

QEEG Reveals Interactive Link Between The Principles of Business, the Principles of Nature and the Whole-Brain State

Jeffrey L. FANNIN, Ph.D.
Center for Cognitive Enhancement
5681 W. Beverly Lane – Suite 102
Glendale, AZ 85306
(602) 548-9092

Robert M. WILLIAMS, M.A.
The Myrddin Corporation
829 Ridgeview Way
Crestone, CO 81131-0548

INTRODUCTION

Today, we the authors, contemplate our individual and collective sojourns spanning two decades; bringing us to this point in time to be able to present our thoughts, experiences and research to a scientifically astute body of people in the field of neuroscience. We offer our contribution to be considered along with the work of many others that have preceded us in seemingly different fields that today provide common insight. We are grateful to those who choose to stretch the boundaries of knowledge and understanding and choose to communicate what they have learned from “science” to others who have an interest in understanding.

At first glance, neuroscience and business may seem an odd juxtaposition of backgrounds and skills. The neuroscience side of this article began the investigation of these two topics in 2001. Working for many years with a colleague at Arizona State University, including the leadership research done at the United States Military Academy at West Point, the connection between

neuroscience and business received worldwide recognition in an article that appeared in the Wall Street Journal, September 20, 2007, *This Is Your Brain on the Job* [1]. This work offered scientific evidence that business leaders use their brain differently. Other papers written at that time offered insights into the operation of a more efficient *default network* connected to effective leadership. This work also included insights to the engagement of right hemisphere empathetic networks. Many other articles followed, appearing in national and international publications.

The research presented in this article is not affiliated with Arizona State University and is the work of the authors of this article.

Because of our mutual interest in human performance, and our scientific curiosity about human consciousness, the authors of this article crossed paths in January of 2010. The research cited here is an attempt to satisfy that curiosity.

The belief change process used in this research had been tested in the

“laboratory of life” for more than twenty years with satisfying and often remarkable results. The process used to create changes in beliefs is known in the marketplace as PSYCH-K®, or the corporate and leadership version, known as PER-K®.

This human performance technology was developed in 1988-89. It utilizes whole-brain integration processes to create a whole-brain state. This state of consciousness is associated with high levels of performance in virtually any area of human experience. This bilateral, symmetrical state of mind/brain optimizes the mind/brain potential to better meet life’s challenges and opportunities, as well as providing a “user-friendly” state for changing subconscious perceptions and beliefs.

The opportunity to scientifically test the efficacy of this belief change process, already used worldwide, in a more controlled environment presented itself when the neuroscientific technology was available to do so. Both authors were surprised, as well as pleased and encouraged with the results, and what those results may mean for the collaboration of neuroscience and business, now and in the future. As a society we are facing many difficult challenges in the world today, e.g. political, ecological, social, and economic. The authors believe that, used properly, this collaboration between business and neuroscience can help individuals develop *creatively different* solutions to many of those challenges.

This article presents research that clearly links the mind/brain interface, presenting empirical evidence of what is identified by the authors as *the whole-brain state* (a bi-lateral, symmetrical brain wave pattern). It also provides insight into

how subconscious belief patterns affect our behavior and control the outcome of such behavior in our life. This kind of research might well be important and useful in providing a greater understanding of how to implement processes oriented toward integrating thought and behavior patterns applied to leadership, as well as the structure of business principles and practices. The creation of the essential neuropathways, indicated by the authors, most certainly will help in processes oriented to affect three main components: (1) research, (2) education and (3) applied business principles. The process is key to improving the performance of each of these three activities.

The neuroscience of consciousness provides some understanding of the interrelatedness of subconscious belief patterns that drive our behavior and affect all aspects of one’s life.

Joseph Le Doux (1998) [2] states that, “emotions and feelings are conscious products of unconscious processes.” In writings of this time period, the term “unconscious” is often used. We would suggest that the term “subconscious” is more appropriate in denoting the dichotomy between different functions of the brain, conscious and subconscious.

Harvard cognitive scientist Steven Pinker commented on consciousness. *Although neither problem has been solved, neuroscientists agree on many features of both of them, and the feature they find least controversial is the one that many people outside the field find the most shocking. Francis Crick called it, “the astonishing hypothesis” – the idea that our thoughts, sensations, joys and aches consist entirely of physiological activity in the tissues of the*

brain. Consciousness does not reside in an ethereal soul that uses the brain like a PDA (personal digital assistant); consciousness is the activity of the brain [3].

The authors of this paper offer a different point of view based on new research in biology and human consciousness. The emerging field of epigenetics is fast replacing the older concept of genetics, as evidence mounts that the “astonishing hypothesis” is at best incomplete, and at worst misleading. It is apparent from the failure of the genome project that genes do not possess self-emergent properties that cause the gene to express potentialities originating in the brain. Instead, it is the epigenetic signals (signals above the genes) that trigger such events [4]. Analogously, the authors are suggesting that activity in the brain is largely triggered by epigenetic signals (signals outside of the brain, e.g. mind/consciousness field), creating subsequent biochemical and physiological responses. Consequently the authors are offering an alternative hypothesis that may also seem “astonishing” to the reader. However, it is based on the more current scientific revelations in various fields of science, including, neuroscience, biology, psychology, and quantum physics. The essence of this new hypothesis is incorporated in this paper, and constitutes what the authors call the mind/brain interface.

We suggest that the data from our studies and the research of others show that it is our thoughts and beliefs that drive our actions and create the results we are getting. By changing our conscious thoughts and *subconscious beliefs*, we facilitate changes in our

behaviors and consequently in the results we experience.

