

Consciousness, The Human Heart and The Global Energetic Field Environment

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ABSTRACT

The Global Coherence Initiative (GCI) is a science-based, international effort that conducts research on interactions between humans and the Earth's magnetic field environment as well as collective intention on promoting peace, and harmony.

In order to carry out one aspect of the interconnectedness research, GCI has created a Global Coherence Monitoring System (GCMS), which is comprised of a network of six magnetometers specifically designed to measure geomagnetic and resonant frequencies in Earth's magnetic fields, such as Schumann resonances, Alven waves and other field-line resonances.

The finding from this line of research suggests that global collective behaviors and numerous human physiological rhythms are affected by and in some cases synchronized with solar and geomagnetic activity. Additionally, we discuss why the majority of research conducted thus far has focused on how disruptions in the earth's magnetic fields are associated with adverse effects on health and behaviors. However, it is important to note, that solar and geomagnetic activity can also have a positive impact on human physiology and health.

Furthermore, we believe there is an even more fundamental and important aspect of the earth's magnetic fields that can be utilized to help lift human consciousness. We propose that the earth's magnetic fields provide a plausible mechanism that interconnects and non-locally distributes information to all living systems on our planet. We review several independent lines of research that support the hypothesis that the earth's magnetic fields can act as a carrier of and encoded by physiologically patterned and relevant information. The four primary hypotheses of the GCI are articulated and the existing theoretical and experimental support for each hypothesis is discussed.

Introduction

The Global Coherence Initiative (GCI) was established in 2008, because we believe that we are at a point in the evolutionary history of human consciousness in which humanity has an opportunity to evolve to more interconnected, inclusive and cooperative social, economic and cultural systems around the planet. GCI is a science-based initiative, launched by the HeartMath Institute, a nonprofit research and education organization. Currently, over a quarter million (~265,000) people in 154 countries are involved in the initiative. GCI members can participate online through our

website (<https://www.HeartMath.org/gci/>), social media, and a recently launched smart phone app (Global Coherence app) which assess any sized groups level of HRV coherence from participants located anywhere in the world.

The primary focus of GCI is research that examines the dynamic relationship between human consciousness (physiology, emotions, behaviors, etc.) and Earth's energetic (electromagnetic) environment. Additionally, GCI provides educational content and technologies to help increase personal, social and global coherence to network members.

HeartMath Institute's previous research identified an optimal psychophysiological state for enhanced self-regulation, emotional stability and cognitive functioning, termed *heart coherence* [1,2]. At the individual level, a person's level of heart coherence can be assessed by monitoring the rhythmic patterns that are reflected in the individual's heart rate variability (HRV), the beat-to-beat changes in heart rate. Positive emotions such as love, appreciation and compassion tend to generate a heart-rhythm pattern that is more ordered and coherent, whereas negative emotions such as anxiety, anger and fear generate a disordered, incoherent heart-rhythm pattern. Ongoing feelings of impatience, frustration, irritation, worry or blame are associated with incoherent HRV rhythms, indicating that inner brain and nervous system rhythms are out of sync [1]. The HeartMath techniques, tools and technologies have been developed to help people shift into and maintain a state of heart coherence. Improvements in cognitive performance, focus, effectiveness, self-responsibility and social cohesion through use of the HeartMath System have been shown in numerous youth and adult populations [1-12].

In order to facilitate personal, social and global coherence the HeartMath Institute has created the Global Coherence app, based on a mobile platform, that measures the heart rhythm coherence of groups of any size in real-time, and connects people globally. GCI members receive regular updates via the app that informs them where to direct their energetic contributions of heart-focused care and intention. Monthly global full moon care focuses are often directed at places of unrest or natural disasters, or are carried out on days with strong magnetic field disturbance.

Four primary hypotheses will be discussed below along with some of the existing theoretical and experimental support for each hypothesis.

The Field View of Reality

Classical physics has conceived of reality as elementary building blocks made up of solid objects, separated by empty space. This view continues to be most people's perception of reality, including many scientists. With the discovery of radioactivity and electromagnetic fields and the development of modern quantum physics a new view of reality has emerged over the last century. In this new view, physical objects cannot be understood, or observed in isolation, but rather must be viewed as part of a holistic web of interconnectedness in which fields and relationships are pivotal and there are no clear boundaries between nonmaterial fields and the physical world [13-15].

Early 20th century biologists Paul Weiss and Alexander Gurwitsch proposed that "biological fields" play a crucial role in the development of organisms and that human beings have, a solid physical body, and a field component reaching out beyond the body's boundaries [16]. Recently, biophysics has shown that all living organisms are indeed permeated and surrounded by a weak electromagnetic field, composed of optical photons and radio, microwave and extremely low frequencies [17,18].

Based on experimental evidence indicating the existence of bio electromagnetic fields, or "biofields," new biophysical models have been developed that view human existence as multidimensional. The models include one of several levels of nonmaterial "field organisms" that include the field-related aspects of our thoughts, emotions and intuitions [1,13,19-22].

Magnetic Fields

Magnetic fields are created either by materials that are magnetic or by the movement of charged particles. Life on Earth ultimately owes its existence to the sun, which has a very large and complex magnetic field that affects us in many unseen ways. The sun's magnetic field waxes and wanes over the course of each solar cycle, approximately every 11 years. When the sun develops a sunspot, its local magnetic field can be much greater than the sun's average magnetic field. Disruptions in the sun's magnetic fields near these active regions can produce energetic explosions, known as solar flares, and coronal mass ejections [23]. The solar wind, which is the stream of charged particles that flows outward from the sun, travels at an average speed of around 400 kilometers per second or 1 million miles per hour. The solar wind interacts with planetary magnetic fields in complex ways and during solar storms the solar wind speed can increase dramatically and cause disruptions in the earth's magnetic field [24].

Earth's geomagnetic field, also called the magnetosphere is the field that extends from the earth's interior to where it meets the solar wind. The Earth's magnetic field strength has been continuously measured since the mid-1830s. At the earth's surface, the strength of the field currently ranges from 25 to 65 microteslas (0.25 to 0.65 gauss) [25]. The earth's magnetic field has decreased in strength by about 10% over the last 150 years [26,27].

Heliobiology

Heliobiology is the branch of science that studies how solar and geomagnetic activity affects living organisms. Because our biological system is bathed in an environment of fluctuating invisible magnetic fields of a wide range of frequencies, virtually every cell and circuit in biological systems can be affected [13,28]. The majority of research in this field to date has focused on how magnetic field disturbances affect human and animal physiological health and, to a lesser degree, mental health and behavior [27,29]. Furthermore, in recent studies, links have been found from data from solar and geomagnetic field detectors compared with human brain waves and heart rate variability (HRV) show that human physiological rhythms and collective behaviors are synchronized with solar and geomagnetic activity [30-34].

Central Hypotheses

The following hypotheses guide our ongoing collaborative research:

1. *Human and animal health, cognitive functions, emotions and behavior are affected by solar activity and planetary geomagnetic fields.*
2. *The earth's magnetic fields can act as carriers of biologically relevant and patterned information.*

3. Each individual is connected to a global information field.
4. A large number of people creating heart-centered states of care, love and compassion will generate a more coherent field environment – and information –that can benefit others and help offset the current planetary wide discord and incoherence. This more coherent information can be encoded within the earth’s geomagnetic fields, which act as carrier waves of this physiologically patterned and relevant information.

Evidence suggests that, biologically patterned information can be communicated non locally between people at a subconscious level, via magnetic fields, including the Earth’s fields [20,35-37]. This is in effect linking all living systems and it influences collective consciousness [28]. Thus, we suggest that there is interconnection between all human beings and Earth’s energetic systems. Furthermore, we speculate that coherently aligned individuals who intentionally create physiologically coherent magnetic fields, are able to more effectively resonate with, and encode information in the planetary magnetic fields. This in turn can positively affect all living systems within the field environment and help increase collective consciousness [38].

