FEATURE ARTICLE

Psychophysiological Correlates of Spiritual Experience

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Abstract: *Heartfelt positive emotions, such as love, appreciation, care and compassion, have long been associated with spiritual experience. However, because of a fundamental lack of mental and emotional self-management, such emotions, and associated experiences of increased spiritual connectedness, remain largely transient and unpredictable events in most people's lives. Here, we summarize our research that has linked sustained positive emotion to a distinct mode of physiological functioning, termed psychophysiological coherence. This mode, characterized by heart rhythm coherence, increased heart-brain synchronization and entrainment of diverse physiological oscillatory systems, is associated with increased emotional stability, improved cognitive performance, and a range of positive health-related outcomes. Additionally, individuals frequently report feelings of increased spiritual connectedness during psychophysiologically coherent states. Using heart rhythm coherence feedback training, individuals can readily learn to self-generate the coherent mode and sustain genuine positive emotional states at will, thus establishing an internal environment that is conducive to fostering spiritual experience.*

You feel a deep sense of peace and internal balance – you are at harmony with yourself, with others and with your larger environment. You experience increased buoyancy, vitality and flow. Your senses are enlivened – every aspect of your perceptual experience seems richer, more textured. Surprisingly, you feel invigorated at times when you would usually have felt tired and drained. Things that usually would have irked you just don't "get to you" as much. Your body feels regenerated – your mind, at last, clear. At least for a period of time, decisions become obvious as priorities clarify and inner conflict dissolves. Intuitive insight suddenly provides convenient solutions to problems that had previously consumed weeks of restless thought. Your creativity flows freely. In this state of inner harmony and deep fulfillment, you experience a sense of greater connectedness – to other people, to a larger whole, perhaps to God, or to a higher aspect of yourself.

Positive Emotions and Spiritual Experience

Many people have at some point in their lives experienced a state similar to that described above. In many cases, individuals report that such "magical" moments or periods of time, described by many as states of increased spiritual connectedness, were triggered by the genuine experience of heartfelt positive emotion. Perhaps it was the feeling of being fully and profoundly in love with another person; or the experience of deep appreciation for another's kindness; awe at the majesty of nature; or a sensation of joy and fulfillment spurred by one's own creative accomplishments.

Religious scholars, artists, scientists, medical practitioners and lay authors alike have written extensively on the transformative power of positive emotions. Moreover, recent research corroborates what we have long known intuitively, providing objective evidence that positive emotional states may indeed be key to optimal functioning, enhancing nearly all spheres of human experience. Positive emotions have been demonstrated to improve health and increase longevity (Blakeslee, 1997; Danner et al., 2001; Goldman et al., 1996; Russek & Schwartz, 1997), increase cognitive flexibility and creativity (Ashby et al., 1999; Isen, 1999), facilitate "broad-minded coping" and innovative problem solving (Aspinwall, 1998; Fredrickson, in press; Isen et al., 1987), and promote helpfulness, generosity and effective cooperation (Isen, 1987).

The growing body of research linking positive emotion to the enhancement of physical, cognitive and psychosocial functioning could lead one to surmise that it may be in the natural evolutionary trajectory of our species to learn to increase positive emotional experiences to further advance our ability to function healthily and effectively in the world. This is hardly a new idea. Indeed, most religious and spiritual traditions, regardless of cultural context, have emphasized the value of experiencing and expressing positive emotions – sometimes referred to as the "qualities of the heart" – feelings such as love, care, gratitude, appreciation, compassion, tolerance, forgiveness. Throughout the ages, such positive feeling states have been recognized as a cornerstone of spirituality and frequently associated with transpersonal experiences.

It is now thousands of years since the earliest spiritual teachers first exhorted our progenitors to love one another, to have compassion for our fellow human beings and to live in appreciation of life's gifts. Yet today we find that sustained positive emotions are not as prevalent in most people's lives as we might expect. Such states, along with their numerous benefits, remain, for the most part, transient experiences in people's lives, occurring randomly, and dependent to a large degree on arrangements of external events. Moments of heightened spiritual connectedness are rare and notable experiences for most, and occur largely

unpredictably, rather than being intentionally self-generated.