We will present research related to the process of changing subconscious beliefs. Conventional thinking would offer the notion that changing brainwave patterns that affect subconscious processing is a lengthy process and occurs slowly over time. This article will offer data that suggest that the brain has the ability to reorganize brainwave energy, creating the whole-brain state, and thus allowing for more optimal performance of subconscious belief patterns. The research further suggests that the process is not lengthy, nor must occur over a long period of time. Once the possibility of rapid change in our beliefs is established, it is possible to move to the consideration of *what is worth changing* as it relates to subconscious beliefs that drive our thought processes and behaviors.

The current nature of business on a global scale, demonstrates unprecedented challenges and undesirable consequences that many companies face, bringing into question the very survival of current *business principles and practices*, as well as the belief systems that drive them. Regrettably, fear and avarice are too often primary driving forces in business, and if unaddressed, will virtually ensure the destruction of our *global economy*. Ignorance of the complexity and interdependency of our environment virtually ensures the destruction of our *global ecology*. Both are *potentially lethal* to our entire civilization. The basic solution to this problem was succinctly stated by business leader, Peter Senge when he said, “*It’s not about doing what we are doing more efficiently. It’s about doing something different*”[5].

It seems that for decades, business practices from around the world, brought us to this critical point in history. We stand on the brink of an unstable precipice desperately hoping that things will get better. If we are to avoid this unstable and destructive future, we must heed the words of business visionaries such as Peter Senge when he says, ...*we must do something different*. This article and the research associated with this writing offers the argument that, in the main, business principles and practices are misaligned with those needed to create *sustainable success*, and *only a significantly visionary realignment will create something different*.

SUBCONSCIOUS BELIEF PATTERNS

US News & World Report presented a special issue February 28, 2005, entitled, *The Secret Mind*, featuring an article, *How Your Unconscious Really Shapes Your Decisions*. The posit of the article revealed, “According to cognitive neuroscientists, we are only conscious of 5 percent of our cognitive activity, so most of our decisions, actions, emotions and behavior depends on 95 percent of our brain activity that goes beyond our conscious awareness” [6]. The subconscious mind consists of all involuntary processes and functions including *thoughts, beliefs, emotions, memories, skills, instincts, and behaviors* of which we are not consciously aware. They are generated by the subconscious mind, while the effects occur in the brain and body. Many of the processes and functions of the subconscious mind involve implicit memories. Implicit memories drive much of our subconscious abilities such as, habits, skills, behaviors, reflexes, conditioned responses and emotional reactions,

which we automatically demonstrate or engage in without much or any conscious awareness or thinking. If we want to change any of these subconscious implicit memories, like a recurrent automatic emotional reaction to a situation, a self-limiting or potentially self-destructive belief, or perhaps a negative attitude towards someone or something that limits our capacity to interact constructively, we must interface with the subconscious mind. Often we try to use conscious processes such as visualization, will power, and positive thinking to create the desired changes. Experience, all too often, demonstrates that these processes, when used alone, have a limited effect on creating lasting change. Using our “mind over matter” conscious adaptability is a process that generally works only in the conscious realm. We have to enter the realm of the subconscious mind to create lasting changes.

Here is a brief list of some of the known functions of the subconscious.

Regulation of body functions – The subconscious mind regulates all involuntary bodily functions such as; muscle movement, digestion, breathing, circulation, and temperature, as well as the healing of tissues and organs.

Storehouse and processor for emotional expression, memories and subconscious beliefs – Our primary capacity for emotional expression is stored in the subconscious mind. Every experience and significant feeling we have, or ever had, impacts the energetic matrix of our brain and body, vis-à-vis our memories and beliefs. These experiences, and their related capacity for expression, play a major role in guiding our future actions and behavior.

Provider of creativity and imagination – Various aspects of creativity and

imagination are available in the subconscious mind and can be accessed under the proper conditions. Albert Einstein said, 'Imagination is more important than knowledge', recognizing that our powers of imagination are truly vast, perhaps even limitless.

Information recorder, organizer and retriever – Virtually every event we experience is recorded in the subconscious mind. All thoughts, feelings, memories and the meanings we assign to these events are also recorded. These experiences and the meaning we assign to them become “filters” for our perceptions and beliefs. The subconscious mind also organizes the results of our experiences, creating new beliefs, modifying, or simply re-enforcing previously established beliefs, to meet future needs and challenges [7].

Automator – Every habit of mind and body is carried out by the subconscious mind. For example we can walk, run, sit, ride a bicycle or perform a number of other physical acts without ever consciously thinking about how to do them. They just take place automatically as a direct result of the function of our powerful subconscious mind. Data has revealed that the subconscious mind processes approximately 40 million bits of information per second, while the conscious mind processes only 40 bits per second [8].

Likewise, feelings are also automatically generated in the subconscious mind as we go about our daily activities and interactions with other people. For example, if we see someone we like, we automatically feel good. Conversely, if we see someone we don't like, we automatically feel anxiety or distress. These feelings are often generated by specific past experiences with these people, or with similar type people, e.g. gender, race, appearance, etc.

Reality Filter – The subconscious mind is constantly filtering the story of our life through its own *perceptual filters*, e.g. beliefs. It edits “reality” according to the patterns and meanings we have assigned to the events of life.

Generator of energy vibrations (feelings) – Humans are vibrational beings, constantly emitting energy vibrations, moment-to-moment, day-in-and-day-out. These vibrations are generated and directed largely by the subconscious mind, (a kind of epigenetic energy signal generator) and can cause *constructive* or *destructive* interference patterns in the environment depending upon the thoughts that we are thinking at the time. Thoughts of appreciation, joy and gratitude flood our cells and bodies with chemicals that produce reciprocal feelings or vibrations, thus focusing on such thoughts enhance our health, well being, and vitality. Distressful thoughts tend to produce the opposite effect. That might explain why negatively thinking people often feel stressed or ill. These energy vibrations have an impact on ourselves and can profoundly affect others around us.

