

THE PSYCHOPHYSIOLOGY OF ENTREPRENEURIAL INTUITION: A QUANTUM-HOLOGRAPHIC THEORY

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ABSTRACT

Successful entrepreneurs are passionate innovative risk-takers whose actions are informed by accurate intuitions about future business opportunities. Often such intuitive foreknowledge involves perception of implicit information about non-local objects and/or events by the body's psychophysiological systems. Recent experiments have shown that intuitive perception of a future event is related to the degree of emotional significance of that event, and a new study shows that both the brain and the heart are involved in processing a pre-stimulus emotional response to the future event. Drawing on this research and on the principles of quantum holography, we develop a theory of intuitive perception. The theory explains how focused emotional attention directed to the object of interest (such as a potential future business opportunity) attunes the psychophysiological systems to a domain of quantum-holographic information, which contains implicit information on the object's future potential. The body's perception of such implicit information about the object's future is experienced as an intuition.

It is likely that most, if not all, subtle, ephemeral and unexplained phenomena associated with subjective experience are connected, directly or indirectly, with the phenomenon of non-locality. ... Non-locality and the non-local quantum hologram provide the only testable mechanism discovered to date which offer a possible solution to the host of enigmatic observations and data associated with consciousness and such consciousness phenomena (Mitchell, 2000: 299).

INTRODUCTION

Successful entrepreneurs are passionate innovators and risk-takers who have extraordinarily accurate hunches about the locus of new future business opportunities (La Pira & Gillin, 2006). This paper seeks to explain the intuitive basis of entrepreneurship—that part of entrepreneurial decision and action that is *not* based on reason or logic, or on memories or extrapolations from the past, but is based, instead, on accurate foreknowledge of the future. In previous work (McCarty, Atkinson, & Bradley, 2004a; 2004b) we defined such foreknowledge of a future event as intuition, and viewed intuition as a process by which information normally outside of the range of conscious awareness is immediately sensed and perceived by the body's psychophysiological systems. Aside from a yet-to-be conducted experiment on “nonlocal intuition” (La Pira & Gillin, 2006), still in the design and planning phases involving researchers at Australian Graduate School of Entrepreneurship and the Institute of HeartMath, we know of no empirical research investigating the psychophysiology of intuitive perception in serial entrepreneurs.ⁱ

Fortunately, however, the fundamental question at issue here—accurate foreknowledge of the future—is a phenomenon that has been studied and well documented in rigorous scientific experiments for more than a century.ⁱⁱ A review of this research suggests that the underlying psychophysiological processes

involved are unlikely to be specific to any sub-population, such as entrepreneurs, and seem to operate more generally in individuals when intuitive perception occurs. Therefore, in the absence of direct research on the psychophysiological basis of entrepreneurial intuition (see Lieberman, 2000), we draw on the findings of this research, and, in particular, on a study we conducted. The latter is notable because it not only presents compelling evidence of intuitive foreknowledge, but also, and more importantly for our purposes here, it shows where and when in the body intuitive information is received and how this information is processed (McCraty, Atkinson, & Bradley, 2004a; 2004b).

As we will see, the results of these studies question a commonly held view of intuition: that it is not registered by the five senses of normal perception (vision, audition, taste, smell, and touch), but, instead, is either a direct, unmediated interaction between the mind and a nonlocal source, or is the result of some subtle, extraordinary—even supernatural—sense or force which conveys accurate nonlocal information straight into the mind (Bernstein, 2005).ⁱⁱⁱ Yet the interesting news from this research is *not* that of discovery of a new sixth sense or of a new information pathway to nonlocal things. Rather, it is that existing physiological structures are involved (*both* the brain and the heart), and that the body appears to process intuitive information in the *same* way it processes information from ordinary sensory input. We aim to demystify intuition by building a rational account firmly grounded in recent empirical evidence, whose reason and logic is informed by established scientific principles and concepts, and is amenable to empirical verification.

Towards this end, we use recent work on the psychophysiology of intuitive perception and the principles of quantum holography to develop a theory to explain how implicit information about a future event (such as a potential future business opportunity) can be accessed by the body's psychophysiological systems as intuitive information. Drawing on the principles of quantum holography, the theory explains how information about a future event is spectrally enfolded at the quantum level in the movement of energy, as an implicit field of information which exists as a domain apart from space and time. Focused emotional attention directed to the object of interest (such as a potential future business opportunity) attunes the psychophysiological systems to the quantum level of the object, which contains holographically-encoded information on the object's future potential. The body's perception of such implicit information about the object's future is experienced as an intuition.

INTUITION

Taking an information processing perspective, we view intuition as a process by which information normally outside the range of cognitive processes is sensed and perceived in the body and mind as certainty of knowledge or feeling (positive or negative) about the totality of a thing distant or yet to happen (McCraty, Atkinson, & Bradley, 2004a; 2004b). This “thing” can be a material object or event, or a mental construct such as a thought or idea. Often the feeling of certainty is absolute—the intuition is experienced as beyond question or doubt—and the feeling can encompass positive emotions, such as optimism and excitement, or negative emotions like dread, fear, or terror. This experience of an immediate, total sense of the thing as a whole is quite unlike the informational processing experience of normal awareness. In normal awareness, the contents of the mind are updated incrementally, as the moment-by-moment sequences of sensory experience unfold. Also, the experience of intuition is not confined to cognitive perception, but involves the *entire* psychophysiological system, often manifesting through a wide range of emotional feelings and physiological changes experienced throughout the body. The involvement of the entire psychophysiological system in processing intuitive perception is the basis of its detection and measurement using electrophysiological instrumentation, as we describe in the next section.

EVIDENCE

Although there is now an enormous body of experimental research documenting the phenomenon of intuitive perception (see Radin, 1997a), mainstream science still regards the findings of these studies as anomalous (Walach & Schmidt, 2005). Even among those who study it, intuition is viewed largely as the result of past experience—a function of the unconscious mind accessing existing information within the

brain from forgotten experience (Agor, 1984; Eisenhardt & Zbaracki, 1992; Hogarth, 2001; Laughlin, 1997; Lieberman, 2000; Myers, 2002). In presenting a very brief review of the evidence from studies that challenge this view, we will follow Bernstein (2005) and divide the work on the basis of the kind of intuitive information transmission investigated: *person-to-person* transmission, often referred to as telepathy; *place or object-to-person* transmission, also known as extra-sensory perception (ESP) or remote viewing; and *future-to-person* transmission, involving precognitive perception (thoughts) or presentiment perception (emotions).

Prior Research

In the 1930's Dr. Joseph Rhine (1964; 1981) conducted numerous pioneering studies on telepathic *person-to-person* information transmission. In 27 of 33 laboratory experiments, involving almost one million trials, he found statistically significant results in which a "receiver" correctly identified a simple symbol (square, circle, triangle, etc.) mentally transmitted by a "sender," in a different room, from a randomly selected card. Replication studies at other laboratories yielded a 61% statistically significant success rate, compared to 5% expected by chance. In the 1960's, Dr. Charles Tart (1963) added physiological instrumentation to measure the receiver's bodily response when a stimulus was administered to the body of a "sender," who was located in a separate room. He found that brain waves and peripheral blood volume changed significantly when the stimulus was applied near to or on the sender's body. A meta-analysis (Schlitz & Braude, 1997) of 19 laboratory studies conducted in Scotland and California in the 1980s and 1990s, involving "healers" sending their thoughts on a randomized schedule to receivers, found statistically significant changes in the receiver's body using Galvanic Skin Response (GSR) measures when the sender's thoughts were focused on them. Another forty studies, conducted during this time, employed a Ganzfeld procedure (to isolate the receivers from normal visual and auditory stimuli) and Faraday cages and steel wall screening (to block electro-magnetic radiation), and found that the receivers' overall accuracy rate, in correctly identifying which of four images had been sent by a sender, exceeded the rate expected by chance by 10^{15} to 1 (Radin, 1997a: 87-88).

