence. As people experience sincere positive feelings the more ordered information flowing from the heart to the brain acts to facilitate cortical function and improve cognitive performance. These findings may help explain the significant shifts in perception, increased mental clarity and heightened intuitive awareness many individuals report when practicing heart-centered, positive emotion-refocusing and restructuring techniques.

Throughout history, philosophers, poets and prophets, as well as ordinary people, have associated the heart with positive emotions. In *The Epic of Gilgamesh*, the oldest recorded human story, the heart is seen “as the wellspring of our human emotions” (Godwin, 2001). In most early civilizations, the heart was considered the seat of happiness, joy, ecstasy, and similar emotions (Godwin, 2001;

Young, 2003). Only recently has science begun unweaving the mystery of the heart and decoding its many functions beyond pumping blood, including its functional role in generating emotional states, especially positive emotions.

Recent years have seen the emergence of a new understanding of how the brain functions and how the heart and brain interact in a dynamic

and complex relationship. Rather than assembling thoughts and feelings from bits of data like a digital computer, the brain is an analog processor that relates whole concepts or patterns to one another and looks for similarities and differences, and relationships between them (Ratey, 2001). This way of understanding brain processes has challenged long-held views of how emotions are generated (LeDoux, 1996). Psychologists once maintained that emotions were purely mental expressions generated by the brain alone. We now know that emotions have as much to do with the body as they do with the brain. A current view widely held among neuroscientists and psychophysicists is that the emergence of emotional experience results from the ongoing interactions between the brain, the body, and the external environment (Damasio, 2003; Pribram & Melges, 1969). In this chapter we focus on the key role of the heart in emotional experience and how heart-focused, positive-emotion refocusing techniques can be used to both transform negative emotions in the moment and facilitate an enduring positive change in attitudes and affect.

The Physiology of Positive Emotions

Research at the Institute of HeartMath on how psychophysiological patterns change during stress and various emotional states consistently has found that the rhythmic beating patterns of the heart are reflective of changes in emotional states and that they covary with emotions in real time. Specifically, we examined the natural fluctuations in heart rate, known as heart rate variability (HRV) or heart rhythms. These beat-to-beat changes in heart rate are generated largely by the interaction between the heart and brain via the neural signals

flowing through the afferent (ascending) and efferent (descending) pathways of the sympathetic and parasympathetic branches of the autonomic nervous system (ANS). HRV is thus considered a measure of neurocardiac function that reflects heart–brain interactions and ANS dynamics.

Utilizing HRV analysis, we have demonstrated that distinct heart rhythm patterns characterize different emotional states. In general, emotional stress—including emotions such as anger, frustration, and anxiety—leads to heart rhythm patterns that appear incoherent (Figure 1).

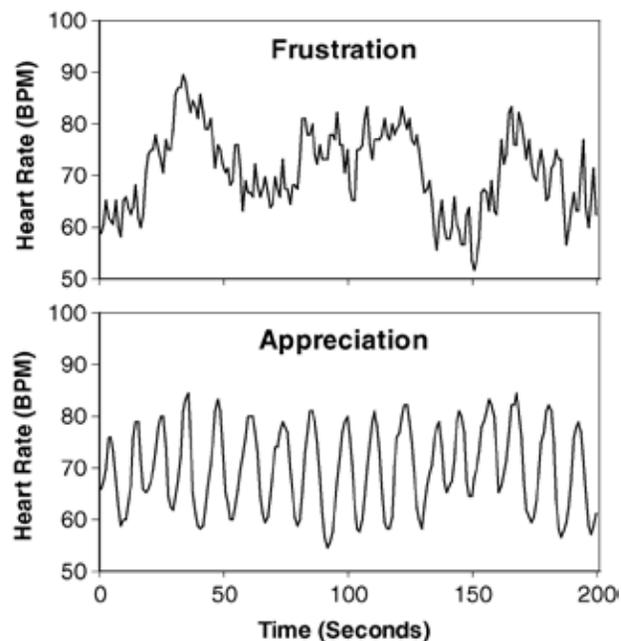


Figure 1. Emotions are reflected in heart rhythm patterns.