Elizabeth Gould studied the detrimental effects of chronic stress on the brains of rats and primates. Gould, a Princeton University psychology professor, has observed inexplicable evidence of the brain's capacity to heal itself by the creation of new neurons. This is a process now known as “neurogenesis.” She has demonstrated that the brain's mechanisms are affected by its surroundings. This adds additional credibility to the significance of Nature, in the Nature vs. Nurture hypothesis [9].

Ronald Duman (2004) offered research that suggests that chronic stress debilitates dendrites and inhibits cell

production which causes atrophy of the hippocampus, a part of the brain essential for learning and memory and also implicated in mood disorders, whereas access to a nurturing adult contributed directly to the development of healthy brain structure and function [10].

Jonah Lehrer (2006) explains that Gould's work uses the term "environmental conditions." He describes Gould's discoveries: "The structure of our brain, from the details of our dendrites to the density of our hippocampus, is incredibly influenced by our surroundings" [11]

Gould poses the question, "If the brain structure is hurt by stressful or negative *environ-mental* conditions, can its functions be helped, even healed, by positive *environ-mental* forces?" Lehrer explains that the social implications of this cutting-edge study of neurogenesis are enormous.

In Dr. Bruce H. Lipton's bestseller, *The Biology of Belief*, he says, "Our positive and negative beliefs not only impact our health, but also every aspect of our life." He goes on to say, "Your beliefs act like filters on a camera, changing how you see the world. And, your biology adapts to those beliefs." [12]

What are beliefs? Beliefs are ultimately conclusions drawn from experience, resulting in *perceptual filters* that determine our attitudes, values, emotions, and actions. Beliefs inform the body, via biochemical and bioelectric cellular interactions, regarding the pre-programmed responses to stimuli in the environment, both internally and externally. Similar to a software programmer who writes instructions into

a computer program, which determines how the computer should run or operate, analogously beliefs are instructions as to how we should run and operate our lives. In 1954, Roger Bannister ran the mile in under 4 minutes. Before this feat, it was a commonly held belief that such an achievement was not physically possible. However, on that day, Bannister's subconscious belief patterns instructed his entire being to do whatever was necessary to achieve this goal. Once the *belief barrier* was broken, several other people achieved the same goal because they now also believed that it was possible. In other words, the capacity of the runners to run the four-minute mile didn't change until their belief in their capacity to do so changed.

What happens when subconscious beliefs change and behavior does not?

When subconscious beliefs are changed, they create new behavioral *potential*. However, most such changes still need the involvement of the conscious mind to *activate* the new potential. For instance, if a person changes a fear based belief about public speaking, they still must choose to create a venue where the new potential can be actualized, i.e. they need to talk in front of a group.

Analogously, if you install a new software program on your personal computer you will see the new icon on your desktop. However, if you never click on the icon to activate its potential, you will not enjoy the benefits of the new program. While the potential of the software is there, it will not be usable without taking a conscious action to activate it.

Also, sometimes individuals choose not to activate a new potential more than once, because due to unforeseen circumstances prior to the making the belief/behavioral change, they find that

the new behavior doesn't meet an important need that the old behavior did meet. This is called *secondary gain*. In this case, visible evidence of the new potential will not be seen. The potential is clearly available to them, as evidenced by brainmapping, but the concomitant behaviors are not displayed.

What is a perception? A perception is simply an awareness of the environment via feelings and sensations. Perceptions are our sensory experiences. For example, if you close your eyes and someone sticks a pin in your arm, you will immediately become aware that something in your environment has caused you to feel a sudden stab of pain. Our lives then are really about responding to our environment, both internal and external. If there were no signals or stimuli from the environment, such as the pinprick, there would be no need to respond. There would be nothing to respond to!

Interestingly, not everyone responds in the same way to environmental signals, even if these signals are exactly the same. For example, two people view an abstract painting. Each person *sees something different* in the painting. The picture is a fixed visual image, yet the interpretation of the image can be radically different depending on the meaning each viewer gives the image depicted on canvas. This meaning is generally derived from *subconscious perceptual associations* originating in the individual's past. One person may connect to positive past associations, and the other to negative ones. The image doesn't change but the meaning, and hence the response to the image, may be very different between the two viewers. These are two very different behavioral responses to the same environmental occurrence or signal. The question is, why does this happen? The answer is

because of perception. How we respond to the environment depends on how we perceive it. So, at the end of the day *it is our perception that creates our experience of the world around us*.

DISCUSSION OF THE WHOLE-BRAIN STATE'S EFFECT ON OUR BELIEF SYSTEM AND PERFORMANCE

A controlling factor in human interactions seems to be the whole-brain (hemispherically synchronized) state. Research has shown that high functioning individuals typically use both hemispheres of the brain simultaneously, rather than operate in a non-integrated state regarding accessing one's full potential to meet life's goals and challenges. In the classic studies of brain dominance theory, it has been shown that each hemisphere serves different functions [13].