Emotional Management: The Missing Link

While most people intuitively know that they *feel* best and operate more efficiently and effectively when experiencing positive emotions, why is it that we do not more consistently engage such states in our day-to-day lives? Why do spiritual experiences remain rare and unpredictable occurrences for most people, even if many would desire to increase time spent in these fulfilling and regenerative states? We propose that a main factor underlying this discrepancy is a fundamental lack of mental and emotional self-management skills. In essence, the "inner noise" generated from unmanaged mental and emotional processes prevents people from more consistently engaging genuine positive emotions and sustaining states of enhanced spiritual connectivity. Despite our best intentions, the human "negativity bias" – the natural tendency to focus on input (including thoughts and emotions) perceived as negative to a greater extent than neutral or positive stimuli – is a very real phenomenon with a sound neurophysiological basis (Ito et al., 1998). Although most people would definitively claim that of course they love, they care, they appreciate, it might shock people to realize the large degree to which these feelings are merely assumed or acknowledged cognitively, far more than they are actively and intentionally experienced in the feeling domain. In the absence of *conscious efforts* to engage, build and sustain positive perceptions and emotions, we all too automatically fall prey to emotions and attitudes such as irritation, anxiety, worry, judgmentalness, being-overwhelmed, self-doubt and blame. Because of a lack of emotional awareness, many people actually do not realize the extent to which these negative emotional patterns (sometimes subtle and other times less so) dominate their internal landscape, eventually becoming so familiar and engrained that it may be difficult to separate them from one's sense of self-identity.

Unmanaged mental, and particularly emotional, activity drains vital energy from our reserves, which we call the *emotional energy accumulators*, and creates disorder or incoherence in our bodily systems. These emotional energy drains and the disordered patterns of neural and hormonal feedback to the brain, in turn, reinforce the negative feeling while also compromising higher processes necessary for clear perception, rational thought, intuition and effective self-regulation (McCraty, in press). Without conscious intervention, we are often left with an internal environment that inhibits and limits the range of positive experience, awareness and deeper spiritual connection. Moreover, although various stress management practices exist whereby people attempt to manage their emotions and reduce emotional drains using the mind, strategies that engage cognitive processes alone are often insufficient to overcome engrained emotional patterns and produce enduring change in the feeling world. This is true, in part, because emotional processes operate at a much higher speed than thoughts, and frequently bypass the mind's linear reasoning process entirely (LeDoux, 1996).

The Heart's Role in the Generation of Emotional Experience

Our research has focused on the development of practical tools and techniques to facilitate the self-regulation of emotions through the direct modulation of emotional experience, utilizing the heart as a point of entry into the psychophysiological networks that comprise the emotional system (Childre & Martin, 1999; Watkins & Childre, in press). We have found that heart-focused approaches are often effective in helping people override and transform maladaptive emotional patterns and establish new, healthier positive emotional patterns and responses. Notably, one of the strongest common threads uniting the views of diverse cultures, religious and spiritual traditions throughout human history has been a universal regard for the heart as a point of spiritual influx, a source of wisdom and of positive emotions such as love, care and compassion. Current research providing evidence of the heart's key role in the generation of perceptual and emotional experience suggests that these long-surviving associations may indeed be more than metaphorical. The heart is now recognized as a sensory organ and sophisticated information encoding and processing center, with an extensive intrinsic nervous system capable of making functional decisions independent of the brain (Armour & Ardell, 1994). Moreover, numerous experiments have demonstrated that patterns of cardiac afferent neurological input to the brain not only affect autonomic regulatory centers, but also influence higher brain centers involved in perception and emotional processing (Frysinger & Harper, 1990; McCraty, in press; Sandman et al., 1982).

The analysis of heart rate variability (HRV), or heart rhythms, is a powerful, non-invasive measure of neurocardiac function that reflects heart-brain interactions and autonomic nervous system dynamics, which are particularly sensitive to changes in emotional state (McCraty, Atkinson & Tiller, 1993; McCraty et al., 1995; McCraty & Singer, in press; Tiller, McCraty & Atkinson, 1996). Our research suggests a critical link between emotions, changes in the *patterns* of both efferent (descending) and afferent (ascending) autonomic activity, and associated changes in heart rhythm patterns. Specifically, we have found that during the experience of negative emotions such as anger, frustration or anxiety, heart rhythms become more erratic or disordered, indicating less synchronization in the reciprocal action that ensues between the parasympathetic and sympathetic branches of the autonomic nervous system. In contrast, sustained positive emotions, such as appreciation, love or compassion, are associated with a highly ordered or *coherent* pattern in the heart rhythms, reflecting greater synchronization between the two branches of the autonomic nervous system, and a shift in autonomic balance toward increased parasympathetic activity (McCraty, Atkinson & Tiller, 1993; McCraty et al., 1995; Tiller, McCraty & Atkinson, 1996).