The heart rhythm pattern shown in the top graph, characterized by its erratic, irregular pattern (incoherence), is typical of negative emotions such as anger or frustration. The bottom graph shows an example of the coherent heart rhythm pattern typically observed when an individual is experiencing sustained, modulated positive emotions.

Overall, compared to a neutral baseline state, this indicates disorder in the higher level control systems in the brain and less synchronization in

the reciprocal action of the parasympathetic and sympathetic branches of the ANS. This desynchronization in the ANS, if sustained, taxes the nervous system and bodily organs, impeding the efficient synchronization and flow of information throughout the psychophysiological systems. This in turn results in cortical inhibition which impairs cognitive functions and diminishes one's ability to think clearly, discriminate among behavioral choices, and self-regulate emotions (McCraty, Atkinson, Tomasino, & Bradley, 2005; McCraty & Childre, 2004).

In contrast, sustained positive emotions, such as appreciation, compassion, and love, generate a smooth, ordered, sine wave-like pattern in the heart's rhythms. This reflects increased synchronization in higher-level brain systems and in the activity occurring in the two branches of the ANS as well as a shift in autonomic balance toward increased parasympathetic activity. As depicted in Figure 1 and also demonstrable by quantitative methods (McCraty et al., 2005; Tiller, McCraty, & Atkinson, 1996), heart rhythms associated with sustained positive emotions are clearly more coherent (autocoherence) than those generated during a neutral or negative emotional experience. During the coherent mode, a harmonious heart rhythm pattern emerges which typically oscillates at around six cycles per minute (Figure 1) (McCraty et al., 2005).

Further research has revealed that these associations hold true in studies conducted in both laboratory and natural settings and for both spontaneous emotions and intentionally generated feelings (Rein, Atkinson, & McCraty, 1995; Tiller et al., 1996). Importantly, although heart rate and the

amount of HRV can covary with emotional changes, *we have found that it is the **pattern** of the heart's rhythm that is primarily reflective of the emotional state.* Thus, it is the rhythmic pattern, rather than the rate, that is most directly related to emotional dynamics and physiological synchronization, i.e., a state in which the body's various functions operate harmoniously in relation to one another (McCraty et al., 2005).

Psychophysiological Coherence and Positive Emotional States

Taking this research further, we observed that when positive states are maintained, through the intentional generation of positive emotions, coherent heart rhythm patterns can be sustained for longer periods, which leads to increased synchronization and entrainment between the heart's rhythm and the activity of multiple bodily systems. Such synchronization is observed between heart rhythms, respiratory rhythms, and blood pressure oscillations; however, other biological oscillators, including very low frequency brain rhythms, craniosacral rhythms, and electrical potentials measured across the skin, also can become synchronized. The coherent state is characterized by increased synchronization between the activity of the heart and brain. Specifically, we have found that the brain's alpha and beta rhythms, as well as lower frequency brain activity, exhibit increased synchronization with the cardiac cycle during this mode. We have introduced the term "psychophysiological coherence" to describe the distinctive set of positive, emotion-driven physiological correlates that consistently are observed in such states across diverse subject populations (McCraty & Childre, 2004). This coherent state reflects a global state

of optimal function, characterized by increased synchronization, harmony, and efficiency in the interactions within and among the physiological, cognitive, and emotional systems.

In terms of physiological functioning, coherence is a highly efficient mode that confers a number of benefits to the system, including: (1) resetting of baroreceptor (sensory nerve sensitive to changes in pressure) sensitivity, which is related to improved short-term blood pressure control and increased respiratory efficiency (Lehrer et al., 2003); (2) increased vagal afferent traffic (McCraty et al., 2005), which is involved in the inhibition of pain signals and sympathetic outflow (Foreman, 1994); (3) increased cardiac output in conjunction with increased efficiency in fluid exchange, filtration, and absorption between the capillaries and tissues (Siegel et al., 1984); (4) increased ability of the cardiovascular system to adapt to circulatory requirements (Langhorst, Schulz, & Lambertz, 1984); and (5) increased temporal synchronization of cells throughout the body (Langhorst et al., 1984). Together, these benefits result in increased system-wide energy efficiency, metabolic energy savings, and increased harmony in bodily processes.