In recent years, the understanding and acceptance of the existence of the brain's *default network* has helped us better understand that there are regions of the brain characterized by decreased neural activity during goal-oriented tasks. We have come to know the relationship of these regions as a "default mode" of brain function. Studies suggested that the brain's default mode supports *self-referential* mental activity. The literature related to the default network indicates brain activity that offers an awareness of the *autobiographical self, stimulus independent thought, mentalizing*, and most recently *self-projection*. Damien Fair (2008) explains that these regions integrate into a cohesive, interconnected network. Fair and his group of researchers consider into the default network as a functionally interconnected *default system* that is required for internally directed mental activity. They

explain that it stands to reason that the default system should demonstrate a mature, or near mature, pattern of functional connectivity at a time in development when internally directed mental activity is demonstrable. We would contend that the research they present regarding the *autobiographical self*, *stimulus independent thought*, *mentalizing*, and *self-projection* is another way of describing subconscious beliefs. Their research also projects that the default network becomes significantly more integrated [14].

Christopher Honey and his colleagues (2007) suggest that spontaneous activity in the brain, in part, accounts for the changes in interregional correlations in the brain [15]. These findings suggest that a process of *integration through synchronization* may partially underlie the development of various brain networks [16], [17], including the default network.

Marcus Raichle (2007) comments on the default network suggesting how the brain works critically depends on the study of its intrinsic activity (i.e., activity not directly related to identifiable sensory or motor events), including that present in the default mode. We would identify that as subconscious belief patterns [18].

Raichle admonishes neuroscientists that they are now obliged to understand not only the concepts and strategies of cognitive psychology and the default network, but also a wide array of behavioral disciplines covered under the rubric of social neuroscience [19], [20]. He also says, behavioral scientists interested in relating their work to the brain are confronted by a rapidly increasing body of knowledge concerning the physiological correlates

of functional neuroimaging signals [21], [22], [23].

Richard Boyatzis (2011) explains that advances in neuroscience may help us understand the internal mechanisms that enable some people to be effective leaders, and some not. He promotes the idea that neuroscience will help us to know how some people can form effective leadership relationships, and some not. It will also help us to understand why some people can sustain their effectiveness and others cannot [24].

Goleman, Boyatzis & McKee, (2002) in their book *Primal Leadership* and *Resonant Leadership* (Boyatzis & McKee, 2005), synthesized their research to help us understand and to support their idea that effective leaders build resonant relationships with those around them. They also say that less effective leaders or those that are more one-sided in their leadership style seem to create dissonant relationships [25].

In Boyatzis' exploratory study (2011), preliminary observations revealed that recalling specific experiences with resonant leaders significantly activated 14 regions of interest in the brain, while dissonant leaders activated 6 and deactivated 11 regions. These experiences with resonant leaders activated neural systems involved in arousing attention (i.e., anterior cingulate cortex), the social or default network (i.e. right inferior frontal gyrus), mirror system (i.e., the right inferior parietal lobe), and other regions associated with approach relationships (i.e., the right putamen and bilateral insula). Meanwhile, dissonant leaders deactivated systems involved in social or default networks (i.e., the posterior cingulate cortex), the mirror system (i.e.,

the left inferior frontal gyrus), and activated those regions associated with narrowing attention (i.e., bilateral anterior cingulate cortex), and those associated with less compassion (i.e., left posterior cingulate cortex), more negative emotions (i.e., posterior inferior frontal gyrus). He also points out that we can begin to understand *how* they may be affecting our moods and cognitive openness. The authors of this article would have you understand that the *whole-brain state* allows access to positive mood and cognitive openness [26].

According to Le Doux (2002), relevant to leadership, there are three implications of these observations: the speed of activation, the sequence of activation, and the endocrine/neural system interactions. The firing of the limbic system seems to occur within 8 milliseconds of a primary cognition *and* it takes almost 40 milliseconds for that same circuit to appear in the neocortex for interpretation and conceptualization [27].

Research conducted by Radin (1997), shows a similar effect with test subjects in a study of precognition [28].

Le Doux says with this timing, our emotions are determining cognitive interpretation more than previously admitted. Le Doux's explanation suggests that once primary cognitions have occurred, secondary cognitions allow for the neocortical events (i.e., reframing) to drive subsequent limbic or emotional labeling. Our unconscious emotional states are arousing emotions in those with whom we interact before we or they know it. And it spreads from these interactions to others.

Boyatzis' research claims that negative emotions are stronger than positive

emotions [29]. He says that the contagion of negative emotion would ignite a stronger neural sequence than positive emotions. This may serve evolutionary functions but, paradoxically, it may limit learning. As a consequence, arousal of strong negative emotions stimulates the *Sympathetic Nervous System* (SNS), which inhibits access to existing neural circuits and invokes cognitive, emotional, and perceptual impairment [30], [31], [32].

The benefits of arousing positive emotions over negative ones have been demonstrated by Fredrickson and Losada (2004) and others. Boyatzis explains that a contagion of positive emotions seems to arouse the *Parasympathetic Nervous System* (PNS), which stimulates adult neurogenesis (i.e., growth of new neurons), a sense of well-being, better immune system functioning, and cognitive, emotional, and perceptual openness [33], [34], [35].

The sustainability of leadership effectiveness is directly a function of a person's ability to adapt and activate neural plasticity. The SNS and PNS are both needed for human functioning. They each have an impact on neural plasticity. Arousal affects the growth of the size and shape of our brain. Neurogenesis allows the human to build new neurons. The endocrines aroused in the PNS allow the immune system to function at its best to help preserve existing tissue [36].

Obviously, the optimal state of consciousness is to have the qualities and attributes of both hemispheres operating simultaneously, in order to have the full response potential of the mind/brain system available to us, on an ongoing basis. This state of being can beneficially influence an individual's

own state of consciousness, and consequently his or her own performance. This positive influence extends to other individuals.