Our research has led us to propose a model of emotion that includes the heart, together with the brain, nervous and hormonal systems, as fundamental components of the dynamic, interactive network that underlies emotional experience (McCraty, in press; McCraty et al., 1998). Our current model builds on the theory of emotion first proposed by Pribram (Pribram & Melges, 1969), in which the brain functions as a complex pattern identification and matching

system. In this model, past experience builds within us a set of familiar patterns, which are maintained in the neural architecture. Inputs to the brain from both the external and internal environments contribute to the maintenance of these patterns. Within the body, many processes 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 (McCraty, in press). These inputs are continuously monitored by the brain and help organize perception, feelings and behavior. Familiar input patterns form a stable backdrop, or reference pattern, against which new information or experiences are compared. According to this model, when an input is sufficiently different from the familiar reference pattern, this "mismatch" or *departure from the familiar* underlies the generation of feelings and emotions.

As a primary generator of rhythmic information patterns in the human body, and possessing a far more extensive communication system with the brain than do other major organs, the heart plays a particularly important role in the generation of emotion (McCraty, in press). With every beat, the heart transmits to the brain and throughout the body complex patterns of neurological, hormonal, pressure and electromagnetic information, which form a major component of the physiological backdrop that ultimately determines our emotional experience. As a critical nodal point in many interacting systems – physiological as well as cognitive and emotional – the heart is uniquely positioned as a powerful point of entry into the communication network that connects body, mind, emotions and spirit.

Psychophysiological Coherence: Internal Correlates of Spiritual Experience

Our research has shown that techniques that combine intentional heart focus with the generation of sustained positive affective states lead to a distinct mode of physiological function, termed *physiological coherence*. This mode is associated with improved cognitive, emotional, performance and health-related outcomes, as well as with subjective reports of increased spiritual experience (McCraty & Atkinson, in press). Correlates of physiological coherence include a sine wave-like pattern in the heart rhythms, a shift in autonomic balance toward increased parasympathetic activity, increased ECG-alpha rhythm synchronization, and entrainment between diverse physiological oscillatory systems (i.e., heart rhythm patterns, respiratory rhythms and blood pressure oscillations). In the coherent mode, the HRV power spectrum reveals a narrow-band, high-amplitude peak in the low frequency range, at a frequency of about 0.1 Hz (McCraty & Atkinson, in press; Tiller, McCraty & Atkinson, 1996) (Figure 1).

Although physiological coherence is a natural state that can occur spontaneously during positive emotional experiences and sleep, sustained episodes are generally rare. While specific rhythmic breathing methods can induce coherence and entrainment for brief periods, our research indicates that individuals can produce extended periods of physiological coherence by actively generating a sustained positive emotion. Using positive emotion to drive the coherent mode allows it to emerge naturally and typically makes it easier to sustain positive emotions and physiological coherence for longer periods, even during challenging situations. Our research supports the concept that during positive emotional states, the change in the pattern of cardiac afferent input reaching the higher brain centers leads to cortical