Psychologically, the coherence mode is associated with a calm, emotionally-balanced, yet alert and responsive state that is conducive to improved cognitive and task performance, including problem-solving, decision-making, long-term memory, and activities requiring perceptual acuity—attentional focus, coordination, and discrimination (McCraty et al., 2005), a state similar to that known as “flow.” These observations between increased physiological efficiency and positive emotions may provide an important aspect of the mechanism that explains the growing number of documented

correlations between positive emotions, increased cognitive flexibility, and creativity (see the chapters by Simonton and Isen in this volume), broadened thought action repertoires, increased personal resources (see Fredrickson in this volume), improved health, and increased longevity (Danner, Snowdon, & Friesen, 2001; Levy, Slade, Kunkel, & Kasl, 2002; Ostir, Markides, Black, & Goodwin, 2000).

The Key Role of the Heart in Emotional Experience

As described previously, our findings suggests a fundamental link between emotions and the *patterns* of both efferent (descending) and afferent autonomic activity as well as changes in ANS activation, which are clearly reflected in heart rhythm patterns and therefore play a key role in emotional experience. It is important to emphasize, however, that the heart’s rhythmic patterns not only *reflect* an individual’s emotional state, they also play a direct role in *determining* emotional experience. At the physiological level, as shown in Figure 2, afferent input from the heart is conveyed to a number of subcortical regions of the brain that are involved in emotional processing, including the thalamus, hypothalamus, and amygdala.

Moreover, cardiac afferent input has a significant influence on the activity of these brain centers (Cameron, 2002; Foreman, 1997; Oppenheimer & Hopkins, 1994). For example, activity in the amygdala has been found to be synchronized to the cardiac cycle (Frysinger & Harper, 1990).