A study reported in 1988 in the *International Journal of Neuroscience*, by researchers at the Universidad Nacional Autónoma de México, suggest that synchronized brain states significantly influence nonverbal communication. The study was done with thirteen paired subjects. The subjects were tested in a darkened and soundproof Faraday cage (a lead-lined screened chamber that filters out all outside electromagnetic activity). Each pair of subjects was instructed to close their eyes and try to “communicate” by becoming aware of the other’s presence and to signal the experimenter when they felt it had occurred. The brainwave states of the subjects were monitored during this process. Experimenters reported that during the sessions an increase in similarity of EEG (brainwave) patterns between the pairs of communicators developed. Furthermore, the experimenters noticed, “The subject with the highest concordance [hemispheric integration] was the one who most influenced the session.” In other words, the EEG patterns of the individual with less synchrony between the brain hemispheres would come to resemble the EEG pattern of the person whose two sides more closely resembled each other [37].

These conclusions support the proposition that our thoughts, even nonverbally expressed, can influence others. In fact, the more whole-brained *we* become, the more we influence *others* toward that state of being as well.

In addition to the energetic influence of

others toward a more integrated brain state, achieving a whole-brain state offers additional advantages, especially regarding the introduction of new beliefs to the subconscious mind. In short, the whole-brain state provides a user-friendly environment for introducing such beliefs, dramatically reducing the typical resistance to affirmations or positive thinking as a mechanism for internalizing new beliefs. The research discussed in this article makes it abundantly clear that the whole-brain state is highly instrumental with respect to facilitating the process of changing beliefs at the subconscious level of the mind.

Further explanation of the significance of subconscious belief patterns suggests that our beliefs, usually subconscious, are the cumulative effect of life-long “programming.” As a result of past conditioning, we sometimes think and behave in self-defeating ways. *Conscious thoughts* can be readily changed, by simply receiving information: reading an insightful book, having a compelling conversation, seeing the unarguable results of scientific research, etc. However, if conscious information were all that was needed to lead satisfying and successful lives, most of us would already be doing that. Unless changes are made at the *subconscious level*, repeating undesired reactions and behaviors will likely continue. Subconscious beliefs have far reaching consequences, both positive and negative, in every aspect of life. They affect our moods, relationships, job performance, self-esteem, and even physical health. Our contention is that it is imperative to know how to change self-limiting beliefs into self-enhancing beliefs that support our goals and aspirations.

By emitting loving or joyful energy vibrations/thoughts our subconscious influences others to feel the same way towards us. Thus, the energy field we are emitting moment-to-moment draws to us a similar energy field effect.

THE ZERO-POINT FIELD AND QUANTUM ENTANGLEMENT

For centuries, the Newtonian perspective that the universe was mechanistic and things work in a comfortable and predictable manner has long been replaced by quantum theories. We understood that subatomic particles were not solid little objects like billiard balls; Einstein taught us that they are vibrating packets of energy that sometimes acted like a particle and sometimes like a wave. Werner Heisenberg presented the notion that quantum particles are *omnipresent*. Quantum physicists discovered a strange property in the subatomic world called *nonlocality* to describe the properties of what we now call *quantum entanglement*. This refers to a quantum entity such as an individual electron influencing another quantum particle instantaneously, over any distance, despite there being no exchange of force or energy. It also suggested that quantum particles once in contact, retain a connection even when separated, so that the actions of one will always influence the other, no matter how far they are separated [38]. Karl H. Pribram presented ideas in 1971 that the mind and consciousness are not just local events. Rather, they exist as part of a constantly changing fundamental field that he termed the *biofield*, as presented by Beverly Rubik [39].

Noted physicist David Bohm based his analysis of the nonlocal field on empirical evidence of quantum theory

[40]. By 1987, Pribram agreed with Bohm's idea that there is an *implicate order* to the universe that pertains to all matter. As it pertains to brainwave activity he proposed that there are holonomic overlapping patches of holographic structures in the cortical surface layers of the brain, which would transform inputs from perception and thoughts into slow electrical potentials presented in EEG brain wave patterns. Bohm also suggested that several different types of fields, each operating at many spatial and temporal frequencies may well be involved. He said that the characteristics of the particular type of *oscillation* would partially determine the range and resolution of the potential information transfer; this has yet to be understood. Quantum fields do not diminish as quickly over distance as electromagnetic fields do in the brain [41].

INTRODUCTION TO QUANTUM EFFECTIVENESS

While quantum correlations, or entanglement, are clearly of paramount importance for efficient pure state manipulations, mixed states present a much richer arena and reveal a more subtle interplay between correlations and how to distinguish between them [42].

Correlations now suggest that this probability will most generally not be expressible as a product of probabilities of subsequences. In 1948, Shannon introduced the notion of mutual information theory in order to quantify how correlated different observations exist [43].

We do not generally understand why events we observe around us are correlated in the first place. Correlations themselves are very simply quantified

within the framework of Claude Shannon's information theory. Suppose we repeatedly perform measurements on a given system, at different instants of time. Let us record the outcomes of our observations as a sequence. Different sequences of outcomes will naturally have different probabilities associated with them.

Applications of fundamental topics of Shannon's information theory include the intersection of mathematics, statistics, computer science, physics, neurobiology, and electrical engineering. Its impact has been crucial to the success of the Voyager missions to deep space, the invention of the compact disc, the feasibility of mobile phones, the development of the Internet, the study of linguistics and of human perception, the understanding of black holes, as well as numerous other fields. We are only beginning to understand what this theory means to the field of neuroscience and quantum effectiveness.