Rhine (1964; 1981) was also a pioneer in research on *place-to-person* information transmission, in which a receiver is to identify a randomly selected distant target, also unknown to the experimenter. In the 1930's he conducted 34 studies involving 792,000 trials, and found success rates above those expected by chance. In the 1980's and 1990's, the CIA and SRI conducted a series of follow-up studies (Puthoff, 1966; May, et al., 1988), involving more than 1,000 trials, and found that the accuracy rates of the receivers' descriptions of the remote targets (scored by an independent panel of judges) exceeded chance by the factor of 10^{20} to 1.

Turning to the work on *future-to-person* information transmission, Honorton and Ferrari (1989) conducted a meta-analysis of the 309 studies (published in English) conducted on precognition between 1935 and 1989. All of the studies were laboratory controlled experiments in which subjects had to predict a target that would be selected in the future by a randomized procedure. Conducted by 62 different researchers and involving more than 50,000 subjects in nearly two million trials, the accuracy rate of correct predictions exceeded chance by 10^{25} to 1. A number of recent studies examining the brain's pre-stimulus response have demonstrated significant differences in event-related potentials^{iv} before target presentation as compared to nontarget stimuli (Don, McDonough, & Warren, 1998; McDonough, Don, & Warren, 2002).

In the last decade, researchers have turned their attention to presentiment and have begun to explore physiological predictors of future events by investigating whether the human autonomic nervous system can unconsciously respond to randomly selected future emotional stimuli. Radin (1997a, 1997b) designed experiments to evoke an emotional response using randomly selected emotionally arousing or calming photographs, with measures of skin conductance level (SCL) and photoplethysmographic measures of heart rate and blood volume. Comparison of SCL response between emotional and calm trials showed a significantly greater change in electrodermal activity around 5 seconds before a future emotional picture than before a future calm picture. These results have since been replicated (Bem, 2003; Bierman, 2000; Bierman & Radin, 1997; Bierman & Scholte, 2002; Radin, 2003), and a follow-up study, using functional magnetic resonance imaging, found brain activation in regions near the amygdala (which handle

the processing of strong emotions such as fear and sexual drive) *before* emotional pictures were shown, but not before the calm pictures (Bierman & Scholte, 2002). The consistent finding across these studies is that the *body often responds to a future emotionally arousing stimulus four to seven seconds prior to experiencing the stimulus*.

A Recent Study

In a recent study of the body's response to information about a future event, conducted at the Institute of HeartMath, we adopted Radin's (1997b) basic experimental protocol (see Figure 1) while including additional electrophysiological measures of brain and heart activity well suited to investigate information processing (McCraty, Atkinson, & Bradley, 2004a; 2004b). Drawing on the presentiment findings, we postulated that the greater the emotional significance of a future stimulus, the larger the physiological response prior to experiencing the stimulus. And because prior research has shown that the pattern of the rhythm of heart activity directly reflects the processing of emotional experience in the body (McCraty & Childre, 2004; Tiller, McCraty, & Atkinson, 1996), we were curious to find out if the heart had a role in the processing of pre-stimulus information about a future event.

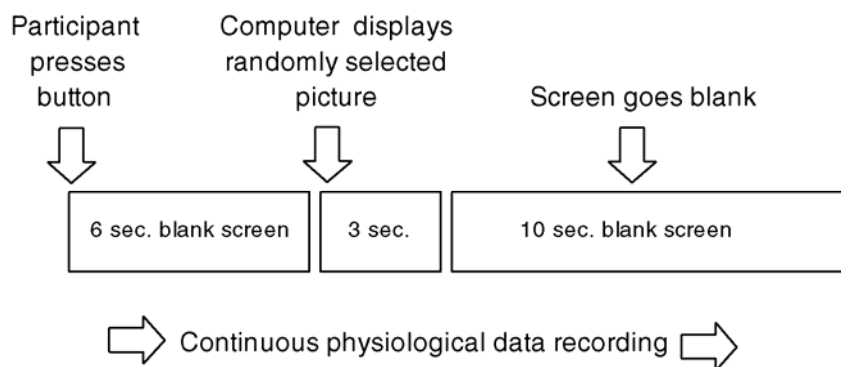


Figure 1. Experimental protocol for electrophysiological study of intuitive perception (McCraty, Atkinson, & Bradley, 2004a, 2004b).

The study used a counterbalanced crossover design in which 30 calm (pleasant) and 15 emotionally arousing (violent and erotic) pictures were randomly presented to 26 participants in two sessions, two weeks apart, under two experimental conditions: a baseline condition of “normal” psychophysiological function and a condition of psychophysiological coherence (heart-focused positive emotional state; see McCraty & Childre, 2002).

We included the second condition because we suspected that a calm, coherent emotional state enhanced the body's response to pre-stimulus information about a future event.^v For each trial in the experiment the subject pressed a button on a computer keyboard and, after a 6 second blank screen interval, the computer displayed a randomly selected picture for 3 seconds, which was followed by 10 seconds of a blank screen, as shown in Figure 1. Throughout each experimental session continuous electrophysiological measurement of the subject's body response was recorded. Primary measures included: skin conductance; EEG, from which cortical event-related potentials (ERP) and heartbeat evoked potentials (HBEP) were derived; and ECG, from which cardiac decelerations/accelerations were derived. These measures were used to investigate where and when in the brain and body intuitive information is processed. Data from 2,340 trials were collected across the two sessions for all subjects and subjected to statistical analysis.

There were a number of significant findings from the study. The first is the surprising evidence that the *heart* receives informational input regarding the future emotional stimulus. As shown in Figure 2, this is where the slope of the heart rate deceleration curve for the emotional trials clearly starts to diverge from the slope for the calm trials. Based on classical psychophysiological interpretations of cardiac

decelerations/accelerations in relation to the processing of sensory information, these data suggest that the heart responds to the unknown stimulus in the *same* way it does when the future stimulus is known. A second finding, also shown in Figure 2, is that there were significant differences in brain response (primarily in the frontal areas) in the cortical event-related potentials, marked by increased negativity and a faster onset of the positive-going wave in the emotional trials. A third finding of particular importance, should it be confirmed in subsequent studies, is that the heart appears to receive intuitive information even *before* the brain (~4.8 seconds versus ~3.5 seconds, respectively); this is also evident in Figure 2 when one compares the divergence of HRV and ERP curves in the pre-stimulus period for the emotional trials. A fourth finding, is the evidence that the frontal cortex, left temporal areas, occipital areas, and, to a lesser degree, parietal areas of the brain appear to be involved in the processing of intuitive information. A fifth finding is that there were significant differences in heartbeat evoked potentials between the calm and emotional trials, primarily in Condition 2, the coherent mode. And finally, there were significant gender differences in the processing of pre-stimulus information. Especially noteworthy was the apparent interaction between the HBEPs and ERPs in the females during the emotional trials, which suggests that afferent input from the heart to the brain contains information pertaining to the future stimulus, and also that females may be more attuned to information from the heart. Overall, our findings suggest that intuitive perception is not a discrete function produced by a single part or system of the body alone—the brain—as previously thought. Rather, it appears that intuition is a system-wide process involving at least the heart and brain (and possibly other body systems), together, in the processing and decoding of intuitive information (McCraty, Atkinson, & Bradley, 2004a; 2004b; McCraty, Bradley, & Tomasino, 2004-2005).