Global Coherence Monitoring System

It is planned for a global network of 12 ultrasensitive magnetic field detectors to be installed strategically around the Earth. With help of these sensors’ interactions between solar activity and the earth’s geomagnetic field environment and human interconnectivity, health and behaviors can be further investigated. So far six Global Coherence Monitoring System (GCMS) sites have been installed. The sensors are located in the USA, Canada, New Zealand, Saudi Arabia, Lithuania, and South Africa, and the next one is planned to be installed in Colombia.



Figure 1: The monitoring site at the HeartMath Research Center in Boulder Creek, Calif., USA.

The GCMS system consists of a global network of highly sensitive calibrated induction coil magnetometers (Zonge ANT-4; sensitivity 10-12 T) designed to continuously measure magnetic signals in

the earth-ionosphere cavity in the range of ultra-low frequencies to extremely low frequencies (such as Schumann Resonances and other magnetic pulsations). The measured frequency range overlaps with the human physiological frequencies such as those of the human brain and cardiovascular systems. Furthermore, each monitoring site detects a relatively wide frequency range (0.01-300 hertz) of the local time-varying magnetic-field strengths, while maintaining a flat frequency response.

For the data acquisition, time and global positioning data is captured and transmitted to a common server. Each magnetometer is sampled at a rate of 130 hertz (130 times each second).

Most ground-based fluxgate and other types of magnetometers around the world that measure the strength of the earth’s magnetic field and geomagnetic disturbances as well as several space weather satellites, and are typically only sampled at hourly or one-minute intervals and cannot continuously measure the resonant frequencies occurring in the earth’s magnetic fields. The advantage of our GCMS network is the capacity to measure the resonant frequencies globally, and with a much higher sampling rate. This enables us to better understand how people and animals are affected by the rhythms and resonant frequencies in earth’s magnetic fields. Our data is freely available to other research groups who wish to explore how it may be utilized to study interconnectedness, solar and geomagnetic interactions, prediction of earthquakes and other events.

Earth’s Energetic Systems and Human Health and Behavior

First hypothesis: *Human and animal health, cognitive functions, emotions and behavior are affected by solar activity and planetary geomagnetic fields.*

Russian scientist Alexander Tchijevsky was the first to link more severe battles in World War I to peak sunspot periods [33]. Since then, numerous other scientists found a correlation on a larger societal scale with increased violence, crime rates, social unrest, revolutions and frequency of terrorist attacks to the solar cycle and the resulting disturbances in the geomagnetic field [30,33,39-43]. After the war, Tchijevsky conducted a thorough study of global human history. Figure 2, is reconstructed from Tchijevsky’s original data, and shows the number of significant human events that occurred compared to the solar cycle from 1749 to 1926 [33].

Importantly, solar activity has also been associated with the periods of greatest human flourishing, such as spurts of innovation and creativity in architecture, arts, science and periods of positive social change [44].

During periods of increased solar activity the sun emits increased ultraviolet (UV) energy and solar radio flux, which is measured by the 2.8 GHz signal (F10.7) radiated by the sun [45,46]. Although the physiological mechanisms in humans and animals are not yet fully understood, increases in these solar and magnetic energy influxes could be utilized as a source of energy for positive change

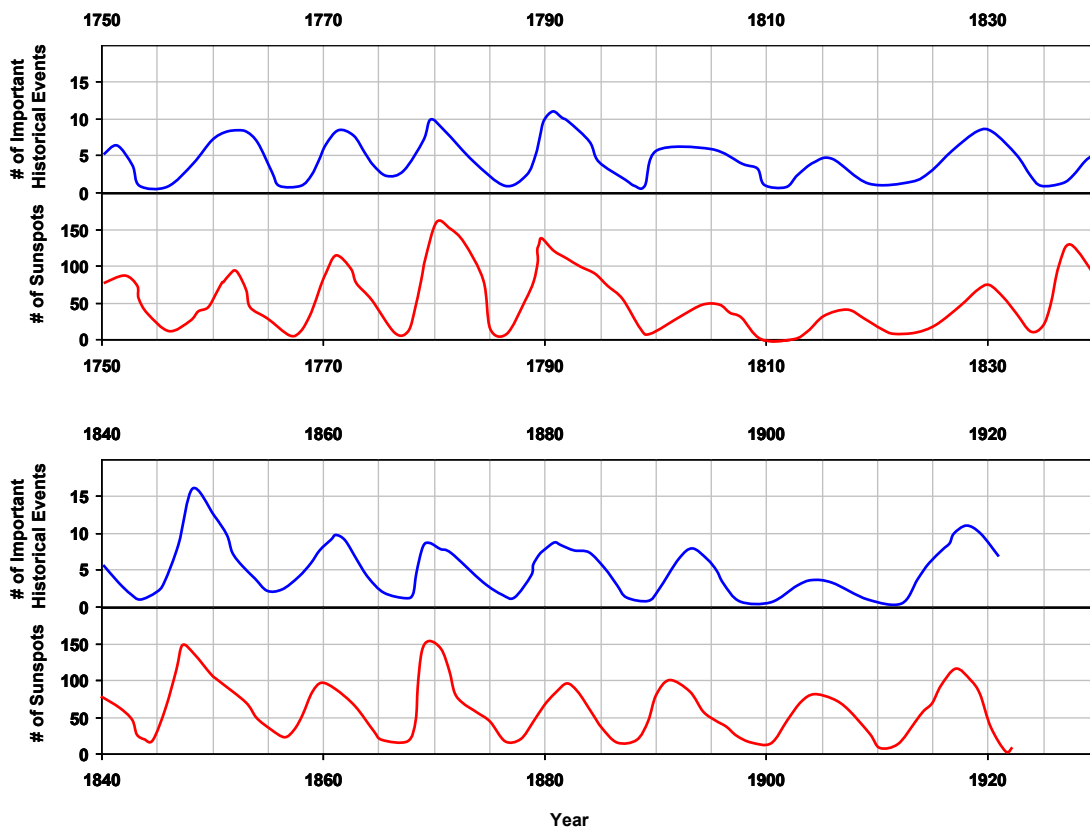


Figure 2: Tchijevsky’s original data. The blue line (top) plots the yearly number of important political and social events such as the start of a war, social revolutions, etc. The red line (bottom) plots solar activity, as indicated by the number of sunspots from 1749 to 1926. The histories of 72 countries were compiled, and it was found that 80% of the most significant events occurred during the solar maximum, which correlates with the highest periods of geomagnetic activity.

[34]. Disruptions in these fields can create adverse effects while other solar and magnetic indices are correlated with improved HRV and mental and emotional states. This likely is the result of a coupling between the human brain, cardiovascular and nervous systems and resonating geomagnetic frequencies such as Schumann resonances, Alfvén waves and other ultralow frequencies called field-line resonances that occur in the earth-ionosphere resonant cavity [28].

There is growing evidence suggesting that magnetic fields, in addition to serving as a protective shield, also help to synchronize, energize and non-locally interconnect living systems. The evidence suggests these fields act as carriers of biologically relevant and patterned information, which is embedded in the same field and is distributed to all other living system [35,37,47]. This implies that our attitudes, emotions and intentions are not limited to the space inside our bodies, but that they also can affect the mental and emotional states (consciousness) of others [48,49]. This broadens our view of what interconnectedness means and how coherent, cooperative intent can be intentionally utilized to shape the future of the world in which we live.

The Impact of Geomagnetic Disturbances

Many studies have indicated that disruptions in the geomagnetic field is associated with adverse effects on human health and

behavior [30,41,50-56]. For example, geomagnetic storms can alter the hormone balance of the body, such as the melatonin/serotonin balance [57-59]. These factors can affect many physiological functions, including blood pressure, breathing, immune system, reproductive, cardiac and neurological processes [34,60-63]. Geomagnetic disturbances are associated with significant increases in hospital admissions for depression, mental disorders, psychiatric issues, suicide attempts, homicides and traffic accidents [51,55,64-68]. Birthrates tend to drop, mortality rates increase and migraine attacks can be triggered during periods of increased solar and geomagnetic activity [69].