Simply, his theory explains if we divide measurements into two groups, A and B, each of them having a well defined probability distribution, respectively, as well as a joint probability distribution, then the mutual information between A and B is defined. This is the well-known Shannon entropy model. There is a certain degree of subtlety in trying to extend Shannon's mutual information to more than two different sets of outcomes (A and/or B). The concept of mutual information is so general that it can easily be extended to quantum systems [44]. This leads us to understand that having quantum mutual information, which, for a general state of either A and/or B is now defined and provides the basis by which the relationship can be understood.

First of all there is entanglement. Given a bipartite quantum state (where there are two separate entities with substrates), entanglement by the states of the form are known as separable or disentangled. Entanglement is then most easily quantified by calculating how different this state is to any separable state. This will simply mean that there is a state for system A and a separate state for system B. Shannon says, the more correlated A and B, the more we can learn about one of them by measuring the other. Suppose we make measurements of A. For each measurement there is an outcome occurring with probability. We can also define this quantity by swapping the roles of A and B. It is true that separate states contain correlations over and above just the classical ones. The discrepancy between the two is known as the quantum discord. We will call discord the correlations over and above classical brain states but excluding entanglement [45]. The general picture is this, quantum mutual information in any quantum state, A or B, can be written as a numeric value of entanglement in the state as measured by the relative entropy of entanglement [46] to put it on an equal footing with other entropic measures of correlations. Physically this means that the quantum mutual information measures total correlation in a quantum state.

We might ask, what feature of quantum mechanics makes quantum information processing more efficient than classical resonance? *It has been said that quantum entanglement is clearly that feature.* The answer seems obvious in the case of pure states. If there is no entanglement during the evolution of pure states, then that evolution can efficiently be simulated by classical systems [47]. We should remember that according to our above discussion, pure

states contain the same number of classical correlations as entanglement. Therefore, we might well say that it is classical correlations of resonance in pure brain states that are responsible for the speed-up. The oscillations from entanglement create the quantum effectiveness, which leads to the unified whole-brain state, which in turn can now operate with complete balance and efficiency in all areas. The result adds to a heightened level of consciousness and cognitive ability.

QEEG AND THE WHOLE-BRAIN STATE

Our research gathering documented one hundred twenty-five (125) cases, with data gathered over 12 months in three different locations, utilizing different EEG technicians, using two different types of EEG equipment; the result of this investigation produced a p-value of ≤ 0.010 .

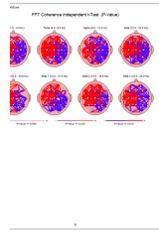
A baseline of EEG data was established for each case. Using EEG caps calibrated by Electro-Cap International, standard procedure was to inject each of the 10-20 international systems for electrode placement with standard electro-gel making contact with the scalp and the electrode. Ensuring that the dc-offset voltages were within acceptable range, three (3) baseline readings of five (5) minutes each was recorded; five minutes eyes open, five minutes eyes closed and five minutes with the brain on task (silently reading a magazine).

A Certified PSYCH-K Facilitator, used standard PSYCH-K[®] practices to achieve the whole-brain state with the subject. Following the intervention of the PSYCH-K[®] change process (aka a *balance*), a post-intervention EEG was

recorded in the same manner as the EEG baseline stated above. The *balance* took approximately 10 minutes to complete. Raw EEG data was artifacted to eliminate eye movement, tongue movement, swallowing or other unwanted disturbances in the EEG. Standard EEG artifacting criteria was used and accomplished by an experienced qualified EEG technician. A minimum of 1 minute of artifacted *clean* data was used (although data presenting at .90 or above is considered acceptable; standards for artifacted data for this study must meet or exceed .95 in both *Split-Half* examination and on *Test-Retest* examination). Statistical analysis was performed by NeuroStat, a function of the NeuroGuide program from Applied Neuroscience. NeuroStat allows for individual independent t-tests to be performed. The following is an example from the base of 125 cases examined for the whole-brain state.

The independent t-test compares condition A to condition B and shows if there are differences in the dominant brain function (consider the discussion of Shannon's method above). The legend is the same in all of the depictions shown in the illustration. The RED represents the dominant brainwave pattern prior to the facilitation of the PSYCH-K[®] *balance*. The BLUE represents the dominant brainwave pattern after the *balance* had been facilitated. The thickness of the line, indicates level of P-factor, see legend below figures.

The whole-brain state is considered to be the combination of RED; condition A, dominance prior to balance process, and condition B, dominance after the balance process was facilitated.



The person depicted by the independent t-test to the left, experienced profound changes. This woman had been an office manager for over ten years. Her dominant pattern before the PSYCH-K[®] balance was facilitated, (seen in RED), is left hemispheric. Very logic oriented, her management style was “my way or the highway.” Her approach was demanding and she expected others to do exactly as she commanded. Most of the people that worked for her did as she asked out of fear of reprisal from her or at times, experienced her uncontrollable anger. After the PSYCH-K[®] balance, the dominant pattern, seen in BLUE, represents access to the emotional/right side of her brain, augmenting the qualities and attributes of her left hemisphere. The result was that her consideration of others was noticeably better, and her interpersonal relationships at home and at the office improved substantially. Her leadership abilities began to flourish and she became well liked. In addition, the office ran smoother, with greater efficiency and productivity. Her shift toward a whole-brain state created a new attitude toward others, fostering a more congenial work environment. The overall shift in the attitude of her employees toward her was supportive, resulting in a more positive feeling about the work place.

Due to the space restriction of this article, it is not possible to provide a comprehensive treatment of this subject or the numerous changes that individuals experienced. However, the volume of data collected, and the unique properties it represents afford us the opportunity to evaluate and continue to understand what the data means, as well as

providing intriguing hints as to the nature of its potential. Singularly, the most significant information to come from this research, in 98% of the cases measured, presented statistically significant correlations, demonstrating the difference between baseline measures and the presence of the *whole-brain state* after the intervention occurred. As mentioned above, just because the whole-brain state is present does not mean that it is being activated, so the person can take full advantage of it in a given situation. Sometimes secondary gain issues, or other subconscious belief patterns may need to be addressed in order to activate and/or allow the person to use the whole-brain state effectively.