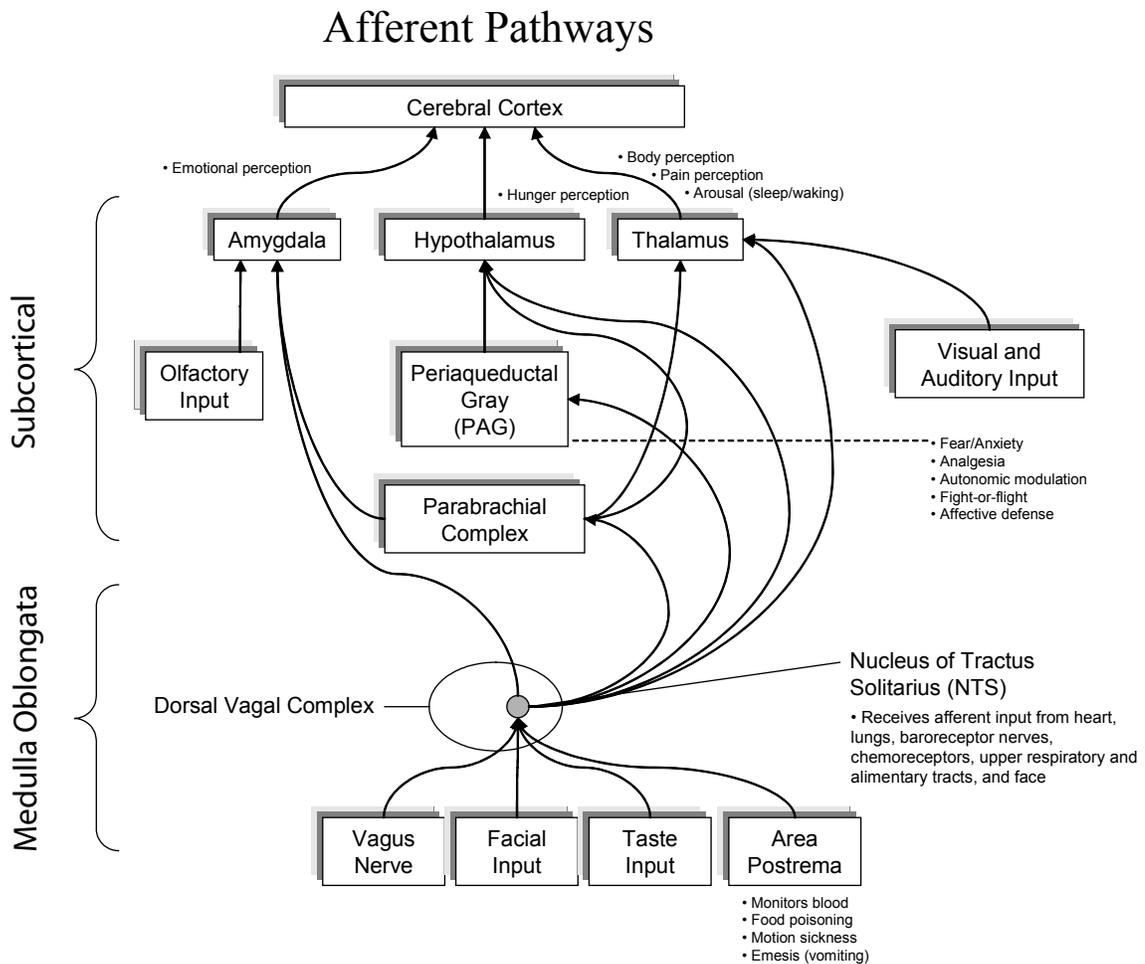


Figure 2.

Diagram of the currently known afferent pathways by which information from the heart and cardiovascular system modulates brain activity. Note the direct connections from the NTS to the amygdala, hypothalamus, and thalamus. Although not shown, there is also evidence emerging of a pathway from the dorsal vagal complex that travels directly to the frontal cortex.

These findings and those from our own research led us to ponder the fundamental physiological significance of the covariance between the heart's rhythms and changes in emotion. This question was especially intriguing in light of current views in neuroscience that the contents of feelings are essentially the configurations of bodily states represented in somatosensory maps (Cameron, 2002; Damasio, 2003). As Damasio states, "The essential content of feeling is the mapping of

a particular body state; the substrate of feelings is the set of neural patterns that map the body state and from which a mental image of the body state can emerge" (Damasio, 2003, p. 88). The essence of this theory of emotion was first proposed by William James (James, 1884).

Pribram's theory of emotion extends the mapping of body states and provides an understanding of how the heart is involved in the processing of emotional experience (Pribram & Melges, 1969). In

this theory, the brain is viewed as a complex pattern storage, identification and matching system. According to Pribram's model, past experience builds within us a set of familiar patterns which become established in the neural architecture. Inputs to the brain from both the external and internal environments contribute to the maintenance of these patterns. Many processes within the body provide constant rhythmic inputs with which the brain becomes familiar. These include the heart's rhythmic activity; digestive, respiratory and hormonal rhythms; and patterns of muscular tension, particularly facial expressions. These inputs are monitored continuously by the brain and help organize perception, feelings and behavior. Current inputs are compared to the familiar reference pattern established in the neural maps. When the pattern of the current input is sufficiently different from the familiar reference pattern, a *mismatch* occurs. This mismatch, or *departure from the familiar*, is what underlies the generation of feelings and emotions.

Although inputs originating from many different bodily organs and systems are involved in the processes that ultimately determine emotional experience, it is now abundantly clear that the heart plays a particularly important role. The heart is the primary and most consistent source of dynamic rhythmic patterns in the body. Furthermore, the afferent networks connecting the heart and cardiovascular system with the brain are far more extensive than are the afferent systems associated with other major organs (Cameron, 2002). Additionally, the heart is particularly sensitive and responsive to changes in a number of other psychophysiological systems. For example, heart rhythm patterns are modulated continually and rapidly by changes in

the activity of either branch of the ANS. Further, the heart's extensive intrinsic network of sensory neurons enables it to detect and respond to variations in hormonal rhythms and patterns (Armour & Ardell, 1994). In addition to functioning as a sophisticated information-processing and encoding center (Armour & Kember, 2004), the heart is also an endocrine gland that produces and secretes hormones and neurotransmitters, including oxytocin (Huang et al., 1996). The heart not only pumps blood, but also continually transmits dynamic patterns of neurological, hormonal, pressure, and electromagnetic information to the brain and throughout the body.