Disturbances in geomagnetic activity can exacerbate existing diseases and are correlated with significant increases in the incidence of myocardial infarction and death, cardiovascular disease and death in epileptics [7-78]. In addition, significant changes in blood pressure, blood flow, aggregation and coagulation, cardiac arrhythmia and heart rate variability (HRV) have been found [30,50,62,73,76,78-82].

It is noteworthy that a large number of studies have found significant associations between magnetic storms and decreased HRV, the measurement of beat-to-beat changes in heart rate [83], indicating a possible mechanism linking geomagnetic disturbance with increased incidents of coronary disease and myocardial infarction

[60,70,84,90]. Several studies that analyzed weeklong recordings found a ~25% reduction in the very-low-frequency (VLF) rhythm during magnetically disturbed days compared to quiet days. The low-frequency (LF) rhythms also were significantly reduced, but the high frequency (HF) rhythms were not [87,91]. Lower activity or power in the VLF rhythm is strongly associated with increased health risk while the vagally mediated HF rhythm is not as predictive, although lower activity in HF rhythm is associated with decreased capacity to self-regulate thoughts, emotions and behaviors [83].

In a literature review on health effects of geomagnetic disturbances, Palmer et al observed these “definite conclusions”: 1) Geomagnetic disturbances have a greater effect on humans at higher geomagnetic latitudes. 2) Unusually high values of geomagnetic activity have an effect on human cardiovascular health. 3) Unusually low values of geomagnetic activity seem to have an effect on human health. 4) Only 10% to 15% of people in areas studied are significantly affected by geomagnetic activity. 5) HRV is negatively correlated with geomagnetic disturbance [29].

In order to investigate the potential correlations between solar and magnetic factors and HRV during normal geomagnetic periods we undertook a collaborative study spanning a five-month period [92]. A total of 960 24-hour HRV recordings were obtained from a group of 16 women. HRV data was collected 24-hours per day, three consecutive days each week over a five-month period using ambulatory HRV recorders. The HRV measures assessed were the inter beat-interval (IBI), SDNN, RMSSD, total power, VLF, LF and HF power, and the LF/HF ratio. The solar activity and magnetic variables were solar wind speed, Kp and Ap index, PC(N), sunspot number, solar radio flux (F10.7), cosmic rays, Schumann resonance power and the ULF power (2mHz to 3.5 hertz). HRV measures were correlated with solar and geomagnetic variables after removing circadian influences from both datasets over a 40-hour period

after changes occurred in a given environmental variable. Overall, the study strongly confirmed that daily ANS activity responds to changes in geomagnetic and solar activity during undisturbed periods. The ANS responses are initiated at different times after the change in the various environmental factors and continue over different lengths of time. Solar wind was negatively correlated with IBIs indicating that heart rate increases with increases in solar wind, suggesting a physiological stress reaction occurred. However, increased cosmic rays, solar radio flux, and Schumann resonance power were all associated with increased HRV and increased parasympathetic activity, and the ANS responds quickly to changes in these environmental factors. These findings support the hypothesis that these energetic environmental factors act as energy sources that outplay in different ways depending on an individual’s health status and maturity level and capacity of self-regulation [92].

A Global Coherence Initiative study with 1,643 participants from 51 countries completed a survey with six scales (positive affect, well-being, anxiety, confusion, fatigue and physical symptoms), given at random times over a six-month period. A correlation was observed with changes in solar wind speed, Kp, and Ap and polar-cap magnetic activity. When the magnetic indices of disturbances in the geomagnetic field increased (Kp, Ap and PcN), positive affect and well-being among the participants decreased. When solar wind speed increased the levels of fatigue, anxiety and mental confusion increased. However, the solar radio flux index was positively correlated with reduced fatigue and improved positive affect, which indicate there are environmental factors that improve human well-being [93].

Interactions between Human Brains and Schumann Resonances

Schumann and Koenig were the first to measure frequencies that were consistent with a mathematical model that predicted an Earth-ionospheric resonance in the late-1950s [94]. The lowest

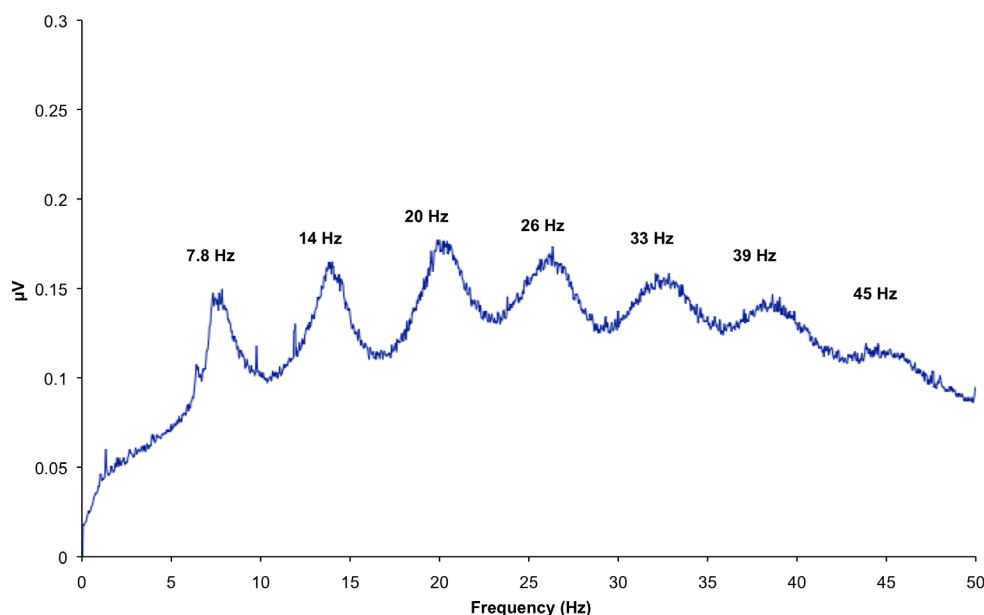


Figure 3: Schuman resonance data recorded from the GCI sensor site in Boulder Creek, California.

frequency Schumann resonances (SR), as they are now called, is approximately 7.83 hertz, with a daily (day/night) variation of about ± 0.5 hertz. The other frequencies are $\sim 14, 20, 26, 33, 39$ and 45 hertz. Figure 3 shows the frequencies of the SR, which are closely overlapping with alpha (8-12 hertz), beta (12-30 hertz) and gamma (30-100 hertz) brain waves. The similarity of the electrical components of the time-varying voltages produced by the brain (EEG) with the SRs was recognized early on, and the ability for the EEG rhythm to become synchronous with SR activity was observed by Koenig [95].

A study by Pobachenko et al. [96] compared the Schumann resonances and the EEG frequencies over a six-week period. During a daily cycle, individuals showed variations in the EEG similar to changes in the SR and the highest correlations between the brain rhythms and the SRs were during the periods of higher solar and magnetic activity. Michael Persinger and colleagues have extensively studied EEG activity and the Schumann resonances in real time. Their data suggests that a transfer of information takes place between the Earth's magnetic fields and human brains. Many of the SR frequencies can be clearly seen in the EEG profiles of most human brain activity [37,97] and the amplitudes of the electric and magnetic fields in human EEG activity are similar to those of the SR (1 to 2 picotesla). In addition, the spectral power within the profiles of men and women displayed repeated transient periods of coherence (synchronization) with the first three resonant frequencies of the SR (7 to 8 hertz, 13 to 14 hertz, and 19 to 20 hertz) in real time. Their data indicates that the maximum coherence with the SR takes place within the right hemisphere, near the temporal-parietal regions, which occur about every 30 seconds. This suggests that under certain conditions, interactive information processing can occur between human brains and the earth's magnetic fields and that variable affecting the Schumann parameters, such as solar wind, could affect brain activity, including modifications of cognition and dream-related memory consolidation [37].