Empirical Generalizations

On the basis of this brief review of the research on intuition, we can derive the following empirical facts that an adequate theory of intuition must explain:

- the experiments on telepathy, involving Faraday Cages and steel wall shielding, show that electromagnetism cannot be the “carrier wave” for the transmission of intuitive information between persons;
- the remote viewing experiments show that the transmission of intuitive information does not decrease over distance and is not affected by location;
- the experiments on precognition and presentiment show that intuitive foreknowledge about a future event is not limited by the normal causal relations of time;
- the recent experiments on presentiment show that intuitive perception is related to the degree of emotionality of a nonlocal object or event;
- and, subject to confirmation by future studies, the results from our own study suggest that both the heart and the brain (and possibly other bodily systems) are involved in intuitive perception of future events, and also that intuitive information appears to be processed by the body in the same way as information from normal sensory input.

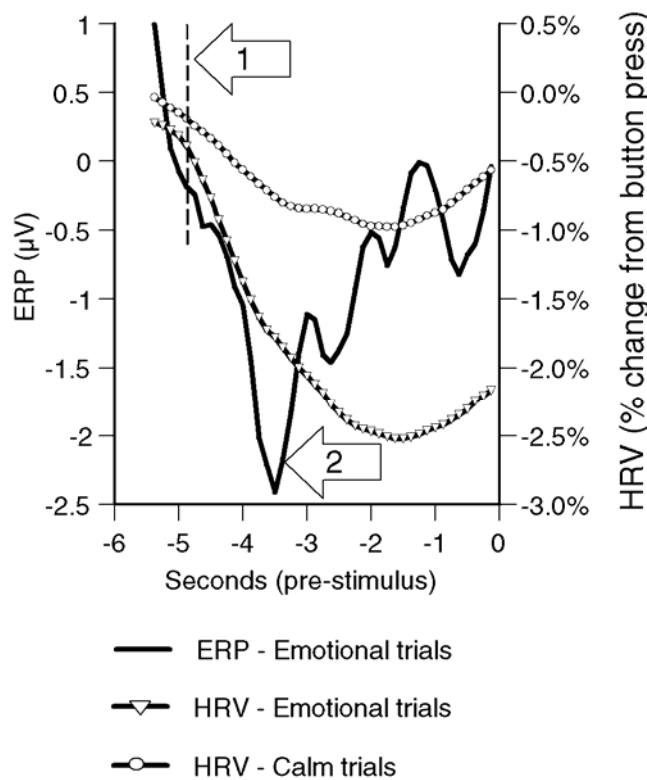


Figure 2. Temporal dynamics of heart and brain pre-stimulus responses. This overlay plot shows the mean event-related potential (ERP) at FP2 and heart rate deceleration curves for the female subgroup ($n = 15$) in condition 1 during the pre-stimulus period. (The “0” time point denotes stimulus onset.) The heart rate deceleration curve for the emotional trials diverged from that of the calm trials (sharp downward shift) about 4.8 seconds prior to the stimulus (arrow 1), while the emotional trial ERP showed a sharp positive shift about 3.5 seconds prior to the stimulus (arrow 2). This positive shift in the ERP indicates when the brain “knew” the nature of the future stimulus. The time difference between these two events suggests that the heart received the intuitive information about 1.3 seconds before the brain (from McCraty, Atkinson, & Bradley, 2004b).

THEORY

For mainstream science, intuition—the body’s ability to receive information about things distant or in the future—is, at best, an empirical anomaly that belongs to a class of phenomena that has been especially perplexing and difficult to come to grips with, let alone explain (Walach & Schmidt, 2005). This is the phenomenon of *action at a distance*, which is nowadays referred to as *nonlocality*. In reflecting, over four hundred years ago, upon the difficulty posed by gravitational force, Newton summed up the quandary of action at a distance in a letter to Bentley, his closest friend:

It is inconceivable that inanimate brute matter should, without the mediation of something else which is not material, operate on and affect other matter without mutual contact ... That one body may act upon another at a distance and through a vacuum without the mediation of anything else by and through which their action or force may be conveyed from one to another is to me so great an absurdity that I believe no man who

has in philosophical matters any competent faculty of thinking can ever fall into (Newton, in Turnbull, 1961: 253f).

Yet modern science has found that the capacity to receive and process information about nonlocal events appears to be a fundamental property of all physical and biological organization, and is likely due to the inherent interconnectedness and inseparability of everything in the universe (Bohm & Hiley, 1993; Laszlo, 1995; Nadeau & Kafatos, 1999). At the molecular level, all matter absorbs and reemits quanta of energy from and into an underlying field of quantum fluctuations called *zero point energy*. Instead of being random fluctuations, the emissions from complex matter exhibit quantum coherence and also carry information nonlocally about the event history of the quantum states of the emitting matter. This suggests that all biomatter at all scales of organization are informationally connected by nonlocal quantum coherence and externally to the larger environment by their coherent quantum emissions (Mitchell, 2004: 155). Thus, in seeking to “explain” how human intuition occurs, recent theories have endeavored to build on this understanding and have used the concept of nonlocal quantum interconnectedness as a physical means or medium for the transmission of intuitive information.

Broadly speaking, there have been two approaches to build a scientific explanation for communication of intuitive information. The most common approach is based on different applications of holographic theory. The other is based on an extension to the space-time dimensionality underlying relativity theory, which we will present first.

Rauscher and Targ’s Zero-Point Theory of Space-Time Dimensionality

To build an explanation for the time-reversal cause and effect dynamics involved in intuitive foreknowledge, Rauscher and Targ (2001) make an extension to Relativity Theory’s Einstein-Minkowski 4-dimensional space-time. By adding three extra dimensions to space and an extra dimension to time to the conventional 4-dimensional Einsteinian conception of space-time at the macro-scale, they construct a complementary micro-scale domain which establishes nonlocality as a property of this 8-dimensional universe. They use the universal connectivity of the zero-point energy field of the quantum vacuum as the mechanism for the kind of instantaneous communication involved in precognitive and presentiment. They demonstrate universal connectivity by showing, mathematically, that there is always a path between any two points in this 8-dimensional space-time universe that has zero units of separation.^{vi} This condition of adjacency, or inseparability, means that non-locality holds for both space *and* time, which provides a physical mechanism for communication of information about an object or event from the future. Therefore, because any two points in time can become adjacent—in effect, they are inseparably entangled or interconnected—an effective pathway of *no-time* between the two exists. This means that information transmission between the two points occurs in “no-time,” so that what will happen in a future time can be known now, in present time.

Although Rauscher and Targ’s extension to an 8-dimensional space-time concept of physical reality appears to be consistent with the explanatory principles of modern physics, in that it does not seem to violate the equations of Maxwell, Einstein, or Schrodinger, nor the Poincare and Lorentz invariances (Bernstien, 2005), and while it appears to provide a physical means for bridging both the spatial and temporal elements of nonlocal information transmission, it only seems to explain a part of what intuition involves. It leaves unaddressed two basic issues: first, the question of how the body “knows” which, from the set of all possible pairs of points that connect “now” to all future points, is the “correct” pairing to the actual point in the future relevant to the situation at hand; and second, the question of the means and processes by which the body accesses and translates information from this 8-dimensional world into intuitive perception. Because holographic approaches are both used in physics to explain nonlocal interaction (Bohm & Hiley, 1993; Laszlo, 1995; Nadeau & Kafatos, 1999) and used in neuropsychology to explain sensory perception and memory in the brain (Pribram, 1971; 1991), holographic theory offers a single explanatory framework for understanding information communication in both the physical and biological realms that, we believe, provides a more fruitful approach to explaining intuition.