An example illustrating the influence of cardiac afferent input on emotional experience is provided from research showing that psychological aspects of panic disorder are often created by an unrecognized cardiac arrhythmia. One study found that DSM-IV criteria for panic disorder were fulfilled in more than two-thirds of patients with sudden-onset arrhythmias. In the majority of cases, once the arrhythmia was discovered and treated, the symptoms of panic disorder disappeared (Lessmeier et al., 1997). When the heart rate variability patterns of such an arrhythmia are plotted, the erratic, incoherent waveform appears quite similar to the heart rhythm pattern produced during strong feelings of anxiety in a healthy person. Because the sudden, large change in the pattern of afferent information is detected by the brain as a mismatch relative to the stable baseline pattern, it consequently results in feelings of anxiety and, since the brain mechanisms involved in self-regulation cannot regain control, it escalates into feelings of panic.

The previous example illustrates the immediate and profound impact that changes in the heart's

rhythmic activity can have on one's emotional experience. In this example—as is usually the case—such changes occur unconsciously. One of the most important findings of our research, however, is that changes in the heart's rhythmic patterns also can be *intentionally generated*. An intentional shift of focus to the physical area of the heart with the self-induction of a positive emotional state, rapidly initiates increased coherence. This, in turn, results in a change in the pattern of afferent cardiac signals sent to the brain, which serves to *reinforce* the self-generated positive emotional shift, making it easier to sustain. Through the consistent use of the coherence-building techniques, the coupling between the psychophysiological coherence mode and positive emotions is further reinforced. This subsequently strengthens the ability of a positive feeling shift to initiate a beneficial physiological shift toward increased coherence (with the resulting increase in efficiency and performance), or a physiological shift to facilitate the experience of a positive emotion.

While the process of activating the psychophysiological coherence mode clearly leads to immediate benefits by helping to transform stress in the moment it is experienced, it also can contribute to long-term improvements in emotion regulation abilities and emotional well-being that ultimately affect many aspects of one's life. This is because each time individuals intentionally self-generate a state of coherence, the “new” coherent patterns—and “new” repertoires for responding to challenge—are reinforced in the neural systems. With consistency of practice, these patterns become increasingly familiar to the brain. Thus, these new, healthy patterns become established as a new baseline or reference which the system then

strives to maintain. It is in this way that HeartMath tools facilitate a *restructuring process* whereby the maladaptive patterns that underlie the experience of stress are progressively replaced by healthier physiological, emotional, cognitive, and behavioral patterns as the “automatic” or familiar way of being (McCraty, 2003; McCraty & Childre, 2004).

Positive Emotion-Refocusing Tools and Techniques

The research described here has informed the development of a set of positive emotion-refocusing techniques, known as the HeartMath System (Childre, 1994; Childre & Cryer, 2000; Childre & Martin, 1999; Childre & Rozman, 2002, 2005). The significance of the HeartMath process is that it offers individuals a systematic and reliable means to intentionally shift out of a state of emotional unease or stress into a “new” positive state of emotional calm and stability. This occurs as result of a process in which the individual intentionally creates a new positive emotional state as a future target and activates changes in patterns of psychophysiological activity that enable the system to achieve and maintain that new state.

Studies conducted across diverse populations in laboratory, organizational, educational, and clinical settings have demonstrated that these coherence-building techniques are effective in producing both immediate and sustained reductions in stress and its associated disruptive and dysfunctional emotions together with improvements in many dimensions of psychosocial well-being (McCraty, Atkinson, Tiller, Rein, & Watkins, 1995; McCraty, Atkinson, & Tomasino, 2003; McCraty, Atkinson, Tomasino, Goelitz, & Mayrovitz, 1999; McCraty, Barrios-Choplin, Rozman, Atkinson, & Watkins,

1998; Tiller et al., 1996). Collectively, results indicate that such techniques are easily learned and employed, produce rapid improvements, have a high rate of compliance, can be sustained over time, and are readily adaptable to a wide range of ages and demographic groups.

Such emotion-refocusing techniques are designed to enable people to intervene in the moment when negative and disruptive emotions are triggered, thus interrupting the body's normal stress response and initiating a shift toward increased coherence. This shift facilitates higher cognitive functioning and increased emotional regulation, both of which normally are compromised during stress and negative emotional states.