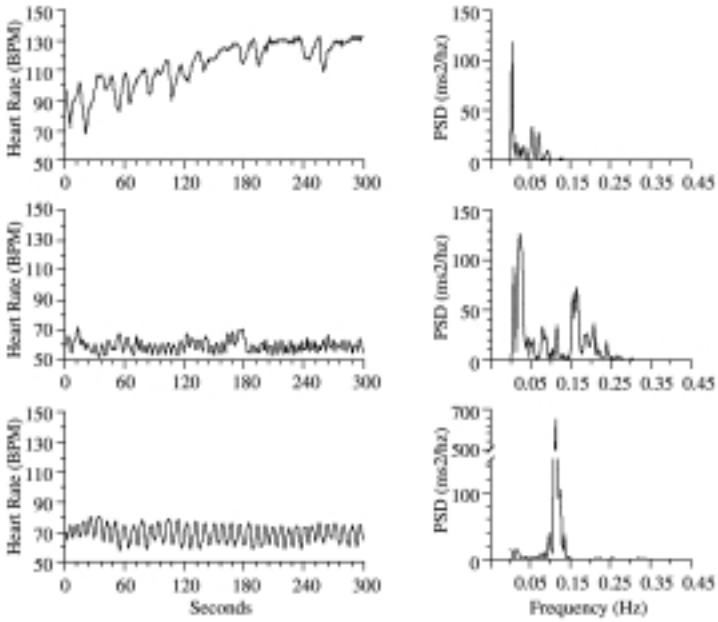

Figure 1. Emotions and heart rhythm patterns. Heart rate tachograms (left) and HRV power spectra (right) typical of different emotional/psychophysiological states. Anger (top) is characterized by a lower frequency, disordered heart rhythm pattern and increasing mean heart rate. As can be seen in the power spectrum, the rhythm is primarily in the very low frequency band, which is associated with sympathetic nervous system activity. Relaxation (center) results in a higher frequency, lower amplitude rhythm, indicating reduced autonomic outflow. In this case, increased power in the high frequency band of the power spectrum is observed, reflecting increased parasympathetic activity (the relaxation response). In contrast, sustained positive emotions such as appreciation (bottom) are associated with a highly ordered, smooth, sine wave-like heart rhythm pattern (coherence). As can be seen in the power spectrum, this physiological mode is associated with a large, narrow peak in the low frequency band centered around 0.1 Hz. This indicates system-wide resonance, increased synchronization between the sympathetic and parasympathetic branches of the nervous system, and entrainment between the heart rhythm pattern, respiration and blood pressure rhythms. The coherent mode is also associated with a shift in autonomic balance toward increased parasympathetic activity, encompassing the relaxation response, yet it is physiologically distinct from relaxation because it also requires increased harmony and synchronization in nervous system and heart-brain dynamics. In addition, the coherent mode does not necessarily involve a lowering of heart rate per se, or a change in the amount of variability, but rather, a change in heart rhythm pattern. Also note the scale difference in the amplitude of the spectral peak during the coherent mode.

facilitation, whereby mental clarity, creativity and intuitive insight are increased and the genuine positive emotional experience is further reinforced (McCraty & Atkinson, in press). When the physiological coherence mode is driven by a positive psychological state, we call it *psychophysiological coherence.*

During states of psychophysiological coherence, bodily systems function with a high degree of synchronization, efficiency and harmony. Psychologically, this mode is associated with improved cognitive performance, increased emotional stability, and enhanced psychosocial functioning and quality of life (Luskin & Thoresen, 1999; McCraty & Atkinson, in press; McCraty, Atkinson, & Lipsenthal, in preparation; McCraty et al., 1999a; McCraty et al., 1998). Studies conducted across diverse populations have associated the use of positive emotion self-induction methods that increase psychophysiological coherence with a range of favorable health-related outcomes, including reduced anxiety and depression, decreased physical symptoms of stress, enhanced immunity, reduced cortisol and increased DHEA (Barrios-Choplin et al., 1997; McCraty, 2001; McCraty et al., 1998; McCraty et al., 1999b; Rein et al., 1995). Additionally, improvements in clinical status have been demonstrated in various medical patient populations, including individuals with hypertension, diabetes, congestive heart failure and AIDS (Luskin et al., 2000; McCraty, Atkinson, & Lipsenthal, in preparation; McCraty, Atkinson, & Tomasino, in preparation; Rozman et al., 1996).

In addition to these objective findings, subjective reports from numerous individuals practiced in self-generating states of psychophysiological coherence indicate that this mode is associated with increased spiritual experience. Depending on an individual's particular belief system, this may manifest as a feeling of greater connectedness to God, unity with others, or greater connection to one's intuitive intelligence, spirit, or higher self. Some describe experiencing a notable reduction in inner dialogue along with deep feelings of self-security, peace and love. Individuals who have learned techniques to generate the coherent mode with consistency in their daily lives frequently report greater physical vitality, clearer thought processes, greater creativity and intuitive insight, increased emotional balance and the capacity to meet even challenging situations with ease and grace.