Altered EEG rhythms in response to changing magnetic fields have been observed by Belov et al., with low-frequency magnetic oscillations (around 3 hertz) having a sedative effect [98].

Interactions between the Cardiovascular System and Field-line Resonances

There are a wide variety of magnetic waves occurring in Earth's magnetosphere that are excited by different processes inside the magnetosphere and by the solar wind. The occurrence of these magnetic waves depends on conditions in the solar wind and in the magnetosphere. Field-line resonances are the most common source of ultralow-frequency wave energy measured on the ground and exhibit the largest wave amplitudes compared to other waves occurring in the magnetosphere (Figures 4 and 5) [99]. The frequency of these oscillations depends on the length of the magnetic field line, field strength and the plasma density (number of charged ions) spinning around the field line. Waves in the frequency range below 1 hertz are classified with respect to their

waveform and frequency, where quasisinusoidal oscillations are called "Pc" (pulsation continuous) and oscillations with irregular waveforms are called "Pi" (pulsation irregular). Each major type is subdivided into frequency bands roughly corresponding to distinct phenomena. Standing field-line oscillations are associated with Pc3 to Pc5 waves corresponding to a frequency range between 1 mHz and 100 mHz. Oscillations classified as Pc1 and 2 are traveling waves, with frequencies up to 5 hertz, which are typically excited by geomagnetic substorms [100].

Plasma is the name given to highly ionized gases threaded by a magnetic field, and the ionosphere is a layer of plasma surrounding the earth. The charged particles in a plasma can gyrate and spiral around the magnetic field line and travel along it. This is the process involved in creating the auroras, as high-energy particles from the solar wind and ionosphere flow along the field lines to the earth's magnetic poles. Any force that moves the particles also moves the magnetic field and vice versa. This concept was first described by Hannes Alfvén to explain a process that creates low-frequency waves that propagate along a magnetic field line [101]. He received the Nobel Prize in 1970 for this discovery, and the wave he described is now called the Alfvén wave.

A standing wave in the magnetosphere implies that a lot of magnetic field lines with a combined length equivalent to several times the earth's radius is excited and oscillate similar to the plucking a guitar string. Longer field lines have lower resonant frequencies and shorter ones have higher resonant frequencies, similar to a guitar string that is depressed in different frets up and down the guitar neck. Field lines with more or heavier particles around them also will have lower frequencies. Changes in orientation and polarity of the interplanetary magnetic field or an increase in solar wind velocity can have dramatic effects on the waves as seen on Earth [102].

Studies have shown that an increase in magnetic field-line resonances can affect the human cardiovascular system because the Pc frequencies are in a comparable range with the rhythms of the cardiovascular and autonomic nervous systems (Figure 6) [103]. EEG patterns, heart rate, blood pressure and reaction times were measured in a group of people by Doronin et al. and compared with the low-frequency rhythms in geomagnetic activity [50]. The authors found that the oscillations in the Kp index had identical periods in the monitored EEG alpha rhythm, suggesting that whole-body changes occur in conjunction with geomagnetic activity by changing both heart and brain patterns.

Experiments were conducted by Zenchenko et al. in Russia that monitored heart rate at rest in healthy individuals in comparison with variations in the lower-frequency components (0.5 to 3.0 mHz) of the geomagnetic field. They found that two-thirds of the experiments revealed synchronization between rhythms in heart rate and the ultralow-frequency components of the geomagnetic field over periods of 4 to 30 minutes [104].

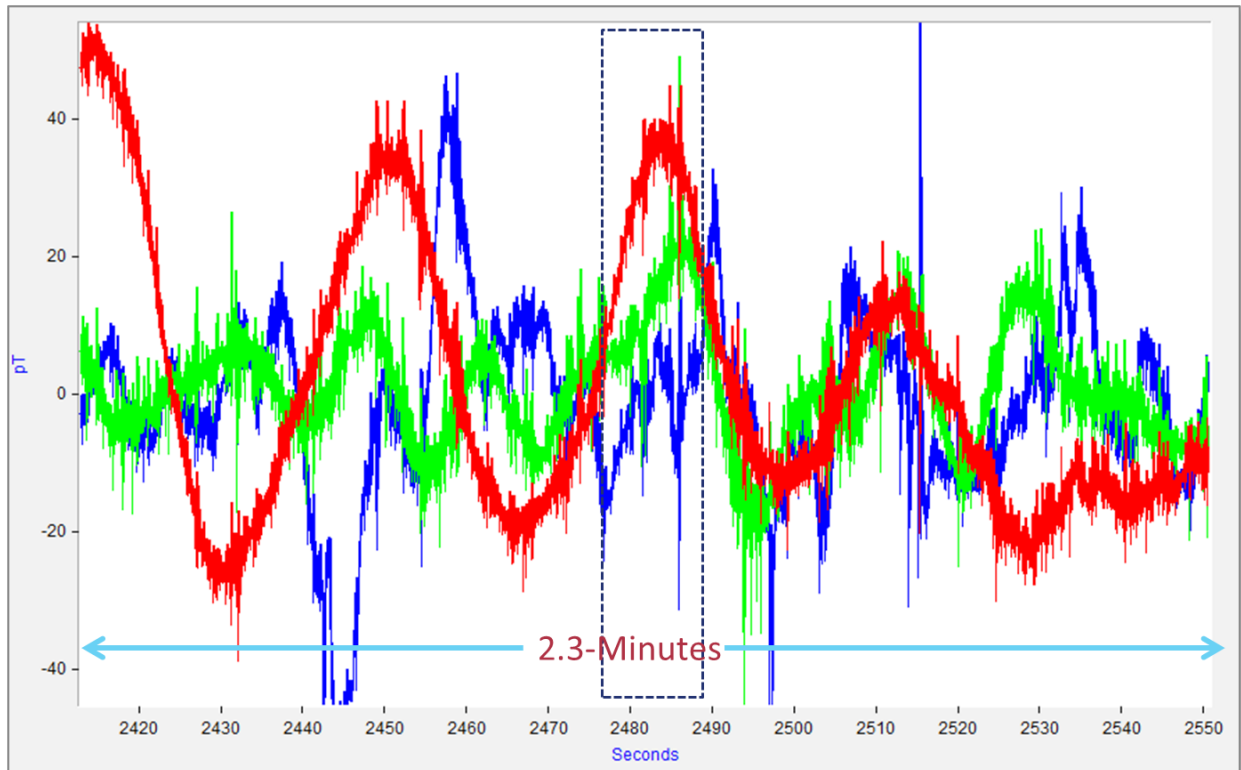


Figure 4: Shows the ultralow frequency field-line resonance magnetic waves recorded from the north-south channels at the GCMS sites in California (Blue), New Zealand (Green) and Canada (Red) on Feb 28th, 2015 at 1:00 UTC. The Y axis is picoteslas and X axis is time in seconds. The higher frequency Schumann Resonances can be seen riding on the low frequency waves. The box with dotted lines shows the time segment for the Schumann Resonance waves shown in Figure 5.