In addition to such positive emotion-refocusing techniques, which generally are used to address stress in the moment, HeartMath has developed several emotion-restructuring techniques through which individuals hold a positive emotional focus and maintain a state of coherence for longer periods (5–15 minutes or longer, if desired). These emotional-restructuring techniques can be an effective means to diffuse accumulated stress and negative feelings and to facilitate physical, mental, and emotional regeneration. The movement to a more organized pattern of cardiac afferent input that accompanies a coherent heart rhythm is one that the brain associates with feelings of security and well-being, resulting in a “pattern match” with positive emotional experience. This shift in the pattern of the heart's input to the brain thus serves to reinforce the self-generated positive emotional shift, making it easier to sustain. Through consistent

use of HeartMath tools¹, the coupling between the psychophysiological coherence mode and positive emotions is further reinforced.

Practice of the emotional restructuring techniques is typically accompanied by feelings of deep peacefulness and a sense of inner harmony. By quieting the normal stream of mental dialogue through this process, many users report the spontaneous emergence of increased intuitive clarity and insight relative to problems or troublesome issues.

The process of coupling an intentional shift in attention to the area of the heart with the self-induction of a sincere heartfelt positive emotion appears to excite the system at its resonant frequency, thus facilitating the emergence of the psychophysiological coherence mode (Figure 1). This shift to coherence, in turn, results in a change in the pattern of afferent cardiac signals sent to the brain, which is significant because at the physiological level, this shift serves to interrupt or prevent the triggering of the body's normal stress response. In addition, the increased physiological efficiency associated with the coherent mode appears to facilitate the body's regulatory and regenerative processes and speed recovery from stress (Luskin, Reitz, Newell, Quinn, & Haskell, 2002; McCraty et al., 2003; McCraty et al., 2005; McCraty, Atkinson et al., 1999; McCraty et al., 1998; McCraty, Tomasi, Atkinson, & Sundram, 1999). This may explain Frederickson's observations that positive emotions can undo the accumulated effects of negative emotions (Fredrickson, Mancuso, Branigan, & Tugade, 2000).

¹HeartMath has developed a set of practical, easy-to-use positive emotion-refocusing and restructuring tools and techniques. These include Neutral, Quick Coherence, Freeze-Frame, Heart Lock-In, Attitude Breathing, Cut-Thru, etc. (Childre & Martin, 1999; Childre & Rozman, 2002, 2005; Childre, 1994).

A further outcome of the shift to a state of coherence manifests at the cognitive level as a result of the change in the pattern of cardiac afferent information reaching the brain's higher cognitive centers. Research has shown that changes in input to the brain from the cardiovascular system can modify the brain's electrophysiological activity and lead to changes in perceptual and cognitive processing, leading specifically to increased mental clarity and higher cognitive functions (reviewed in McCraty et al., 2005; McCraty & Tomasino, 2006). The activation of the coherent state thus often results in a change in perception or attitude about a given stressor and the ability to address it from a more objective, discerning, and resourceful perspective.

Heart Rhythm Coherence Feedback Training: Facilitating Coherence

The learning and effective use of these positive emotion-focusing tools can be facilitated by heart rhythm coherence feedback training. The technology designed specifically for this purpose provides real-time physiological feedback that serves as a powerful aid and objective validation in the process of learning to self-generate positive emotions and increase psychophysiological coherence.

Heart rhythm feedback and coherence-building systems known as the emWave PC and emWave Personal Stress Reliever (Quantum Intech, Boulder Creek, California) allow one to see one's heart rhythm patterns in real-time on a computer screen or series of indicators. They also provide an objective measure of the current level of physiological coherence as well as an accumulated score. The systems also include tutorials that provide instruction in the coherence-building techniques. As us-

ers practice the techniques, they can readily see and experience the changes in their heart rhythm patterns, which generally become more ordered and more sine wave-like as they cultivate positive emotional states. The computer-based version includes a series of interactive games, controlled by the user's coherence level, which are designed to reinforce the positive emotion-refocusing skills.

Heart rhythm coherence feedback training and positive emotion-focused, coherence-building techniques are employed in diverse contexts by physicians and other mental health professionals, law enforcement personnel, educators, athletes, executives, and individuals to increase positive emotions and reduce the effect of negative and maladaptive emotions. Applications include: managing stress and anger; decreasing anxiety, depression, and fatigue; promoting improved academic, work, and sports performance; reducing physical and psychological health risk factors; and facilitating improvements in health and quality of life in patients with various clinical disorders.