Holographic Theory

The appeal of holographic theory (Gabor, 1948) is the explanatory power of its principle of distributed organization as the informational mechanism for nonlocal interaction—that the information about the properties and organization of a whole (object or event) is spectrally encoded into the movement of energy as an interference pattern and distributed throughout a field of potential energy to all points and locations. Because it is possible to retrieve information about the whole from *any* location within the field, holographic theory, and its basis in the linear mathematics of the Fourier transform function, has been postulated to provide a reversible physical mechanism by which intuitive information can be encoded, transmitted, received, decoded, and perceived.

However, there are two basic forms of holography: Classical Holography, developed to understand the physics of *image* processing (Gabor, 1948); and Quantum Holography, developed to explain the physics of *information* transmission in signal processing (Gabor, 1946). Because Classical Holography is based on an invertible linear process involving a Fourier transform function, there are *no* degrees of freedom in the transformation relations; chance and probability are not involved. This means, in effect, that Classical holography is a principle of system organization in which constituent parts are enfolded into and whose behavior is in-formed and, therefore, *determined* by the global organization of the system as a whole. As a result, theories that attempt to use the principles of Classical Holography as a means for explaining intuition, such as Bohm's (1980) theory of the implicate order or Laszlo's (1995) theory of quantum-vacuum interaction, run into the inherent limitations of holographic determinism which, by definition, rule out human choice and free will (see Bradley, 1998).

Quantum holography is based on Gabor's (1946) energy-based concept of information, the *logon*, which provides the foundation for a non-determinist kind of holographic organization (Bradley, 2002). He defines a unit of information as *the minimum uncertainty with which a signal can be encoded as a pattern of energy oscillations across a waveband of frequencies*, as in the encoding and transmission of vocal utterances for telephonic communication. Gabor was able to define the smallest area, in space and in time, within which a signal can be encoded in the movement of energy and still maintain fidelity for information communication (see Figure 3). He called this area a *logon*, or a *quantum* of information (hence the term *quantum holography*), and showed that the signal that occupies this minimum area “is the modulation product of a harmonic oscillation [of energy] of *any* frequency with a pulse in the form of a probability function” (Gabor, 1946: 435; my addition and emphasis). In mathematical terms, the logon is a sinusoid variably constrained by space-time coordinates—essentially a *space-time-constrained hologram* (see Pribram, 1991; Bradley, 1998).

An important point, which bears directly on the question of determinism, is that logons are *not* discrete units but occur as space-time-constrained sinusoids, each wrapped in a Gaussian probability envelope: a series of overlapping units in which the “heads” and “tails” of adjacent units interpenetrate one another, as is illustrated in Figure 4. This *overlap* among logons introduces indeterminacy in that the data in each unit are spectrally enfolded, to some degree, into the data of adjoining logons. This overlap among logons has a significant implication for information communication from the future, in that each logon contains, in Gabor's words, an “*overlap [with] the future*” (Gabor, 1946: 437). This means, in effect, that each unit of information, by virtue of its spectral enfoldment with adjoining units, contains information on the future order energetically encoded in the units that succeeds it (Bradley, 1998).

In addition to my own earlier application of the principles of quantum holography to explain the intuitive “anticipation” of future social order in social collectives (Bradley, 1987; 1996; 2003), on which we build below, there are two other holographic theories of intuitive perception.

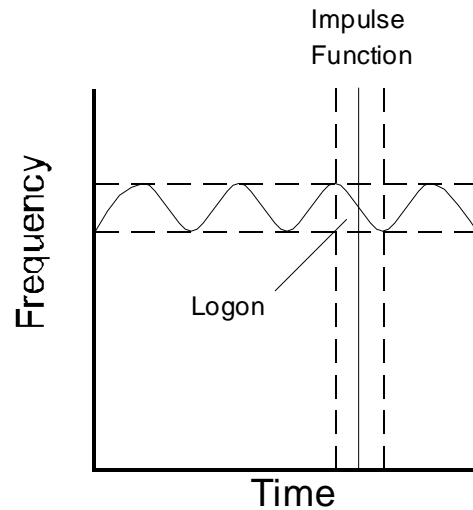


Figure 3. An idealized graph of a Hilbert Space showing a logon (Gabor elementary function) in terms of Gabor's (1946) limits of measurement.

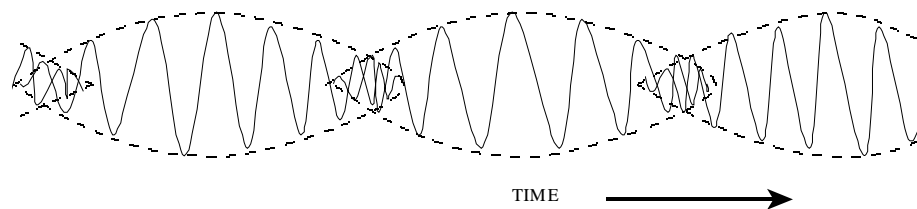


Figure 4. Representation of the overlap among logons (Figs. 3 & 4 are from Bradley & Pribram, 1998).

Tiller's Theory of Magnetic Wave Information Transmission

Developed to explain telepathic communication (intuitive transmission between one person and another), one of these is Tiller's theory of super-luminal magnetic carrier wave propagation (Tiller, 1999; 2004). Based on an extension of wave-particle duality, his theory proposes information transmission through a part of the zero point energy field of the quantum vacuum he calls R-subspace, by magneto-electric carrier waves. By moving into a more internally coherent state (like meditation), the human mind propagates magnetic waves into R-subspace; because the magnetic waves are modulated by the information content of the sender's mind, they encode, via Fourier transform equations, this information into magnetic

wave-forms that radiate from the source at great speed. Thus this provides a physical means by which human intention, emotion, and other characteristics of mind are (quantum-holographically)^{vii} encoded and transmitted at much higher speeds through the micro-scale quantum vacuum's R-subspace (up to twice the speed of light), than the information transmitted over long distances in our macro-scale 4-dimensional world by carrier waves of electromagnetism (visible light, radio, etc.) at the speed of light.

Mitchell, Marcer, and Schempp's Theory of the Nonlocal Quantum Hologram

The other theory is the theory of the non-local quantum hologram as the nonlocal carrier of quantum-level information for molecular and macro-scale organization, which emerges from the work of Mitchell, Marcer, and Schempp (Marcer & Schempp, 1997, 1998; Mitchell, 2000; Marcer & Mitchell, 2001). They combine the information processing efficiency and storage capacity of holography with the inherent interconnectedness (or "entanglement") of objects and events at the quantum level, to create a theory to explain remote viewing (intuitive perception of objects or events over great distances).

Their theory is based on the following postulates: first, that a quantum hologram is created at the quantum level which contains nonlocal information on the specific organization of quantum reality associated with an object, entity, or event at the macro-scale world; second, that the act of perception requires both an incoming wave field of sensory information about the object *and* an outgoing wave field of attentional energy; and third, that a relationship of "phase-conjugate-adaptive-resonance" between the incoming wave field and the outgoing wave field is required to perceive an object in the 3-dimensional world. Phase-conjugate-adaptive-resonance is a process in which the incoming and outgoing wave fields are phase conjoined by the percipient's act of attention in which s/he tunes into and maintains "vibratory resonance" with the object's energetic oscillations at the quantum level.^{viii} The concept was proposed by Marcer to show how both quantum information and space-time information are involved in perception—that the percipient and the source of information must be in a resonant relationship for sensory information to be accurately perceived:

... if we consider that the condition of phase-conjugate-adaptive-resonance is necessary to completely specify the act of perception as described in the mathematical formalism of the non-local hologram by Marcer, then we may also consider the perceived object and the percipient's perceptual system as locked in a resonant feedback loop. The incoming wave front carrying information may be labeled as "perception" from the point of view of the percipient, and the return path required by the resonant relationship may be labeled "attention" ... (Mitchell, 2000: 302).