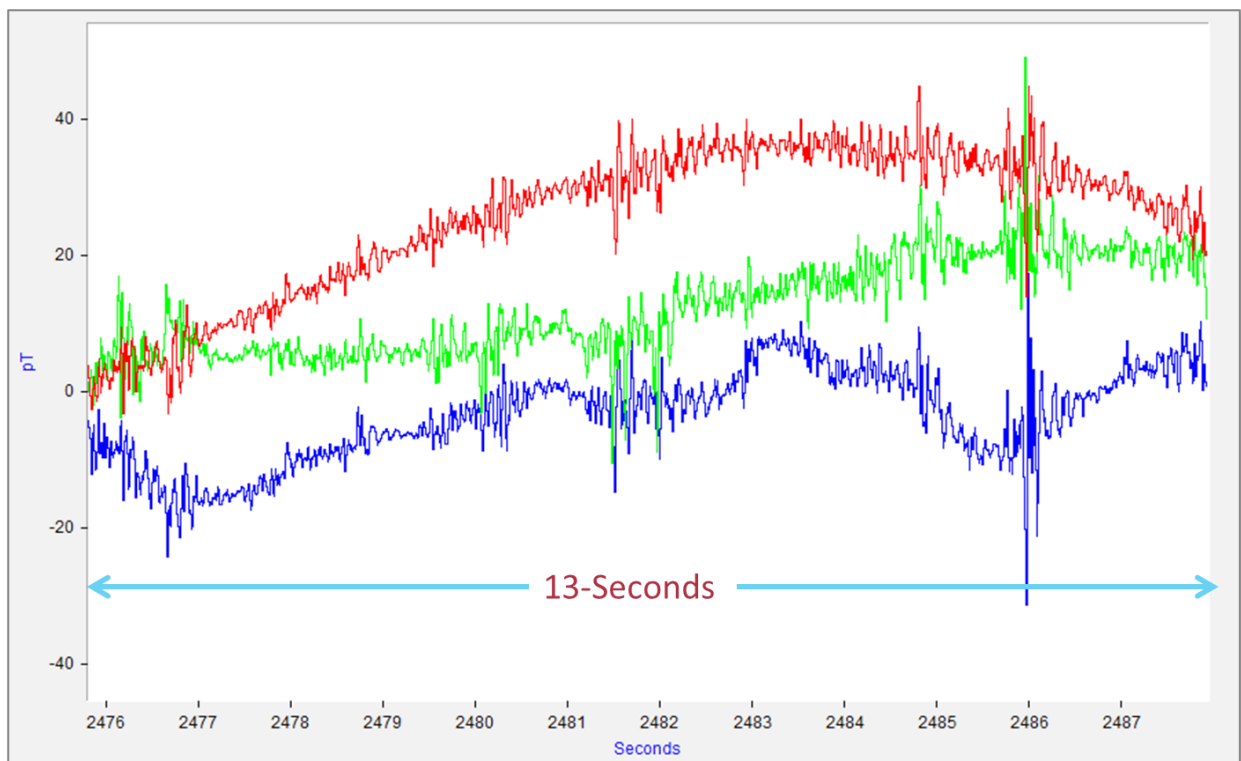


Figure 5: Shows the Schumann Resonances magnetic waves recorded from the north/south channels at the GCMS sites in California (Blue), New Zealand (Green) and Canada (Red) during period shown by the box with dotted lines in Figure 4. The Y axis is picoteslas and X axis is time in seconds.

**July 5, 2009 5 AM - 6 AM UTC
(5 minute Average PSD)**

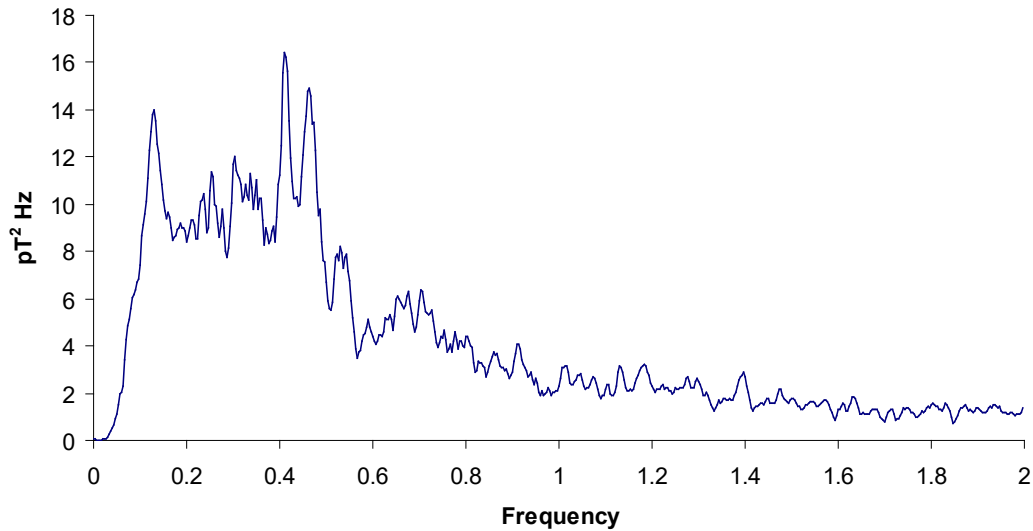


Figure 6: Geomagnetic field-line resonance data recorded from the GCMS site in Boulder Creek, Calif. Note that all the resonant frequencies directly overlap human cardiovascular system frequencies and there is a clear standing wave frequency at 0.1 hertz, which is the same resonant frequency of the cardiovascular systems and thus coherent heart rhythms in humans and many animals.

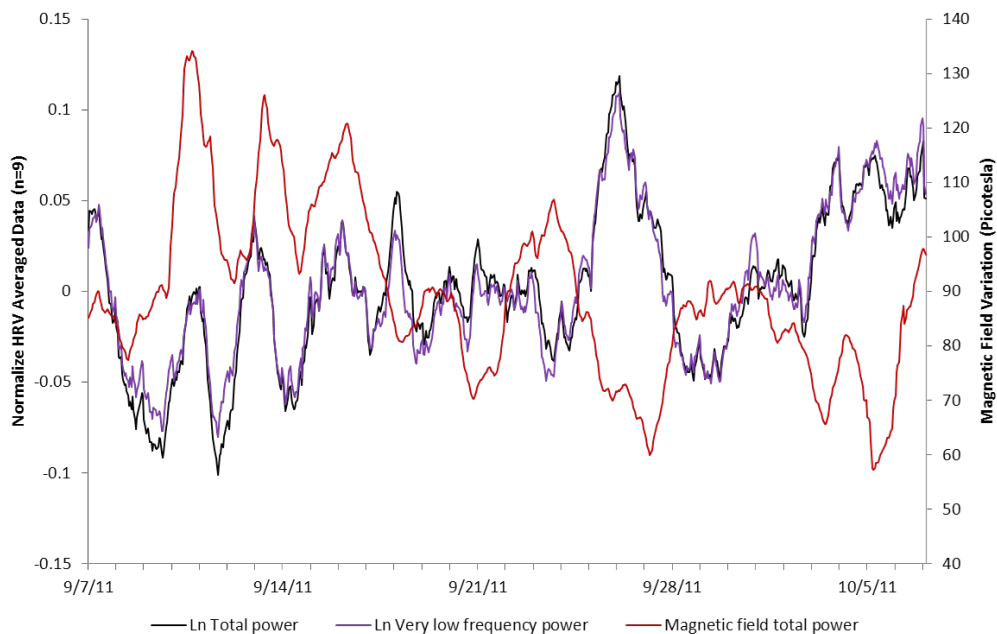


Figure 7: Shows the averaged time-synchronized HRV data from participants located in separate locations across California over a 30-day period. The rhythms for the HRV total and very-low-frequency power and the time-varying magnetic-field-strength power (red) are shown for the 30-day period.

A study conducted in India demonstrated that Pc frequencies can affect humans and animals [105]. The subjects experienced uneasiness, confusion, restlessness and a lack of sense of well-being when subjected to the simulated pulsating fields, and some complained of headaches [105].

In a study we conducted with participants in the USA (California), continuous ambulatory HRV recordings were carried out for 30

consecutive days. The study confirmed that autonomic nervous system activity was correlated with solar and geomagnetic influences [31].

However, the study yielded some surprising and unexpected results, which emerged after time synchronizing and normalizing and removing all circadian rhythms from the HRV time series data. We found that participants' HRV rhythms synchronized with each other across much of the 30-day period even though the

participants simply went about their days normally and were in widely separate locations across the state of California (Figure 7).

This suggested that the participants were synchronizing to an external signal, and a significant correlation was found between the group's HRV indices and the measures of the earth's time-varying magnetic-field.

