

Observations of Environmental Interactions with the Human Organism

by

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Abstract

The recording and diffusion of ideas provides future generations of humanity the opportunity to further the advancement of understanding. This dissertation will begin the investigation of understanding ‘What influences of the Earth’s environment exist on human behaviour?’ The phenomena comprising the thesis involve the human organism, environmental stimuli, and societal customs.

This investigation will consider the large degrees of variability due to the large number of interactions within the defined local environmental system. Review of research literature has introduced opportunity for identifying current limitations of the knowledge acquired. Novel interdisciplinary research is presented, including the relationship between the sun and earth, the ability correctly identify the human organism from background photon measurements, effects of population density on disease incidence, and the corresponding relationship between the sun-earth interactions and the global behaviour of the human organism.

The presented research accounts for the large degrees of variability between humans by utilizing global, big data analysis. The implications propose future health and well being awareness on a planetary scale.

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Chapter 1 - Introduction

1.0 General Introduction

The initial interdisciplinary question is: ‘What influences of the Earth’s environment exist on human behaviour?’ The key phenomena involved are the human brain, environmental stimuli, and societal customs. Subsidiary phenomena also include emotion and the physical processing of information within the brain. The integration of different brain regions via chemical, photo, and electromagnetic interactions produce the constructs of consciousness. Information from the external environment, interact with the human body creating signals of neuronal information. These signals are bound within the brain, and together create a theatrical sense of what we perceive as reality. The result of the binding is commonly known as our conscious reflection. This interdisciplinary action of the brain unifies our subjective perceptions of the external world. The time required for these signals of sensory information to be unified into a constitution of consciousness would imply that we perceive only what has already happened. The inherent binding of sensory information within the brain reflects the interdisciplinary nature of the integrated knowledge my research topic will investigate.

This interdisciplinary approach will synthesize the disciplines of psychology, sociology, behavioural neuroscience, and physics (both geophysics and astrophysics). Key terms that are operationally well defined within each discipline will be drawn upon to provide a relevant understanding of the human perception of reality. The role the environment plays to influence the human being will be made from a variety of observations. The proposed research will seek to advance the knowledge and understanding of which subjective behaviour plays within the human experience of reality.

To enhance the original question, a more comprehensive approach should also include the phenomenology of mind. This approach will rely upon the study of perceptual structures and experiences of the mind. Understanding the integrations of neuronal structures will also include a further literature reviews concerning emotional and behavioural actions. It is from the observable behaviour actions that inferences can be made on the influences of the Earth's environment. Current review of the literature provides insight into the interdisciplinarity nature of research concerning human-environment interaction and neuroscience. A historical aspect must also be accompanied to gain an understanding of the progression of the sub-disciplines towards a complete interdisciplinary synthesis.

Vital to the dissemination of interdisciplinary conduct, communication of the results will include peer-reviewed journal publications, conference presentation and thesis dissemination. Encompassing the interdisciplinary approach is epistemology, adding philosophical theory of how we know what we know. This accompaniment will help to define the domains of reason and human experience.

The particular theories to the research question above include Cartesian Dualism, Phenomenal experiences, and introspection or how knowledge is acquired. Although philosophical credit is given to the literatures of the phenomena above, few research investigations have indulged the temporal components of consciousness, while holding account influential environmental variables. As recognized by Cartesian Dualism, the philosophy of mind must posit the belief that the body is distinctly separate from the mind. Thus incorporating Descartes' (1637) view, the research investigation is an interdisciplinary approach to the dynamics of both the mind and body.

The synthesis of the literatures of physics, psychology, and neuroscience will provide a step towards an agreeable definition of the role the Earth's environment plays within the human experience. A structured layout will incorporate the highlights of each of the four disciplines. Disciplines such as the brain and neuroscience, from which this research topic incorporates, are comprised of sub-disciplines including quantitative physical measurements of the brain, mathematics, and psychological underpinnings. From the neuroscience discipline, a focus on the quantitative electroencephalographic measures and analysis techniques will provide an insight into the relations of visual stimuli and the internal processes within the human brain. From the psychology discipline, a focus on the behavioural valence of daily global proportions will provide a level of understanding which external factors influence the individual. From the physics discipline, a focus on the fundamental laws of space and time will provide the necessary structure from which the interactions occur. Emotional stimuli and the perception of reality within the human brain, especially pertaining to the Earth and local Solar System, can be then drawn upon.