As a wave field of any kind interacts with a physical object, parts of its amplitude and phase are altered, not only because part of the wave is reflected from the object's surface, but also because part of the wave's energy is absorbed by the object. This absorption energizes the object to emit a wave outward, part of which may travel back towards the source of the initial wave (Marcer, 2004). Based on the derivation of macro-scale images from the application of quantum holography in Magnetic Resonance Imaging (MRI), it is now known that the returning wave inevitably contains nonlocal quantum information about the object's internal organization and microscopic features, along with its external and macroscopic features (Schempp, 1992). Moreover, the complete event history of the object's movement in time through its three-dimensional environment is carried by a quantum hologram. "It evolves over time to provide an encoded nonlocal record of the 'experience' of the object in the four-dimensional space/time as to its journey in space/time and the quantum states visited" (Mitchell, 2000: 299). Taken altogether, this produces a holographic process in which nonlocal quantum-level information about the object's organization and history is encoded and communicated back to the source of the initial wave.

Retrieval of this information by a human brain requires, first, that the individual calms his thoughts and emotions, and then directs his mind to a distant location (not visible to the eyes). The mental activity involved in "paying attention to" the location, generates an outgoing wave directed externally towards the object. This establishes a "phase-conjugate-adaptive-resonance" with the quantum-mechanical level of objects at the distant location whereby, insofar as vibratory resonance is maintained, the individual's neural system can apprehend quantum-holographically encoded information instantaneously

available through quantum entanglement (Marcer & Schempp, 1997; 1998). The quantum holographic information about distant objects is decoded and converted by the brain through a Fourier transform process, as described by Pribram (1991), into mental imagery, feelings, and other sensations.

PULLING IT ALL TOGETHER: TOWARDS A GENERAL THEORY OF INTUITION

The brief review of the theories of Tiller, and Mitchell, Marcer, and Schempp reveals a number of interesting commonalities and points of difference: both use a holographic approach which is based (implicitly, in Tiller's case) on the principles of quantum holography; both use quantum entanglement—the inherent interconnectedness and inseparability of everything at the quantum level—as the means to achieve nonlocal information communication; and both assign a key role to the body's mental and emotional state in establishing a bio-energetic means of connection to the energy fields of the external environment through which nonlocal information can be communicated. However, while intuitive information transmission, in the theory of Mitchell, Marcer, and Schempp, can occur through *any* energy wave field (no matter whether it be quantum-mechanical, electromagnetic, acoustical, or another), which is comparable to Gabor's (1946) concept of the enfoldment of information in the oscillation of energy at "any frequency," Tiller endeavors to account for intuitive telepathic communication with energy waves of a *specific* frequency—that is with super-luminal magneto-electric wave propagation in his R-subspace of the zero-point energy field. Finally, Mitchell, Marcer, and Schempp's concept of phase-conjugate-adaptive-resonance—the mechanism for creating a reciprocal communication channel for nonlocal quantum holographic information transmission between the percipient and the object—is a key concept which we will expand below to show how energetically encoded information can also be propagated, by harmonic resonance, through the wave fields of different energy frequencies and is transmitted, in effect, both within and across micro and macro scales of organization.

Drawing on what is known about intuitive perception from the empirical research, and from the existing theories, each of which was developed to explain a specific mode of intuitive perception (telepathy, remote viewing, or intuitive foreknowledge), we can begin to sketch the outlines of a general theory of intuition. In this effort we will be aided by Gabor's (1946) energy-based concept of information, as described above, since none of the other theories offers a rigorous definition of information, even though it is a fundamental term. But Gabor's notion is useful for another reason in that his concept of information—the encoding of information in energy oscillations at *any* frequency—is a general idea that applies to energetic information transmission at both the macro-scale of the four-dimensional world and the micro-scale of quantum reality. Also because their theory of the quantum hologram seems to fit best with the physics and psychophysiology of the information processing involved in intuitive perception, we will use the theory of Mitchell, Marcer, and Schempp as the foundation for what follows.

Outline of a Quantum-Holographic Theory

From the micro-scale of the quantum domain to the macro-scale of the four-dimensional world, all objects and entities in the universe are energized in a constant state of oscillation at different energy frequencies. The energetic oscillations from all objects generate energy wave fields that radiate outward and interact. As a wave field of *any* kind interacts with a physical object, a part of the wave is reflected directly from the object's surface and part of the wave's energy is absorbed, causing the object to become energized and emit another wave outward back towards the source of the initial wave. The interaction among these wave fields generates an interference pattern which spectrally encodes the object's internal and external organization, and also encodes its event history.

At the quantum level, the area of intersection in the interference pattern is a quantum hologram, containing quantum-level information reflecting this macro-scale process. Because the area of intersection involves an interaction between wave fronts, in which the movement of energy in one wave front is constrained by the movement of the other, it is equivalent to Gabor's quantum or unit of energetic information, the logon (~ ½ cycle, see Figure 3).^{ix} This means that the quantum hologram is essentially a logon, or a space-time-constrained hologram, in Pribram's (1991) terms. And since each logon contains

nonlocal information about the future, then each quantum hologram also contains quantum level information about the future organization of the macro-scale object with which it is associated. At the very least, this would provide an information processing mechanism by which moment-by-moment intuitive *anticipation* of future order can occur, such as that involved in rapidly moving animal collectives like shoals of fish and flocks of birds (Bradley, 1996; Bradley & Pribram, 1998).

It can be shown (see Figure 5a), that when two interpenetrating wave fields are generating synchronized oscillations at the same energy frequency, a channel of coherent interaction is created connecting the object source points of the two wave fields (Bradley, McCraty, & Rees, 2004). This channel is essentially a logon transmission pathway for optimal information communication. This does not hold for interaction between wave fields of different energy frequencies (see Figure 5b); effective communication is blocked by an incoherent pattern of interpenetration between the two wave fields. However, when wave fields at different energy frequencies oscillate in *harmonic resonance*, as shown in Figure 6, a coherent channel of communication emerges from synchronized oscillations across the wave fields. Thus when the set of wave fields constitute a harmonic series—two waves, four waves, eight waves, and so forth, per cycle, with synchronized wave peaks and troughs across the series, as shown—oscillatory resonance creates a channel of communication across the different frequencies of individual wave fields (depicted with a dashed vertical line in the figure). This provides for a logon transmission pathway of optimal nonlocal information communication across different scales of organization—from the quantum level micro-scale domain, to the four-dimensional macro-scale world, and vice versa. Since the overlap among logons means information about future order is spectrally enfolded, it is suggested that this creates an information processing mechanism by which foreknowledge of the future is contained in the logon or quantum hologram at hand.

When the dynamics of these interactions are considered, information transmission at hyper-speeds appears as an emergent property of the movement of the two wave fields. Using a simple dynamic model,^x it can be shown that when two wave fields at the same energy frequency interact from opposing directions, a *third emergent wave field* is generated with wave fronts moving at a *hyper-speed*, significantly faster than the rate of movement of the original wave fronts. This third wave field radiates outward in all directions from the point source of the leading wave fronts in each wave field. It is suggested that this third wave field encodes the quantum holograms created by the interaction of the two original wave fields, and, as such, is a likely mechanism for nonlocal information transmission at hyper-speeds—for example, super-luminal, in the case of quantum mechanical wave fields, and super-acoustical, for sound waves. It is further suggested that when wave fields from different scales of organization are in harmonic interaction, an emergent oscillatory resonance is generated for nonlocal information transmission at hyper-speeds. It is postulated that this provides a transmission mechanism for nonlocal information communication across macro and micro-scales of organization at super-luminal speeds—faster than the speed of light.