SUMMARY

Clearly there is more to learn and understand in this robust field of study. More scientific articles are forthcoming to better identify the nature and results of this work, as well as its relationship to neuroscience. A greater understanding of the relationship between the oscillation of the zero-point field and brainwave resonance is an area for continued research. In addition, more research needs to be done to discover the significance of thought and its effect on subconscious belief patterns. Subconscious belief patterns circumscribe our perception and drive our behaviors. Knowing how changing perception at the subconscious level of the mind can transform a subconscious belief pattern can now be depicted in brainwave energy and the creation of the whole-brain state. Continued research in this area will assist in recognizing and adopting applications that will be beneficial in academics, personal health, professional performance, and virtually every area of human life. Practical

applications of changing subconscious belief patterns have existed for over two decades; today we can measure them and graphically demonstrate their efficacy, lending to further understanding and utilization of this important aspect of human existence, in virtually all walks of life.

Aligning the principles of business with the Principles of Nature, in order to achieve *sustainable success*, and effect significant thought patterns and behavioral changes in individuals who make decisions that determine the fate our world, are critical to creating a sustainable future for ourselves, and for generations to come. Our very existence, as well as the existence of this planet, is made possible and sustained by the intelligent design of Nature's Principles. Nature has millions of years of experience in creating *sustainable success*. Our presence here is testimony to the wisdom and practical application of those Principles. Some of the most salient Principles of Nature include; adaptability, resiliency, harmony, balance, collaboration, growth management, diversity, and more. These Principles, when anthropomorphized from Nature are applicable in business *and* in our personal lives, although sadly they are frequently lacking in both.

Our concern that business practices, as well as human civilization in general, are going down a path of *misalignment* with the Principles of Nature, speaks to a sense of urgency in making this aspect of neuroscience a high priority. If we are to make a significant difference in the way we conduct business and our personal lives, we must start refining and applying our knowledge about how the human mind/brain interface operates regarding subconscious belief systems, as well as how those belief systems

affect the *global field of consciousness*, via *quantum entanglement*. As Nobel Physicists Erwin Shrodinger puts it, "*The total number of minds in the Universe is One.*"

Subconscious belief systems are the driving force for changing our thoughts and actions. By better understanding the mechanisms of changing subconscious beliefs, we may well be able to ameliorate or even avoid the otherwise probable economic, ecological, and cultural maelstrom we are facing now, and in the future.

A commonly heard statement in the business world is, "Don't take it personally, it's just business." The authors of this article suggest a very *different* perspective. *We must take it personally because it is business!* Business decisions impact and change our world every day. By aligning the principles of business with the principles of Nature, we can foster a world where *sustainable success* is an everyday reality, rather than an obscure, idealistic goal. It is our contention that the field of neuroscience can play a leading role in the creation of this generative future, if we are willing to broaden our horizons of possibility for neuroscience in today's world.

The authors leave you with this *food for thought* from Albert Einstein:

"A human being is a part of the whole, called by us 'Universe,' a part limited in time and space. He experiences himself, his thoughts, and feelings as something separated from the rest, a kind of optical delusion of his consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons nearest to us. Our task must be to free ourselves from this prison by widening

our circle of compassion to embrace all living creatures and the whole of nature in its beauty. Nobody is able to achieve this completely, but the striving for such achievement is in itself a part of the liberation and a foundation for inner security.” **–Albert Einstein–**

Keywords: *QEEG, Quantum, Brain Mapping, PSYCH-K[®], PER-K[®], Thought, Subconscious, Belief Patterns, Business Principles, Whole-Brain State*