The question of investigation will therefore include an approach that utilizes an understanding of physics and entropy (or information). Drawing from the physical discipline will provide insight into the sensitivity of incoming sensory information messages from the external world to the internal human brain. Few research investigations have indulged the physical nature of 'time' and the 'predictive' components of consciousness. A common analogy would be to consider the time it takes light to travel from distant stars into our eye for perception. The distance of travel is so large, that many years have passed by the time the light reaches Earth. This physical truth implies that even the local reality we perceive, has already happened.

To investigate such perceptions that include the theory of mind, a comprehensive approach must therefore include the study of perceptual structures, physical experiences, and physical characteristics of the emotional brain. Integration of laws of thermodynamics will prescribe that with a defined act of consciousness, a quantitative value of entropy (information) can be assumed to have been conducted. The research investigation will then provide a succinct and thorough quantification of emotional intuition, which would otherwise be unattainable within a single discipline alone.

The relevant theories and concepts that will assist the interdisciplinary research include Epistemology. This concept will include investigating the sensory communications of information from the environment to the body and then to the brain. The tenants of perceived experience, the role of mental and mood state of society at large, and the physical laws of nature will also be included.

Testimony given by Welch, Schindler & Henry (2003) within their Delphi study states that an understanding of the 'philosophy of interdisciplinarian' should be required of a graduate student in interdisciplinary studies. Incorporating the literatures of neuroscience, psychology, sociology, and physics to investigate 'What influences of the Earth's environment exist on human behaviour, disease, and perspectives of reality?', will benefit from an interdisciplinary approach. Conducting such an investigation within any one of the single disciplines presents limitations on the philosophical exercise.

1.1 The Advancement of Understanding

The curiosity of understanding is necessitated by the acquisition and expansion of knowledge, creativity, and the dissemination of ideas. The perceived ability to explore the domain of reality remains largely unexplained. The recording and diffusion of ideas provides future generations of humanity with the meaningful opportunity to further the advancement of understanding. This major component will serve to begin the investigation of understanding ‘What influences of the Earth’s environment exist on human behaviour, disease, and perspectives of reality?’

The process of advancing such an understanding is complex and not easily obtained. Large degrees of variability exist due to the large number of interactions within the universal system. This implies a large variability of opinions are also possible. For example, we know it takes time for a sensory signal to travel from the extremities of the body (Ahrens & Sahani, 2011), through the network of nervous systems, to the brain for processing. Reardon and colleagues (2018) compared the variability of human brain size and discovered that the larger the brain, the greater a distinct areal expansion was apparent in the specialized networks responsible for conscious processes. This network was also greater than those areas responsible for motor or sensation. Not only is the time for a sensory signal to be communicated from the body to the brain variable, so too is the internal processing of such a signal of information.

There are high degrees of complex interactions within the domain of reality. Humanity has developed disciplines of individuality and specialization that serve to provide stabilization (Kant, 1781) to understand portions of the complex universe. Such segmented knowledge of how interactions progress permit a small but significantly powerful insight into the (otherwise) chaotic unknown. A technology embodies the influences from consciousness into future real

uses. The acquisition of knowledge furthers the ability to change understanding from an idea into a tangible substance. Such communicative tools as language, symbols, mathematics, science, recorded history, and greater philosophical growth were procreated. Consciousness of the individual self, and a conscious awareness of others, places, and things external of the self, have continued to be promoted.

Prior relation to the philosophical theories of epistemology advances the investigation into the nature of human consciousness and the advancement of understanding, The etymology of epistemology is from the Greek words *episteme* meaning knowledge or understanding, and from the suffix *logos* meaning the study of (Green, 2008). Epistemology is the study of how we know what we know. Researchers and philosophers have investigated epistemology through thought and scientific experiments (Dupré, 2007). The theories of ‘how we know what we know’ remain at the root of many unanswered questions of today. Involving the domains of reason and experience, epistemology searches to identify the light of truth, while the central thesis of how knowledge ascertainment is continuously questioned. The distinctions of scientific and human (cultural) knowledge made by Dilthey in 1903, (Bulhof, 2012), implicate complexity beyond a single discipline.