To follow up and confirm these surprising findings, an international study with 104 participants in five countries was conducted. The preliminary findings have confirmed and extended the results of the first study and they indicate human's heart rhythms are also synchronized on a global scale. In other words, we are synchronized not only with each other, but also with the earth's energetic (geomagnetic) systems.

As discussed above, it is well established that the earth and ionosphere generate a symphony of resonant frequencies that directly overlap with those of the human brain, cardiovascular and autonomic nervous systems and that of all the bodily systems studied thus far, changes in geomagnetic conditions appear to most strongly affect the rhythms of the heart and the brain [58,63,67,70,96,106-108].

The evidence that human health, cognitive functions, emotions and behaviors are affected by solar activity and planetary magnetic fields is quite strong and convincing. The data suggests that changes in the resonances in Earth's magnetic field environment can influence the function of the human autonomic nervous system, brain and cardiovascular system.

Interconnectivity Between Living Systems: The Role of Earth's Magnetic Fields

Magnetic Fields Carry Biologically Relevant Information

The second hypotheses states: *The earth's magnetic fields are carriers of biologically relevant information that connects all living systems.*

The first bio magnetic signal was demonstrated in 1863 by Gerhard Baule and Richard McFee in a magneto cardiogram (MCG) that used magnetic induction coils to detect the fields generated by the human heart outside of the body [109]. A remarkable increase in the sensitivity of bio magnetic measurements was achieved with the introduction of the Superconducting Quantum Interference Device (SQUID) in the early 1970s [110].

Of all the organs, the heart generates the largest rhythmic electromagnetic field, one that is approximately 100 times stronger than that produced by the brain. This field is measured in the nanotesla ranges and can be detected several feet from the body [111]. We have found that the rhythmic patterns in beat-to-beat heart rate variability reflect emotional states 1,2 and thus encode and transmit biologically relevant information patterns via the electromagnetic field radiated into the environment (Figure 8) [49].

The heart generates a series of electromagnetic pulses in which the time interval between each beat varies in a complex manner. These pulsing waves of electromagnetic energy give rise to interference patterns when they interact with magnetically polarizable tissues and substances [1].

We have shown in our laboratory that the heart's electromagnetic field can be detected by nearby animals or the nervous systems of other people and can mediate several types of physiological synchronization between individuals [49,112,113]. These findings have been confirmed by a number of other investigators. For example, in a study on interpersonal effects of nonverbal compassionate communication in which physiological effects were measured, Kemper and Shaltout found significant changes in the receiver's autonomic nervous system [114].

Russek and Schwartz found that cardiac energy and information exchange can occur between individuals and that the degree of physiological synchronization between pairs was greater in people who reported being raised in a loving environment. They showed that the EEGs of one person could synchronize to another person's heartbeats (ECG) who was sitting across from the person at a table. They found that participants who rated themselves 40 years before the study as having been raised by loving parents had significantly more synchronization between the pairs than those that reported not being raised in a loving environment [115].

Although there are too many studies showing physiological synchronization to discuss here, one other interesting study that examined physiological synchronization was conducted during a Spanish fire-walking ritual that looked at synchronized cardiac activity between fire-walkers and spectators [116]. It found a high degree of synchronized activity during a 30-minute ritual between the fire-walkers and related spectators, but not in spectators who were unrelated and did not have an emotional connection with the firewalkers. The study concluded that the mediating mechanism must be informational.

We have found that when individuals are in a state of heart coherence, the heart radiates a more coherent electromagnetic signal into the environment and they are more sensitive to detecting the information in the fields radiated by others [49,112]. The magnetic field generated by the heart provides a plausible mechanism for how we can "feel" or sense another person's presence and emotional state independent of body language or other factors [113].

There is a direct relationship between the heart-rhythm patterns in the HRV waveforms and the spectral information encoded in the frequency spectra of the magnetic field radiated by the heart (Figure 8). Thus, information about a person's emotional state is encoded in the heart's magnetic field, and this information is communicated throughout the body and radiated out into the external environment [49].

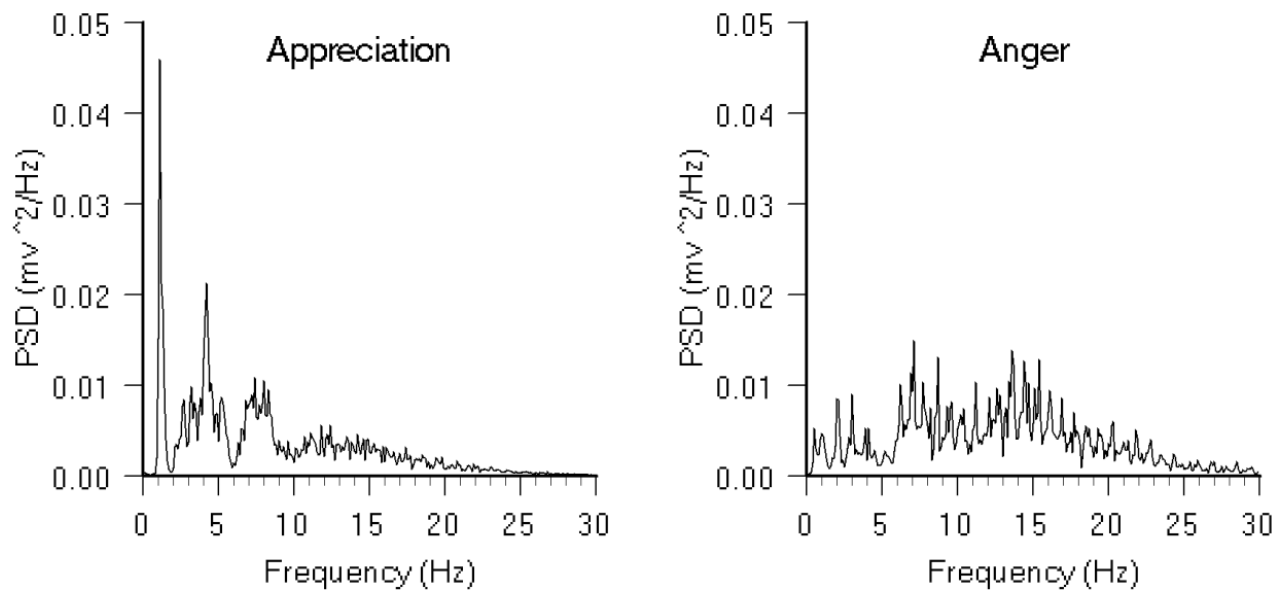


Figure 8: ECG spectra during different emotional states. The above graphs show the average power spectra of 12 individual 10-second epochs of ECG data, which reflect information patterns contained in the electromagnetic field radiated by the heart. The graph on the left is an example of a spectrum obtained during a period of high heart-rhythm coherence generated during a sustained heartfelt experience of appreciation. The graph on the right depicts a spectrum associated with a disordered heart rhythm generated during feelings of anger.

A good analogy for this is how cellphones work. In this example, we routinely encode information (our voice, text message, etc.) into an electromagnetic field that can carry the information across great distances.

The ability of electromagnetic fields to induce long-range organization in living systems has been proposed by a number of researchers [117-123]. Additionally, it has been suggested electromagnetic fields are responsible for the self-organization of entire ecosystems [124]. Giorgio Piccardi was one of the first to show that environmental electromagnetic fields could affect chemical reactions, both by direct contact and at a distance. Furthermore, Piccardi suggests that phenomena can be caused at distance, in solar and astrophysical space, due to radiation, and electromagnetics [125].

Larissa Brizhika and Emilio Del Giudice, professors of theoretical physics and who received the prestigious Prigogine award for their research on ecological systems, state:

“The electromagnetic field acts as a messenger able to involve simultaneously a large number of molecular components, affecting therefore a macroscopic being; electromagnetic fields interact with all the molecules present within its own wavelength. Moreover, liquid water, which accounts for the huge majority of molecular components of living organisms, should play an essential role in this process, as realized by Piccardi. It has been shown that biological dynamics works only when water exceeds a threshold” [126].