RESOURCES

- [1] Wall Street Journal. (September 20, 2007). *This is your Brain on the Job*.
- [2] Le Doux, Joseph. (1998). *The Emotional Brain: The Mysterious Underpinnings of Emotional Life*. Simon & Schuster Inc. United States of America.
- [3] Pinker, S. (January 19, 2007). The mystery of consciousness. *Time*.
- [4] Lipton, B. H. (2005). *The Biology of Belief*. Santa Rosa, CA: Mountain of Love/Elite Books. 143.
- [5] Senge, Peter. (2011). *It's not about doing what we are doing better, it's about doing something different*. MIT Sloan Management Review Video Interview.
- [6] US News & World Report presented a special issue February 28, 2005, entitled, *The Secret Mind*, featuring an article, *How Your Unconscious Really Shapes Your Decisions*.
- [7] Nørentander, Tor. (1991). *The User Illusion – Cutting Consciousness Down to Size*. Penguin Books.
- [8] Kirsten, F. (2009). *The Subconscious Mind: What It Is and How to Reprogram it Using Advanced Technologies*. The Brain Science Academy. www.brainscience.co.za
- [9] Gould, Elizabeth. (Fall 2006. Revised for Spring 2008). *Vision*
- [10] Duman, Ronald. (August 2004). *Nature Neuroscience*.
- [11] Lehrer, Jonah. (February-March 2006). The Reinvention of the Self. *Seed*.
- [12] Lipton, B. H. (2005). *The Biology of Belief*. Santa Rosa, CA: Mountain of Love/Elite Books.
- [13] Cade, Maxwell & Coxhead, Nona. (1979). *The Awakened Mind: Biofeedback and the Development of Higher States of Awareness*. NY, NY. Dell Publishing Co. Inc.
- [14] Fair, Damien A. et al. (March 11, 2008). The Maturing Architecture of the Brain's Default Network. *PNAS*. **105,10**. pp. 4028-4032.
- [15] Honey C., Kotter R., Breakspear M., Sporns O. (2007). Network Structure of Cerebral Cortex Shapes Functional Connectivity on Multiple Time Scales. *Proc Natl Acad Sci USA* 104: 10240 –10245.
- [16] Fair DA, et al. (2007) Development of distinct control networks through segregation and integration. *Proc Natl Acad Sci USA* 104:13507–13512.
- [17] Varela F., Lachaux J.P., Rodriguez E., Martinerie J. (2001). The Brainweb: Phase Synchronization and Large-Scale Integration. *Nat Rev Neurosci* 2:229–239.
- [18] Raichle Marcus E. and Snyder, Abraham Z. (2007). A Default Mode of Brain Function: A Brief History of an Evolving Idea. *NeuroImage*, **37**, 1083–1090.
- [19] Cacioppo, J.T., Berntson, G.G., et al. (Eds.), 2002. *Foundations of Social Neuroscience*. MIT Press, Cambridge, MA.
- [20] Cacioppo, J.T., Visser, P.S., et al. (Eds.), 2006. *Social Neuroscience: People Thinking About People*. MIT Press, Cambridge, MA.
- [21] Logothetis, N.K., Pauls, J., et al., 2001. *Neurophysiological investigation of the basis of the fMRI signal*. *Nature*, **412 (6843)**, pp.150–157.
- [22] Attwell, D., Iadecola, C., (2002). *The Neural Basis of Functional Brain Imaging Signals*. *Trends Neurosci*. **25 (12)**, 621–625.
- [23] Lauritzen, M., (2005). *Reading Vascular Changes in Brain Imaging: Is Dendritic Calcium the Key?* *Nat. Rev., Neurosci.* 6 (1), 77–785.
- [24] Boyatzis, Richard. (January / February 2011). Neuroscience And Leadership: The Promise Of Insights. *Leadership*.
- [25] Goleman, D., Boyatzis, R., & McKee, A. (2002). *Primal Leadership: Realizing the Power of Emotional Intelligence*. Boston: Harvard Business School Press.

- [26] Boyatzis, Richard. (January / February 2011). Neuroscience And Leadership: The Promise Of Insights. *Leadership*.
- [27] LeDoux, J. (2002). *Synaptic self: How Our Brains Become Who We Are*. NY: Viking.
- [28] Radin, D. (1997). *The Conscious Universe*. Harper Collins. New York.
- [29] Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology*, 5: 323-370.
- [30] Sapolsky, R. M. (2004). *Why zebra's don't get ulcers (third edition)*. NY: Harper Collins.
- [31] Schulkin, J. (1999). *Neuroendocrine regulation of behavior*. NY: Cambridge University Press.
- [32] Dickerson, S.S. & Kemeny, M.E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*.130(3): 355-391.
- [33] McEwen, B. S. (1998). Protective and damaging effects of stress mediators. *New England Journal of Medicine*. 338: 171-179.
- [34] Janig, W. & Habler, H-J. (1999). Organization of the autonomic nervous system: Structure and function. In O. Appenzeller (ed.). *Handbook of Clinical Neurology: The Autonomic Nervous System: Part I: Normal Function*, 74: 1-52.
- [35] Boyatzis, R. E., Jack, A., Cesaro, R., Passarelli, A. & Khawaja, M. (2010). *Coaching with Compassion: An fMRI Study of Coaching to the Positive or Negative Emotional Attractor*. Presented at the Annual Meeting of the Academy of Management, Montreal.
- [36] Dickerson, S.S. & Kemeny, M.E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin*.130(3): 355-391.
- [37] Ferguson, M. (1988). *The Brain Revolution and Brain*. Universidad Nacional Autonoma de Mexcio. *International Journal of Neuroscience*, vol 13, 10a, 148.
- [38] Basar, E. (2011). *Brain-Body-Mind in the Nebulous Cartesian System: A Holistic Approach by Oscillations*.
- [39] Rubik, B. (2002). The biofield hypothesis: Its biophysical basis and role in medicine. *Journal of Alternative and Complementary Medicine* 8,6, pp. 703-717.
- [40] Bohm, D. B. (1983). *Wholeness and the Implicate Order*. Page references to Ark Paperback Edition, New York: Cox & Wyman, Reading, England. p. 24.
- [41] Pribram, K. H. (1987). *The Implicate Brain*. In B. J. Hiley & F. D. Peat, Eds., *Quantum Implications: Essays in Honour of David Bohm* (Rutledge, London, England.
- [42] Vedral, V. (2009). *The Elusive Source of Quantum Effectiveness*. Clarendon Laboratory, University of Oxford, Parks Road, Oxford OX1 3PU, United Kingdom Centre for Quantum Technologies, National University of Singapore, 3 Science Drive 2, Singapore 117543 Department of Physics, National University of Singapore, 2 Science Drive 3, Singapore 117542.
- [43] Vedral, V. (2002). *Rev. Mod. Phys.* 74, 197.
- [44] Shannon, C. (1948). *The Bell System Technical Journal* 27, 379423, 623656.
- [45] Jozsa, R. & Linden, N. (2003). *Proc. Roy. Soc. series A-Mathematical Physical and Engineering Sciences* 459, 2011.
- [46] Olivier H., & Zurek, V. (2001). *Phys. Rev. Lett.* 88, 017901.
- [47] Vedral, V., Plenio, M. B., Rippin, M. & Knight, P. L. (1997). *Phys. Rev. Lett.* 78, 2275.