Looking to the investigation of human-environment interactions, a temporal component must also be considered. It takes time for a signal of information to travel through the nervous system of the body (Ahrens & Sahani, 2011) before reaching the brain for processing and eventual cognition. In the study of the physical world, a distinction of subjective and objective reality clarifies the environment versus the individual. For the purposes of this comprehensive, objective reality is defined as existing without the necessary perception of an individual. This objective reality is absolute and measurable. As stated by Peter Berger (1966) societies actively

seek to preserve a measure of symmetry between objective and subjective perceptions of reality. By developing procedures of reality maintenance that safeguard against any domination of institutional consciousness, the individual's perceptions of reality are defended. Subjective reality is therefore defined as purely psychological experiences and includes such concepts as sensations and perceptions. The perception of the individual is prone to complex variability and is subject to the time-space location within the domain of reality.

The proposed research investigation of human interactions with the environment will serve to incorporate an understanding of behavioural psychology and exhibited emotional behaviours. There is growth of technological advancements towards a genetic theory and scientific understanding of how traits (especially emotional ones) are genetically inherited by future offspring. Charles Darwin (1872) did synthesize many ideas that pointed towards random mutations. Learned habits were hypothesised as adaptive and thus carry the beneficial habits towards the mutation of the next generation. Emotional and adaptive behaviour will best aid a species with survival in a world of possible interactions and consequences. Darwin (1872) believed that "animals are changeable or variable, and that changes which lead to greater chances of an animal surviving and having offspring would be preserved in the species." Recent advancements in genetic technology have developed a more sophisticated look at how individuals with the most adaptive habits carry the learned behavioural mutation to the next generation. The common phrase term "emotion is adapted" provides little weight to the definitions of emotional behaviour, especially when there are situational 'triggers' that promote certain behavioural reactions. Behaviours described by Plutchik (1980) compliment Darwin's evolutionary and adaptive theories as designed to help animals survive. Emotion is variable and is the process of continual change, and so encompasses adaptiveness within its very meaning.

William James (1890) was one of the first modern psychologists to develop a theory of emotion. What James pondered is precisely related to the interdisciplinary research being proposed. James remained steadfast that the bodily process of emotion and the environmental link to the resulting behaviour influenced further emotions within the individual. Although James' model was not perfect at covering subtler emotions and aesthetic feelings, the sequencing theory he displayed was vitally important to the future Interdisciplinarity development of theoretical evolution and the advancement of understanding.

The study of conscious experience through introspection is phenomenology. Such knowledge is perceived by an individual as existing without the accompanying impressions of the individual self, including the impressions of subjective emotion. Edmund Husserl (1901) in his book *Logical Investigations* referred to two different types of introspection. This first was a focus on intentionality and the second was a focus on subjective experiences. The knowledge of the signal as being absolute, without the requirement for a brain to have even processed it, begins the definition of a true existence of knowledge. It is important here to note that while most of the sensory information from the body is processed within the brain, not all sensory signals of information become consciously aware by the individual (Kolb & Whishaw, 2003).

Epistemology searches to identify the light of true knowledge acquisition. The central thesis of how the advancement of understanding is achieved is continuously questioned. Human intuition can now be understood as an individual's capability of knowing or sensing without the use of rational processes. In 1783, Immanuel Kant formulated an understanding in his work on the *Prolegomena to Any Future Metaphysics*, that such things as pure intuitions (space and time) are necessary preconditions for there to be any experience of understanding at all. Without experience there is no ability to pursue any form of confident knowledge. Kant explained that it

was a mistake to assume that because our knowledge arises from experience that it is therefore grounded in experience.

As Kant further examined (Kant, 1783), concepts such as the notion of 'infinity' cannot be considered by experience alone. An individual must have some intuitive insight into the notion of 'infinity' to be able to result with such an understanding. Kant believed that conscious experience is not a simple explanation of the components that contribute to it. Kant did place intuition as the fundamental to the benefits of gaining certain truths. Every experience a human being will have will be within a spatial and temporal context. The pursuit of certain knowledge therefore requires the use of pure intuitions that involve awareness of space and time.