The coherence mode contributes to long-term attitude shifts and improvements in emotional regulation and well-being. When individuals intentionally arrest and override the patterns associated with stress responses by self-generating a positive emotion and activating a state of coherence, a "new" coherent pattern—and "new" repertoires for responding to challenges—are deepened and reinforced in the neural architecture.

The occurrence of such a repatterning process is supported by both physiological and psychological data. At the electrophysiological level, ambulatory recordings demonstrate a greater frequency of spontaneous periods of coherence in the heart

rhythm patterns of individuals practiced in the HeartMath techniques, in comparison to the general population. There are also data linking the practice of HeartMath tools to favorable changes in hormonal patterns. Specifically, a significant increase in the DHEA/cortisol ratio was manifest in individuals who consistently used the HeartMath tools for thirty days. This finding, which recently has been independently replicated (Cobain & Butlin, 2002), is evidence of a repatterning process occurring at a fundamental level, given that there is normally little variability in levels of these hormones from month to month (McCraty et al., 1998).

Another important recent finding is that the heart produces as much oxytocin as does the brain (Gutkowska, Jankowski, Mukaddam-Daher, & McCann, 2000). This hormone has been demonstrated to be associative both with countering negative and boosting positive emotional states. Oxytocin, released in the body in such bonding experiences as lactation, romantic and sexual bonding, and positive social affiliation, is also produced in response to stress. As Taylor, Dickerson, and Klein (2005) summarize in the first edition of this Handbook, "Oxytocin, released in response to stress, appears to induce a state of mild sedation and relaxation, reduce anxiety, decrease sympathetic and HPA activity, and promote affiliative and pre-social behavior under stressful circumstances" (p. 561). Imagine: a hormone that both diminishes negative emotions and magnifies positive ones!

The Heart, Positive Emotions and Spirituality

George Vaillant (2005, 2006) asked, "Is spirituality just another word for the positive emotions?" and answers his own question by stating,

"Spirituality and the positive emotions are virtually synonymous." The heart has long been associated with positive spiritual states. All faith traditions consider the heart the seat of positive emotions, including love, compassion, praise, and joy. From earliest recorded history, humans considered the heart a sacred center of human experience essential not only for the transfer of knowledge and for passing on wisdom, but for achieving and expressing transcendent spiritual feelings. From father to son, mother to daughter, rabbi, shaman and sage to their followers, and even God to prophets, spiritual feelings were conveyed from heart to heart as well as from heart to mind. Images of the heart show up in the iconography of most ancient cultures. As Louisa Young says, "As soon as mankind knew anything about itself, it knew that it had a heart" (2003, p. xxiii).

The heart is at the heart of all religious traditions. The ancient Hebrews, Greeks, Egyptians, Sumerians, Hindus, Muslims, Christians and Buddhists all saw the heart as a major force in spiritual birth and rebirth. For ancients, the heart was not merely a metaphor for the home of the spirit, it was seen as being literally so. In fact, many traditional cultures saw the heart as the locus of the intellect, memory, spirit, and regenerative power. In many early texts we find the idea of offering one's heart to deity. The Bible uses such language as God creating a new heart for those who seek to change their lives, purifying one's heart, and having God's word written on one's heart. Similar ideas are found in Muslim, Buddhist, and other sacred books.

One of the strongest common threads uniting the views of diverse cultures and religious and spiritual traditions throughout human history has been a universal regard for the heart as a point of

spiritual influx and as a source of wisdom and positive emotions. According to the Buddha, “There is the heart element or current, which is the center of a being’s consciousness, and the very center of its mind. The Buddha referred to it as the ‘reflective current of the heart’.... The function of this current is to reflect in the mind the feelings, the passions, and the emotions” (Reiter, 2006, p 87). It is striking how specific this statement is and how close it comes to capturing the essence of our scientific model of emotion where the rhythms and patterns of heart activity are interpreted by the brain and mind as feelings and emotions.