Brizhika and Del Giudice suggested that the magnetic vector potential could be the physical agent acting as messenger in

coherent structures, such as living systems, that provides a continuous exchange of information between living systems within the larger ecosystem. They suggest that magnetic potential provides the mechanism for the establishment of the coherence, complexity, non locality and self-consistency of living systems and ecosystems [13,124].

“The messengers should be the electromagnetic fields produced by all the coherent parts of the organism. We recall that a coherent system is one where the phase (namely the rhythm of oscillation of the coupled matter and electromagnetic field) is sharply defined. Here we generalize this approach to a larger scale and show that according to quantum field theory, the electromagnetic field is the messenger that, via its electromagnetic potential, governs the dynamics of not only individuals, but of the whole ecosystem to which the individuals belong.” This generalization is based on the fact that the field causes the emergence of the coherent structures, which, in view of their coherence, openness and nonlinearity, are able to self-organize and form a chain of hierarchical levels of ecosystems.” [124].

Support for the hypothesis that magnetic fields are carriers of biologically relevant information has also been provided by studies conducted by Luc Montagnier, who was awarded the Nobel Prize for physiology or medicine in 2008 for his discovery of HIV [127,128]. He and his co-researchers discovered that epigenetic information related to DNA could be detected as electromagnetic signals radiated from solutions containing DNA. They demonstrated that this information could be transferred to and instruct the re-creation of DNA in a remote test tube of water containing the appropriate basic constituents of DNA by electromagnetic frequency fields of 7.8 hertz, which is, of course,

the first Schumann resonance frequency. They showed that the presence of the magnetic field was critical for the information transfer to occur between the test tubes [128]. Furthermore, the authors suggest that the electromagnetic fields that transfer DNA information could be provided from natural sources such as Schuman resonances.

Persinger has conducted numerous studies examining the effects of magnetic fields, with the same magnitude as the geomagnetic field, on brain functions and information transfer [37,97]. He too suggests that the earth's magnetic field can act as a carrier of information between individuals' neural networks [36].

Global Information Field

Third hypothesis: *We each affect the global information field.* As an extension to the hypothesis above, we suggest that we not only are receivers of biologically relevant information, but additionally, we can feed information into a "global field environment."

Here we discuss studies and theories supporting the suggestion that bio electromagnetic fields such as the ones radiated by human hearts and brains can affect other individuals and potentially couple to a type of "global information field." Note that the studies discussed in the previous section support the first part of this statement, namely bio electromagnetic fields such as those radiated by human hearts and brains can affect other individuals.

The concept of a noosphere was introduced by Vladimir Vernadsky, [129] founder of the National Academy of Sciences of Ukraine, although credit for coining the term noosphere is often given to Pierre Teilhard de Chardin, a French philosopher, paleontologist and geologist [130]. He viewed the noosphere as the third evolutionary step of Earth, after the geosphere (rocks, water, atmosphere, etc.) and the biosphere (biological life). Teilhard perceived a continuous growth and increasing complexity in the evolution of consciousness that expands in space and time. For him, the noosphere is a sphere of thought and spiritual energy encircling the earth where interaction between human minds occurs and embraces the social domain and evolution of our legal, educational, religious and technological systems. The noosphere evolves in steps with the mass consciousness of the human population, and Teilhard believed consciousness could expand beyond the earth and out into the universe. His focus was to "connect the two energies of the body and the soul in a coherent manner." He believed love was the principal driver of what he called "noogenesis" and that evolution would reach an omega point: an apex of thought and consciousness.

Coherent with Teilhard's concept of the noosphere is "morphic resonance," a term coined by Rupert Sheldrake who defined it as a type of interconnection between all similar organisms across time and space [131]. Sheldrake's morphogenic field theory states that once a member of a group that shares the same biological structure acquires a new skill, the same skill can be acquired more quickly by other members of the group in successive order [132]. He states that our minds extend into time and space and that members of

social groups are linked together through an invisible field even when they are far away [131].

The concept of global information field embedded within the earth and other universal magnetic fields and its correlates to human conscious process also has deep roots in Islamic faith and other Abrahamic Religions. The preserved Board in Islam is considered as the endless mega hard disk where all life information and events are encoded since the beginning of the creature until the end of all life.

There is indeed evidence to suggest an energetic field connection is formed among individuals in groups through which communication among all the group members can occur simultaneously. In other words, there may well be a "group field" that connects all the members [2].

Bradley and Pribram, developed a theory of social communication to explain the patterns of social organization common to most groups, independent of size, culture, degree of formal organization, length of existence or member characteristics [133]. They found that most groups have a coherent network of energetic connections that link virtually all members into a single multilevel hierarchy. The model that best fits the data was one based on a field concept in which information about the group as a whole was distributed to all members in such a way that information about the group's global organization could be obtained from any member within the field – a type of collective consciousness referred to as "social hologram" [133].

Ervin László, a Hungarian philosopher of science and systems theorist suggests that a field of information is the substance of the cosmos. Using the Sanskrit term for "space," akasha, he calls this information field the "akashic field" or "A-field." [134] He suggests that the "quantum vacuum" is the fundamental energy and information-carrying field similar to that of Brizhika, and Del Giudice. László asserts that consciousness is generated not only by human brains, but by all living organisms, which are interconnected by a field similar to the global information field we have suggested. Furthermore, he states, there is mounting evidence that consciousness is not confined to the brain, but rather is "nonlocal," embracing minds and events beyond the brain and the body [135]. Many other well-known and respected physicists have made similar suggestions [15,136-138].

As discussed in the sections above, Saroka and Persinger point out the similarities of basic frequencies, harmonics, magnetic field intensities, voltages, and bandwidths of the Schumann resonances (SR) and human brains, which suggest the capacity for direct interaction and resonant coupling between them [139]. They suggest that dynamics in the magnetosphere that affect the SR stability and amplitudes might be reflected in human brain activity, including as modifications of cognition and dream-related memory consolidation [139].

In a recent experiment, pairs of individuals separated by more than 6,000 km exhibited a significantly increased correlation in EEG activity primarily between the right hemispheres of the

pairs of participants [140,141]. In addition, the pairs' subjective experiences, as measured by the Profile of Mood States indicated significantly increased excess correlation for scales reflecting anger and vigor.

Not only has Persinger shown that applying external fields similar to the SRs can induce altered states of consciousness, he also published a detailed theory of how the geomagnetic field can store information related to brain activity and this information can be accessed by other human brains [35].

Saroka and Persinger recently suggested that the number of people asleep may affect the activity in the Schumann resonance values in the 12- to 14-hertz range (second harmonic) with peak-to-peak changes of ~0.1 hertz and 0.1 pT in the SR. They found that after potential artifacts were removed and as the number of people sleeping increased, the frequency within the 12- to 14-hertz range increased while the intensity decreased by about 1 pT [142].

Collective Effects on the Global Field Environment

Our fourth hypothesis states: *Large numbers of people creating heart-centered states of care, love and compassion will generate a more coherent field environment that can benefit others and help offset the current planetary wide discord and incoherence.*

There is experimental evidence that human bio-emotional energy can have a subtle, but significant (scientifically measurable) nonlocal effect on people, events and organic matter [47,143-147]. For example, Steve Morris, studied the effect of heart coherence in a group setting with people trained in maintaining states of heart coherence for several minutes and found that they could promote an increase in the coherence of untrained participants, who were unaware of the experiment's goal [48].