The act of conscious perception requires both an incoming wave field of sensory information about the object *and* an outgoing wave field of attentional energy. Based on recent research, it is clear that more than the brain is involved in the act of attention. The body's psychophysiological systems generate numerous fields of energy, at various frequencies, that radiate outwards from the body as wave fields in all directions. Of these, the heart generates the most powerful rhythmic electromagnetic field. Not only does a massive deceleration in the heart's pattern of rhythmic activity occur at the of moment mental attention, which would generate a powerful change recorded in the outgoing wave field, but it is also clear from recent research that nonlocal perception is related to the percipient's degree of emotional arousal generated by an object. It is the individual's *passion* or "rapt attention"—biological energy activated in his emotional connection to the object of his interest—that generates the outgoing attentional wave directed to the object. And since it is well established that the heart's energetic pattern of activity reflects feelings and emotional experience, it is likely that the heart is instrumental in generating the outgoing wave of attentional energy directed to the object.

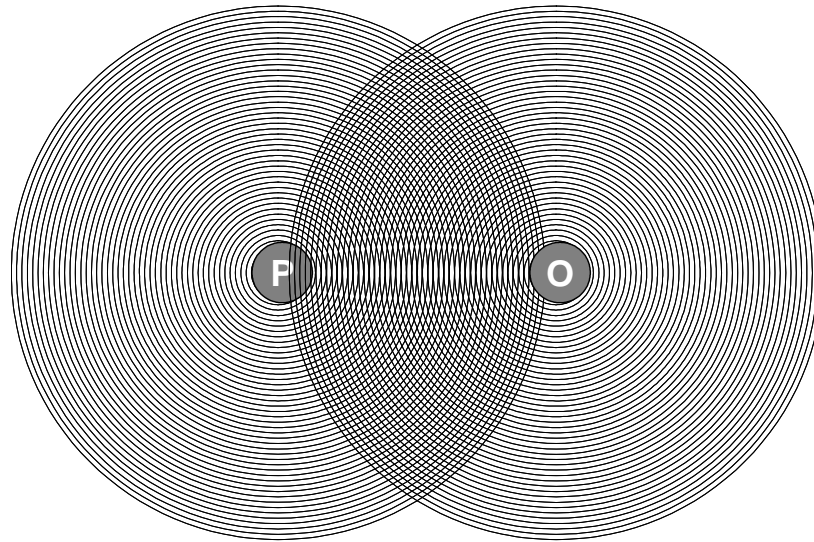


Figure 5a

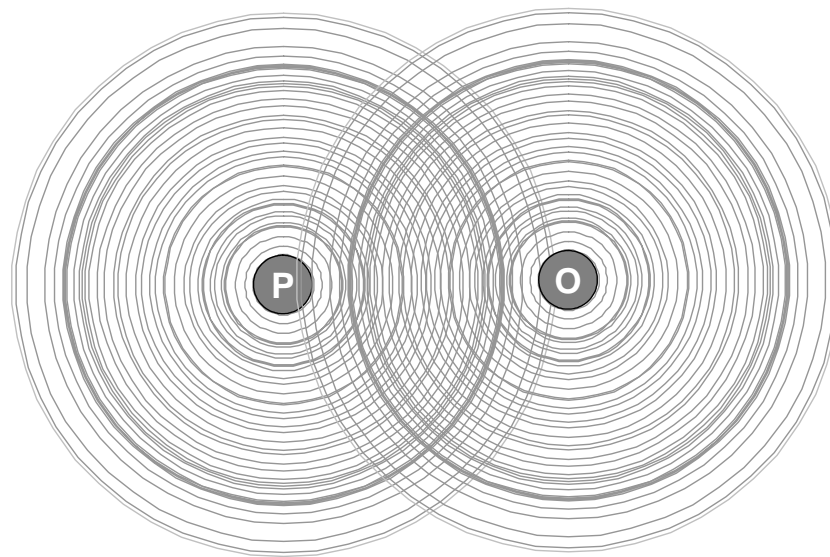


Figure 5b

Figure 5. Figure 5a shows how a channel of coherent interaction is created between a percipient (P) and an object (O) when their two interpenetrating wave fields are generating synchronized oscillations at the same energy frequency. Figure 5b shows that this does not hold for interaction between wave fields of different energy frequencies; effective communication is blocked by an incoherent pattern of interpenetration between the two wave fields (from Bradley, McCraty, & Rees, 2004).

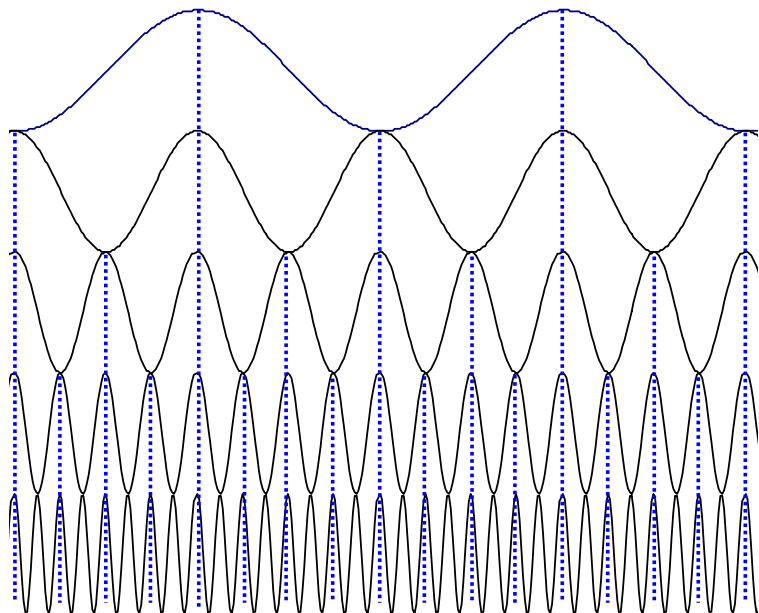


Figure 6. This figure depicts a set of wave fields at different energy frequencies in a harmonic series—two waves, four waves, eight waves, and so forth, per cycle, with synchronized wave peaks and troughs across the series. Note how a coherent channel of resonance emerges from synchronized oscillations across the wave fields, depicted with a dashed vertical line in the figure.

The calming of extraneous thoughts and adoption of positive emotional interest involved in the act of “paying attention to” distant locales or nonlocal objects, establishes a relationship of phase-conjugate-adaptive-resonance with the quantum level of an object at the distant location. Research has found that attention is optimized when a focused positive emotional state is adopted which induces a shift to a coherent wave field in the heart’s beat-to-beat pattern of rhythmic activity (McCraty, 2002; McCraty & Atkinson, 2003). To the degree that a relationship of energetic resonance between the object and the percipient is maintained—that the object’s quantum wave field and the attentional wave field of the percipient is locked in a resonant feedback loop—the individual’s psychophysiological system (the brain, the heart, and the body as a whole) can receive and process nonlocal information as quantum holograms. Thus, it is the continuous resonant feed-back loop between the outgoing coherent wave fields generated by the body’s psychophysiological systems and the incoming wave fields from objects that is the basis of nonlocal perception, in that the interaction between the two enables the body to receive and process quantum-holographic information about nonlocal objects and events spectrally encoded in the movement of energy.