Such ideas about the heart flourished in Western society until the seventeenth century. However, since then, the heart has been reduced essentially to either a simple pump or a sentimental valentine. We contend that much of the alienation of the spirit in the West is related to the loss of understanding of the heart as a central organ in spiritual transformation. Charles Siebert argues that we may “be suffering a kind of collective heart attack, a modern metaphysical one—pained by the weakening of long-held notions of the heart as the home of the soul and the seat of deep emotions” (Siebert, 1980, p.54).

One of these notions is that intuitive insight is related to the connection between the heart and spirit. In this context, a number of studies have shown that the body often responds to a future unknown emotionally-arousing event four to seven seconds prior to experiencing the actual event. In a study of the electrophysiology of intuition (McCraty, Atkinson, & Bradley, 2004a, 2004b), which was designed to investigate where and when in the brain and body information about a future

event is registered and processed, we discovered, surprisingly, that both the heart and brain appear to receive and respond to intuitive information. Even more surprising was the finding that the heart appears to receive intuitive information *before* the brain. The ability of the heart to respond to emotionally-relevant information indicates that the heart seems to be tuned to or assesses a field of information that is not limited by the boundaries of time and space. This may be the first scientific demonstration which indicates that the heart may indeed be linked to what might be called the higher self or spirit, as all the great religions and ancient civilizations have maintained.

As the research reported here demonstrates, when people engender heart-centered feelings, the resultant coherent heart rhythms reflect an emotional state normally associated with the spiritual—internal harmony, tranquility, a greater capacity for love and compassion, an increased impulse to forgive, and even euphoria and transcendence. Many speak of profound life changes as a result of incorporating such tools and techniques into their personal and professional lives.

We believe that understanding the heart’s role in spiritual development and spiritual evolution requires both scientific and humanistic tools and that these will prove complementary. We postulate that the investigation of the heart as the locus or portal of spiritual transformative experience represents a new field of inquiry, one that holds promise of discovery of elemental truths about the interconnectedness of the whole person— body, mind and spirit. As Jung said, “The utterances of the heart— unlike those of the discriminating intellect—always relate to the whole” (cited in Godwin, 2001, p.13).

Summary and Conclusion

Most people do not need to be convinced that the heart is intimately and deeply involved in positive emotions since most feel such emotions in or near their hearts. Additionally, most people experience heart-felt emotions in regard to their most significant, enduring and intimate relations with others. Further, imaginative and artistic expressions of positive emotions in such forms as music, poetry, and dance often are expressed in terms of the heart. Finally, the essence of our spiritual traditions and expressions are heart-centered.

The heart, that strange, mysterious organ beating rhythmically at the center of our bodies, which for millennia has inspired the imagination, turns out to be the very core of our being. As Schwartz and Russek state, "Metaphorically the heart is the sun, the pulsing, energetic center of our bio-physical solar system, and the brain is the earth. . . . One implication of the energy cardiology/cardio-energetic revolution is the radical idea that, energetically, the brain revolves around the heart, not the other way around" (cited in Young, 2003, p.100). Recently, science has begun unraveling the heart's mystery and revealing its hidden power. New discoveries about the heart and its place in our physical, social, and spiritual lives hold the promise not only of reconnecting us to the enlightened understanding about the heart found in ancient cultures but also of revealing new understandings not yet unfolded to our minds or imaginations.

Throughout history and across diverse cultures, religions, and spiritual traditions, the heart has been associated with spiritual influx, wisdom, and emotional experience, particularly with regard to other-centered, positive emotions such as appreciation and love. Current research provides evidence that the heart does indeed play a role in the generation of emotional experience. The model of emotion discussed herein includes the heart, together with the brain, and nervous and hormonal systems, as fundamental components of a dynamic, interactive network from which emotional experience emerges. Further, research has identified new physiological correlates associated with the experience of heartfelt positive emotions. Heart-based, positive emotion-focused techniques designed to help people self-induce and sustain states of positive emotions have proven effective in a variety of settings. The study of the relation of the heart to positive emotions is one of the exciting frontiers in positive psychology.

Questions about the future of this topic:

1. What discoveries are yet to unfold that will broaden and deepen our understanding of the heart's role in generating emotional and perceptual experience?
2. What explains how the heart can "know" a future emotionally relevant event before it happens?
3. Can the generation of coherent fields facilitate coherence among humans and between humans and other living organisms?

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