The philosophical concept of intuition within the pursuit of certain knowledge is intricate. Intuition and conscious perception should be simply considered as the proof of certain knowledge within and of itself, with no questions about validity. It does take time for sensory signals to travel for processing within the brain, and so even through the personal experience is individualistic, intuition can most certainly be called into doubt. The notion of a pure knowledge without experience can be rendered as competitive with another bodily knowledge. The role of the human neuronal network does indicate that a certain level of processing within the brain can be explained by the external environment of the individual. Applications of electroencephalography (Gloor & Guberman, 1997) have increased the researcher's ability to quantify the internal states of the human individual and provide insight into brain functioning. By measuring the brain waves of electromagnetic activity near the scalp of the individual, the technological advancements of electroencephalography have been able to quantify what was once conceptual.

The neuronal oscillations recorded by an electroencephalography reflect the rhythmic fluctuations of activity of the post-synaptic dendritic trees of a large grouping of neurons (Logothetis et al., 2001). These periods of high excitability typically indicate the likelihood of neurons firing a signal, whereas periods of low excitability indicate the reduction or suppression of neuron activity (Kolb, 2003). The classical frequency bands of the electroencephalography are measured by a montage of electrodes on the scalp of participants that records the variations of potential differences between the electrodes over time.

The introduction above has provided certain grounding definitions which the rest of this comprehensive will reside. The first is an understanding that the nature of reality of complex and intricate. The second is an understanding that the very process of understanding is also complex, intricate, and has evolved over the course of human history into well-defined disciplines of knowledge, for the purpose of advancing understanding beyond generations. Third is an understanding that the means of human understanding can be doubted and are influenced both by internal and external factors to which the environment plays a significant role. Lastly, technology advancements and dissemination of past external validations have provided for the utilization of individual disciplines within an intergrade and interdisciplinary approach to increase the advancement of understanding beyond simple definitions.

The following four sections of the comprehensive are designed to answer key questions surrounding the human understanding of how the local domain of reality can influence the human species. The first question identifies what we currently know about the Earth's environmental influences on human existence. The second question then identifies what major problems that exist with the knowledge thus far acquired, and what is possibly lacking in the research conducted. The third question positions the future research to be conducted, and how it

will address the problems existing within question two. And the fourth question serves to develop the process of investigations to begin the inquiry into the future research outlined by question three.

1.2 Basic Concepts

The universe remains complex. Human beings have organized information and understanding into logically posited disciplines. Humanity has divided our understanding of reality with great skills of organization and brilliance. From understanding the planets to cells, galaxies to species, atoms, and nanotechnology, specializations have continued to grow. Much of what we know within our own environment still eludes understanding. An urge to continue to evolve and to 'know' how matter works endures. Absolute knowledge does not contain doubt. Without certainty and confirmation that things are known to be true, advancement of understanding is built upon shaky foundation. To formalize a strong methodology towards answering the question about the Earth's environmental influences on human existence, the three (3) elements to human understanding are presented.

The first element to human understanding is the act of observation. The simple criterion of observation is such that an individual must be able to point to something external from the self. Understanding of existence is without the ability to be confirmed as true without observation or inference of measurement by some form of registered recognition. The act of exploration necessitates inquiries and generates desires to find answers. The drive within humanity to hold experience and know truth is an absolute necessity. Immanuel Kant considered such natural instincts and requirements of an individual to be a fundamentally crucial thing, and so according to his critique, classified the requirement to be a categorical imperative (Kant, 1781). Such a responsibility initiates actions within the individual that progressively radiate out, and possibly generate movements of other's opinions. This evolving and revolving quest for truth continues and is the condensed basis for science. With the masses of new opinions accumulating and undermining a continual paradigm, shifts are obviously required (Dupré, 2007). The

encouragement for exploring a new possibility within a new environment sparks the continual human drive for observation.

The second element of human understanding is measurement. This is understood as the act of counting that which has been observed. Everything in this universe is in constant motion, making measurements somewhat difficult. Certain disciplines (e.g. physics, astronomy) have provided relative perspectives. Observation does not have to be larger than the phenomenon in question in order to measure it. Some things, despite their size, can be measured. The act of measurement is an extension of the human senses towards understanding reality. The synthesis of the sensory signals from the body provide the human brain the information to form a perception (measure) of the surrounding environment. Any combination of chemical and electromagnetic signals taken in from the manifold of reality bind together to create a theatrical sense of reality. What is logically known as our conscious reflection, and our perceptions of the world are unified coherently. The time it takes for these signals to travel to the observer and become unified into consciousness would imply that what we perceive has already happened. The inference of reality is based upon the time-delayed sensations being processed. A common analogy would be to consider the time it takes light to travel from distant stars into our eye for perception. The distance of travel is so large that many years have passed by the time the signal of information reaches Earth. Any reality perceived has already happened. The influences of the local environment on the individual have therefore already occurred prior to observational measurement.