One pathway of virtually instantaneous nonlocal information transmission is at the quantum level through quantum coherence. Another pathway for information transmission at hyper-speeds appears likely when a third emergent wave field is generated by the interaction between incoming and outgoing wave fields at the same frequency, or by harmonic resonance when wave fields of different frequencies interact, as described above. It appears that the heart plays a significant role in the body’s sensing and processing of the quantum holograms of nonlocal objects and events, in that our study showed that the heart receives information about future events *before* the brain. It is even possible that the pre-stimulus heart-generated change in afferent neural signals observed in our study (McCraty, Atkinson, & Bradley, 2004b) is actually a signal to the brain about the incoming quantum-holographically encoded information about the intuitive

event. Once the pre-stimulus information is received by the brain it is decoded and converted by the neural micro-structure through a reverse Fourier transform process into mental imagery, feelings, and other sensations.

CONCLUSION

By way of conclusion, I want to show how the theory offers an understanding of the psychophysiological basis of entrepreneurial intuition.

The entrepreneur's passionate attention—that is, the biological energy activated in his emotional connection to the object of interest (e.g., the quest for future opportunities in a certain field of business)—attunes him to the object's unfolding pattern of activity and to the implicit order of its future potential. Both the pattern of activity and the potential future order are spectrally encoded as a quantum hologram in a field of potential energy as implicit information in a domain apart from space and time. At a biological level, the body's psychophysiological systems generate numerous fields of energy, at various frequencies, that interpenetrate the field of potential energy. Of these, the heart generates the most powerful rhythmic electromagnetic field, which radiates out from the body in all directions.

When the entrepreneur calms his mind and feelings, and adopts a heart-focused state of positive emotion directed to the object, a global shift to psychophysiological coherence is induced which optimizes attentional resonance with the incoming quantum level information from the object of interest. Such attunement brings the outgoing wave field of attentional energy from the entrepreneur's psychophysiological systems into harmonic resonance with the incoming wave field of energy from the object. The harmonic resonance between the two wave fields of energy creates an optimal channel for communication of nonlocal information. We hypothesize, therefore, that the more the entrepreneur maintains coherent attentional interest directed to the object of interest, the more his body's psychophysiological systems will access to this implicit field of quantum holographic information, and, hence, the greater the intuitive foreknowledge about the object of interest.

NOTES

ⁱ While there have been a number of studies investigating self-report measures on the use “intuition” in managerial decision making and its relationship to organizational effectiveness (e.g., Allison & Hayes, 1996, and La Pira & Gillin, 2006), we can find no research that has employed objective electrophysiological measures of managerial intuitive ability to establish whether the most effective managers have intuitive foreknowledge of the future (see Lieberman, 2000).

ⁱⁱ See Radin (1997a) for the most comprehensive contemporary review of this research. Also see Bernstein (2005), and Walach and Schmidt (2005) for recent reviews.

ⁱⁱⁱ For example, precognition, involving intuitive thoughts, is defined in the *McGraw-Hill Dictionary of Scientific and Technical Terms* (1994:1565) as “a form of extrasensory perception involving foreknowledge of a future event.”

^{iv} Event-related potentials are voltage fluctuations that are associated in time with some physical, mental, or emotional occurrence. These potentials can be recorded from the scalp and extracted from the ongoing electroencephalogram (EEG) by means of filtering and signal averaging.

^v We had previously found that increased heart rhythm coherence correlates with significant improvements in performance on tasks requiring attentional focus and subtle discrimination (McCraty, 2002; McCraty & Atkinson, 2003), and thought, therefore, that it could also be involved in processing intuitive foreknowledge.

^{vi} To construct these four new space-time dimensions, they multiply the original 4-dimensions of space-time by the square root of -1 (conventionally symbolized as the coefficient i), which creates an 8-

dimensional space-time universe in which any two points are always adjacent. Rauscher and Targ note that eight dimensions are the minimum number of dimensions required, if quantum nonlocality, as empirically demonstrated by Aspect and Gisin (Nadeau & Kafatos, 1999), is to remain consistent with the Poincare and Lorentz invariances.

^{vii} This is my term and characterization, not Tiller's. Although he does not label it as such, Tiller is actually describing a quantum-holographic process (see below)—a distributed order of energy frequency (a field of magneto-electric waves) coupled to a space-time constraint (modulation of the magnetic waves by informational content of a human mind at a given point in time and at a given location in space).

^{viii} “Marcer (1997) has proposed that ... resonance requires a virtual path mathematically equal but opposite to the incoming sensory information about the object. Further, that it is the incoming space/time information (visual, acoustic, etc.), which decodes the information of the quantum hologram and establishes the condition of pcar [phase-coherence-adaptive-resonance] so that accurate three dimensional perception is possible” (Mitchell, 2000: 297).

^{ix} Recall that his concept of information—minimum of uncertainty—involves the interaction between a distributed order of energy at a certain frequency and a space-time constraint.

^x Two overhead transparencies, each depicting a series of arcs drawn at the same frequency to represent wave fronts in a wave field, are moved across each other in opposing directions.

REFERENCES

- Agor, W. (1984), *Intuitive Management: Integrating Left and Right Brain Skills*, Prentice Hall, New Jersey.
- Allison, W. C., & J. Hayes (1966), The cognitive style index: a measure of intuitive analysis for organizational research, *Journal of Management Studies*, 1: 119-135.
- Bem, D. J. (2003), Precognitive habituation: Replicable evidence for a process of anomalous cognition, *unpublished manuscript*.
- Bernstein, P. (2005), Intuition: what science says (so far) about how and why intuition works, in R. Buccheri et al. (eds), *Endophysics, Time, Quantum and the Subjective*, World Scientific, Singapore.
- Bierman, D. J. (2000), Anomalous baseline effects in mainstream emotion research using psychophysiological variables. *Proceedings of Presented Papers*, The 43rd Annual Convention of the Parapsychological Association.
- Bierman, D. J., & Radin, D. I. (1997), Anomalous anticipatory response on randomized future conditions. *Perceptual and Motor Skills*, 84, 689-690.
- Bierman, D. J., & Scholte, H. S. (2002), Anomalous anticipatory brain activation preceding exposure of emotional and neutral pictures, Paper presented, *Toward a Science of Consciousness IV*, Tuscon AZ.
- Bohm, D. (1980), *Wholeness and the implicate order*, Routledge, London.
- Bohm, D., & Hiley, B. J. (1993), *The Undivided Universe*, Routledge, London.
- Bradley, R. T. (1987), *Charisma and Social Structure: A Study of Love and Power, Wholeness and Transformation*, Paragon Press, New York, NY.
- Bradley, R. T. (1996), The anticipation of order in biosocial collectives, *World Futures*, Vol 49: 93-116.
- Bradley, R. T. (1998), Values, agency, and the theory of quantum vacuum interaction, in Pribram, K. H. (ed), *Brain and Values: Is a Biological Science of Values Possible*, chap. 18, pp 471-504, Lawrence Erlbaum Associates, Mahwah, NJ.
- Bradley, R. T. (2002), Dialogue, information, and psychosocial organization, in N. C. Roberts (ed.), Chap. Ten, pp. 243-288, *Transformative Power of Dialogue*, Elsevier Publications.
- Bradley, R. T. (2003), Love, power, mind, brain, and agency, in D. Loye (ed.), *The Great Adventure: Toward a Fully Human Theory of Evolution*, Chap. Four, pp. 99-150, SUNY Press, New York, NY.
- Bradley, R. T., R. McCraty, & R. Rees (2004), Proposal concept for a study of highly effective and transformational teaching, *unpublished manuscript*, the Institute of HeartMath, Boulder Creek, CA.