There is evidence to indicate interactions occur between human emotions and a global field when large numbers of people have similar emotional responses to events such as organized global peace meditations. A study conducted in 1993 in Washington, D.C., showed a 25% drop in crime rate when 2,500 people mediated over specific periods of time [148]. Indicating that a relatively small group was able to influence a much larger group. A similar experiment was done during the peak of the 1982-85 war between Israel and Lebanon to see if a group of meditators could reduce social conflicts and wars. Drs. Charles Alexander and John Davies at Harvard University organized groups of experienced meditators in Jerusalem, Yugoslavia and the United States to mediate and focus their attention on Israel and Lebanon at various intervals over a 27-month period. After controlling for weather changes, Lebanese, Muslim, Christian and Jewish holidays, police activity, fluctuation in group sizes and other potential influences during the course of the study, the levels of violence in Lebanon decreased 40% to 80% each time a group meditated, with the largest reductions occurring when the number of meditators was largest. During these periods, the average number of people killed during the war per day dropped from 12 to 3, a decrease of more than 70%. War-related injuries fell by 68% and the intensity level of conflict decreased by 48% [149,150].

The Global Consciousness Project

Further evidence that there is an interconnecting field linking collective consciousness and human emotionality has been provided by Professor Roger Nelson, chief scientist of the Global Consciousness Project (GCP). GCP maintains a worldwide network of random number generators (RNGs) and the results suggest events that evoke mass human emotionality affect the randomness of these electronic devices in a globally correlated manner. According to Nelson:

"The GCP is a long-term experiment that asks fundamental questions about human consciousness. It provides evidence for effects of synchronized collective attention – operationally defined global consciousness – on a world-spanning network of physical devices. There are multiple indicators of anomalous data structure, which are correlated specifically with moments of importance to humans. The findings suggest that some aspect of consciousness may directly create effects in the material world. This is a provocative notion, but it is the most viable of several alternative explanations" [145].

Nelson has found clear evidence that large events, defined by the number of people engaged and their level of emotional "importance," can produce larger effects on the global network than smaller events and numbers of people.

One interesting finding in his research is that there is a significant correlation between global events that elicit a high level of emotionality from a large part of the world's population and periods of nonrandom order generated by the RNGs [151]. For example, multiple independent analyses of the network during the World Trade Center terrorist attacks on the morning of Sept. 11, 2001 (Figure 9), correlate with a large and significant shift in the output of the global network of RNGs [47].

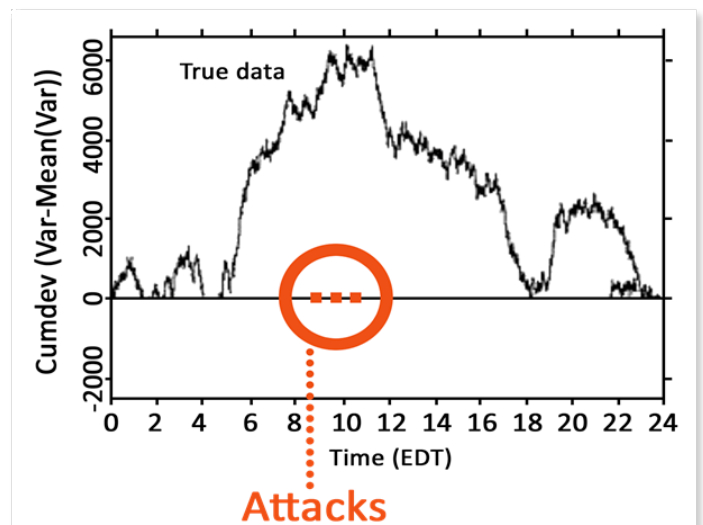


Figure 9: Evidence of collective intuition: Correlated random-number-generator data from the Global Consciousness Project network before, during and after the 9/11/01 terrorist attacks on the World Trade Center.

Although the mechanisms for how human emotions create more coherence in the randomness of this global network are not yet understood, the data clearly shows that such effects are real with an odds-against-chance ratio of over a 1 billion to 1.47. When an event is characterized by deep and widespread compassion, the GCP effects are stronger, [145] which could be explained because compassion is related to interconnection and positive emotional engagement.

When we experience true feelings of compassion, we tend to shift into a more coherent physiological state [1] and are thus radiating more coherent cardiac-related magnetic waves into the environment [112]. Compassion is an emotional state that brings us together and makes us coherent; we invest a small part of our individual being to connect with others and, as the GCP data indicate, with the global field environment.

A study that examined GCP data from 1998 to 2008 matched satellite-based interplanetary magnetic field (IMF) polarity with GCP-defined world events such as meditations, celebrations, natural catastrophes and violence. The results suggested that RNG deviations may depend on a positive interplanetary magnetic field polarity coinciding with emotionally significant conditions [152]. Interestingly, a study of terrorist attacks between the years of 1994 and 2008 found that geomagnetic activity increased significantly both on the day and day after the attacks [40].

The GCP group has investigated a number of theoretical models that could potentially explain the global effect they are detecting with the network. In summary, here is an excerpt from the study's analysis:

“Finally, a nonlinear dynamic field model proposes that individual minds are mutually interactive, and that the interactions are responsible for an emergent field which depends on individual consciousness but is not reducible to it. The model implies that the dynamic and interactive qualities of consciousness also involve subtle interactions with the physical world and that these are responsible for certain anomalous phenomena such as are found in the GCP experiment” [145] (p12).

Global Coherence

If living systems are indeed interconnected and communicate with each other via biological and electromagnetic fields, it stands to reason that humans can work together in co-creative relationships to consciously increase the coherence in the global field environment, which in turn distributes this information to all living systems within the field. Of course, the idea is not new that shared intentions can influence others at a distance. Such ideas have been the subject of numerous studies that have looked at the effects of prayer, meditations and groups sending intentions in various experimental contexts [146,153-155].

How can we have such an influence on each other at a distance? There are no clear answers yet, but we hypothesize that a feedback loop exists among all human beings and the earth's energetic

systems. Our basic hypothesis is that when enough individuals and social groups increase their collective coherence, a more coherent standing reference wave is created and amplified in the global field environment that will help lift individual, social and global consciousness. In time, as more individuals stabilize the global field and families, workplaces and communities move to increased social coherence, it will lead to increased global coherence.

Global coherence will greatly accelerate cooperation, collaboration, innovative problem-solving and intuitive discernment for addressing society's significant social, environmental and economic problems. This will become increasingly apparent as countries adopt a more coherent and inclusive planetary view. This planetary view will be critical for meaningfully and successfully addressing social and economic oppression, wars, cultural intolerance, crime and disregard for the environment.

The human heart has been conceived of throughout time and across Western and Eastern traditions as the primary organ with energetic connections to our spiritual nature and the hub of perception and sacred awareness. In ancient medical classics from Babylon, China, Egypt, Greece, Rome and Islamic civilizations, it is described as the center of a system supplying life force to the body and as the seat of consciousness and intuition [156,157]. Interestingly, rigorous studies have suggested that the heart is indeed involved in intuitive perception of non-local information [158-161]. The Heart Based Resonant Fields (HBRF) Theory of Consciousness, places the human heart at the center of human higher levels of awareness and consciousness experience and its connections with planetary and cosmic energetic fields, which is nested within [162,163]. The electromagnetic field of the universal systems and its associated potential patterns is the information carrier that orchestrate in a highly delicate manner with the human heart. This ultimately means that our emotions and consciousness are truly pulsating and resonate within the universe in a highly organized hierarchical manner.

Conclusions

This review suggests that every individual contributes to the global field environment, and each person's attitudes, intentions and emotional experiences count. This is empowering for many individuals who often feel overwhelmed by current conflicts on the planet and negative predictions about the future. This helps them realize that their actions can make a difference and that by increasing their own coherence, they can become “coherence builders” and contribute to the shift that many now perceive to be occurring. The human heart is of central role in the bio-energetic communications as well as in the human conscious experience.

The personal benefits of greater emotion self-regulation and self-responsibility enhanced well-being and improved health and relationships are powerful motivators that reinforce the individual's efforts to achieve the greater planetary good. As more and more individuals become increasingly self-regulated and grow in conscious awareness, their increased individual coherence in

turn increases social coherence, which is reflected in increased cooperation and effective co-creative initiatives for the benefit of society and the planet.

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