Promoting Psychophysiological Coherence and Spiritual Experience Using Heart Rhythm Feedback Training

Heart rhythm feedback training is a powerful tool to help people learn to self-generate the coherent mode at will and develop emotional self-regulation skills that increase the capacity to sustain heartfelt positive emotional states and experiences of greater spiritual connectedness. Technologies have been developed which enable physiological coherence to be objectively monitored and quantified. One such device, known as the Freeze-Framer™ Emotional Management Enhancer, is an interactive hardware/software system that monitors and displays clients' heart rate variability patterns in real time as they practice the positive emotional refocusing techniques taught in the on-line menus and books included with the system. These techniques guide people in intentionally generating sustained heart-based positive emotional states and coherent heart rhythm patterns. Using a finger sensor to record the pulse wave, the Freeze-Framer plots changes in heart rate on a beat-to-beat basis. As clients practice the emotional self-regulation techniques, they can readily see and experience the changes in their heart rhythm patterns, which generally become less irregular, smoother and sine wave-like as they enter the coherent mode. The program also analyzes the heart rhythm patterns and calculates a coherence ratio for each session. The coherence level is fed back to the user as an accumulated score or success in playing one of three on-screen games designed to reinforce the use of the self-regulation skills.

This technology has been successfully used in diverse settings by mental health professionals, physicians, educators and corporate executives to decrease stress, anxiety, depression and fatigue, promote improved academic and work performance, lower blood pressure and facilitate health improvements in numerous clinical disorders (McCraty, 2001). Additionally, many of our clients report that using this system has enabled them to develop the capacity to intentionally self-orchestrate benefits such as increased energy, self-directed thought, emotional stability and intuitive discernment, independent of external circumstances and events. They report that this learned ability greatly reduces the amount of stress they experience, increases personal effectiveness, improves relationships with others, and enables them to experience greater fulfillment in their day-to-day lives.

One of the most exciting implications of our findings is that by facilitating sustained states of coherence, this intervention appears to build back energy in cases where an individual's emotional energy accumulators were depleted. This is particularly important, as we propose that the depletion of emotional energy plays a major and largely unrecognized role in both the genesis and aggravation of many psychological and health problems. Our findings suggest that training individuals to *maintain* psychophysiological coherence not only replenishes the energy needed to fuel basic, health-sustaining physiological processes, but also actually permits the accumulation of additional energy to support higher creative capacities, thus enabling individuals to actualize more of their full potential and enrich the quality of their experience.

Our work using heart rhythm coherence feedback training with diverse populations suggests that the effectiveness of this approach in producing enduring change stems from the fact that it not only helps individuals increase psychophysiological coherence in the moment, but also *enables them to effectively build and establish a new internal baseline,* where such states of enhanced functioning increasingly become the norm. Practices that enable individuals to self-generate increased heart rhythm coherence with consistency strengthen the neural circuitry and reinforce the bodily responses activated during this state of enhanced mental, emotional and physiological functioning. Furthermore, the coupling of a positive physiological shift with an intentional positive emotional shift creates a powerful conditioned response – subsequently enabling coherent heart rhythm

patterns to facilitate positive emotional experiences, and positive feeling states to further enhance physiological coherence.

According to the model of emotion proposed here, with repetition, this process effectively establishes a new, stable reference pattern that is recognized by the brain, thus re-training the system to operate at a new, healthier baseline or norm. Ambulatory ECG data shows that this "re-patterning" process does indeed occur. Individuals well-practiced in self-management techniques are able to increase psychophysiological coherence, and enter this mode spontaneously during their day-to-day activities, without conscious application of the techniques.

In conclusion, we believe that heart rhythm coherence training holds promise as a practical and potent approach to empower individuals to improve the quality of their lives. By enabling the intentional self-generation and reinforcement of physiological states that are correlated with increased love, care, compassion, inner harmony, vitality and flow, in essence this intervention helps individuals create an *internal environment* that is conducive to fostering spiritual experience. Some might indeed describe the end result as being able to live more "from the heart," in alignment with their deepest core values, or with greater connection to spirit.

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