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- Bradley, R. T., & K. H. Pribram (1998), Communication and stability in social collectives, *Journal of Social and Evolutionary Systems*, Vol 21, 1: 29-81.
- Don, N. S., McDonough, B. E., & Warren, C. A. (1998), Event-related brain potential (ERP) indicators of unconscious psi: A replication using subjects unselected for psi. *Journal of Parapsychology*, 62, 127-145.
- Eisenhardt, K., & Zbaracki, M. (1992), Strategic decision making, *Strategic Management Journal*, 13, 17-37.
- Gabor, D. (1946), Theory of communication, *Journal of the Institute of Electrical Engineers*, 93: 439-457.
- Gabor, D. (1948), A new microscopic principle, *Nature*, 161: 777-778.
- Hogarth, R. M. (2001), *Educating Intuition*, The University of Chicago Press, Chicago, IL.
- Honorton, C., & D. Ferrari (1989), Future-telling: a meta-analysis of forced-choice precognition experiments, 1935-1987, *Journal of Parapsychology*, 53: 281-308.
- La Pira, F., & M. Gillin (2006), Non-local intuition and the performance of serial entrepreneurs. *International Journal of Entrepreneurship and Small Business*, Vol. 3, No. 1.
- Laughlin, C. (1997), The nature of intuition: a neuropsychological approach, in R. Davis-Floyd & P. S. Arvidson (eds.), *Intuition: The Inside Story*, pp. 19-37, Routledge, London.
- Laszlo, E. (1995), *The Interconnected Universe: Conceptual Foundations of Transdisciplinary Unified Theory*, World Scientific, Singapore.
- Lieberman, M. D. (2000), Intuition: a social and cognitive neuroscience approach, *Psychological Bulletin*, Vol 126, 1: 109-137.
- Marcer, P. (2004), Status of the mission, *Cybernetic Machine Specialist Group*, British Computer Society, www.bcs.org.uk/sgggroup/cyber/status.htm.
- Marcer, P. & E. Mitchell (2001), What is consciousness?, *The Physical Nature of Consciousness*, John Benjamins, Amsterdam—Philadelphia, pp. 145-174.
- Marcer, P., & W. Schempp (1997), Model of the neuron working by quantum holography, *Informatica*, 21: 519-534.
- Marcer, P., & W. Schempp (1998), The brain as a conscious system, *International Journal of General Systems*, 27: 231-248.
- May, E. C., J. M. Utts, V. V. Trask, W. W. Luke, T. J. Frivold, & B. S. Humphrey (1988), Review of the psychoenergetic research conducted at SRI International (1973-1988), *SRI International Technical Report (March)*.
- McCraty, R. (2002), Influence of cardiac afferent input on heart-brain synchronization and cognitive performance, *International Journal of Psychophysiology*, 45(1-2), 72-73.
- McCraty, R., & Atkinson, M. (2003), *Psychophysiological Coherence*, Boulder Creek, CA: HeartMath Research Center, Institute of HeartMath, Publication 03-016.
- McCraty, R., Atkinson, M., & Bradley, R. T. (2004a). Electrophysiological evidence of intuition: Part 1. The surprising role of the heart. *Journal of Alternative and Complementary Medicine*, 10 (1):133-143.
- McCraty, R., Atkinson, M., & Bradley, R. T. (2004b). Electrophysiological evidence of intuition: Part 2. A system-wide process? *Journal of Alternative and Complementary Medicine*, 10 (2): 325-336.
- McCraty, R., R.T. Bradley, & D. Tomasino (2004-2005), The resonant heart, *Shift*, special issue—"The Science of Fields," No. 5, Dec. 2004-Feb.2005:15-19.
- McCraty, R., & Childre, D. (2004), The grateful heart: the psychophysiology of appreciation, in R. A. Emmons & M. E. McCullough (eds.), *The Psychology of Gratitude*, Oxford University Press, New York, NY.
- McDonough, B. E., Don, N. S., & Warren, C. A. (2002), Differential event-related potentials to targets and decoys in a guessing task, *Journal of Scientific Exploration*, 16 (2): 187-206.
- Mitchell, E. (2000), Nature's mind: the quantum hologram, *International Journal of Computing Anticipatory Systems*, 7: 295-312.
- Mitchell, E. (2004), Quantum holography: a basis for the interface between mind and matter, in P. G. Rosch & M. S. Markov (eds), *Bioelectromagnetic Medicine*, Chap 10, pp. 153-158, Dekker, New York, NY.
- Myers, D. G. (2002), *Intuition: Its Powers and Perils*, Yale University Press, New Haven, CT.
- Nadeau, R., & Kafatos, M. (1999), *The Non-Local Universe: The New Physics and Matters of the Mind*, Oxford University Press, New York, NY.

-
- Pribram, K. H. (1971), *Languages of the Brain: Experimental Paradoxes and Principles in Neuropsychology*, Brandon House, New York, NY.
- Pribram, K. H. (1991), *Brain and Perception: Holonomy and Structure in Figural Processing*, Lawrence Erlbaum Associates, Hillsdale, NJ.
- Puthoff, H. E. (1996), CIA-initiated remote viewing program at Stanford Research Institute, *Journal of Scientific Exploration*, 10: 63-76.
- Radin, D. I. (1997a), *The Conscious Universe: The Scientific Truth of Psychic Phenomena*, HarperEdge, San Francisco, CA.
- Radin, D. I. (1997b), Unconscious perception of future emotions: an experiment in presentiment, *Journal of Scientific Exploration*, 11: 163-180.
- Radin, D. I. (2003; in press), Electrodermal presentiments of future emotions. *Journal of Scientific Exploration*.
- Rauscher, E., & R. Targ (2001), The speed of thought: investigation of a complex space-time metric to describe psychic phenomenon, *Journal of Scientific Exploration*, 15: 331-354.
- Rhine, J. B. (1964), *Extra-Sensory Perception*, Bruce Humphries, Boston, MA.
- Rhine, J. B. (1981), *The Invisible Picture: A Study of Psychic Experiences*, McFarland, Jefferson, NC.
- Schlitz, M., & W. Braude (1997), Distant intentionality and healing: assessing the evidence, *Alternative Therapies*, 3: 87-88.
- Schempp, W. (1992), Quantum holography and neurocomputer architectures, *Journal of Mathematical Imaging and Vision*, 2: 109-164.
- Tart, C. (1963), Physiological correlates of psi cognition, *International Journal of Parapsychology*, 5: 375-386.
- Turnbill, H. W. (1961), *The Correspondence of Isaac Newton, Vol. 3*, Cambridge University Press, Cambridge.
- Tiller, W. (1999), Towards a predictive model of subtle domain connections to the physical domain of reality: origins of wave-particle duality, electric-magnetic monopoles and the mirror principle, *Journal of Scientific Exploration*, 13, 1: 41-67.
- Tiller, (2004), Subtle energies and their roles in bioelectromagnetic phenomena, in P. G. Rosch & M. S. Markov (eds), *Bioelectromagnetic Medicine*, Chap 11, pp. 159-192, Dekker, New York, NY.
- Tiller, W. A., McCraty, R., & Atkinson, M. (1996), Cardiac coherence: A new, noninvasive measure of autonomic nervous system order, *Alternative Therapies in Health and Medicine*, 2 (1): 52-65.
- Walach, H., & S. Schmidt (2005), Repairing Plato's life boat with Ockham's razor: the important function of research in anomalies for consciousness studies, *Journal of Consciousness Studies*, 12 (2): 52-70.
- Warren, C. A., B. E. McDonough, & N. S. Don., (1992a), Event-related brain potential changes in a psi task, *Journal of Parapsychology*, 56: 1-30.
- Warren, C. A., B. E. McDonough, & N. S. Don., (1992b), Partial replication of single event-related potential effects in a psi task, *Journal of Parapsychology*, 56: 1-30.