The third and final element towards a strong methodology of answering ‘what do we know’ about the Earth’s environmental influences on human understanding, is inter-observer agreement. Because the structure of perception can vary with large degrees of freedom between

individuals, this third element poses the most variability. Many people can have different perceptions, opinions, or interpretations of what they have observed. People can have different languages or words to explain what they have observed. The different perceptions, observations, and measurements that can be taken by different individuals provide the mechanism for inter-observer agreement. When more than one individual can confirm the observation, it becomes a stronger affirmation that the measurement is valid and a true representation of reality.

Language must therefore be also considered as the supplemental addition to the strong methodology of human understanding. Language is a systematic communication of information of reality, beyond any experience or observation necessitated. Whether animal, cell, or chemical, visual, physical, or human being, the communication of information is vital to existence. Biological life grasp communication and use it in many different forms. Humans have been able to continually expand the technological uses of language.

With the parsing of the complexity of reality, problems are dissected into variable levels of knowledge, and disciplines are inherently developed. Each discipline utilizes a unique language of terminology to reaffirm inter-observer agreement. A university of higher learning is comprised of silos, created where the foundations and fundamental truths of disciplinary specializations are maintained. Language, observational techniques, and forms of measurement are agreed upon. Each discipline will necessarily have a basic unit of understanding, from which the rest of the language within the discipline is structured. Certain language is cherished within a respective discipline, used to explain phenomena, and is considered to be so sacred that it is governed to be maintained and ritualized.

In order to understand what we know about the Earth's influence on human behaviour, the interdisciplinarity approach will merge the languages and silos of specializations. The use of language dictates how individuals perceive their environment. The union of languages can be a method to solidify truths by the wide reach of interdisciplinarity. Within each discipline some fundamental truths can be categorized, and patterns across disciplines will begin to become relevant.

For nearly a century, recorded research has attempted to reveal the equation of relation between humanity and their environment. In 1926, Chizhevsky (alternately Tchijevsky, 1926) published an examination on the influence of natural phenomenon on the mass behaviour of humankind. The relationship between humanity and their environment has long been a curiosity. For the purposes of this comprehensive examination, the Earth shall be considered a bound system, enclosed within another bound system; that being the solar system proper. Expanding outward beyond the two identified boundary conditions is a limitation of the presented research proposal.

1.2.1 Earth's Magnetic Field

The primary boundary that encompasses the Earth is the geomagnetic field. Wallace H. Campbell (1997) published an understanding of the Earth's natural magnetic fields. Campbell presented a foundational knowledge of the physical understanding of the Earth's magnetic field, complete with well-defined concepts, vector mathematics, historical measurements, and applications of the knowledge. Campbell has cited the range of geomagnetic phenomena nearest the Earth's poles to be nearly 6×10^4 gamma (6×10^{-5} Tesla) ($6 \times 10^{-5} \text{ kg}\cdot\text{s}^{-2}\cdot\text{A}^{-1}$), and approximately 3×10^4 gamma (3×10^{-5} Tesla) ($3 \times 10^{-5} \text{ kg}\cdot\text{s}^{-2}\cdot\text{A}^{-1}$) near the equator. With respect to the equator, the field at the poles is approximately double. There exists a wide range

of variability and fluctuation in the Earth's field. These fields are malleable are capable of change depending on influencing variables. Reported daily variations can reach 20 gamma (2×10^{-8} Tesla) ($2 \times 10^{-8} \text{ kg}\cdot\text{s}^{-2}\cdot\text{A}^{-1}$) to 100 gamma (1×10^{-7} Tesla) ($1 \times 10^{-7} \text{ kg}\cdot\text{s}^{-2}\cdot\text{A}^{-1}$), depending on latitudinal location of observation.

Gregory Ryskin (2009) published on the variation of the Earth's magnetic field as possibly due to the flow of ocean being a conductor of electricity. Ryskin utilized magnetohydrodynamics to demonstrate the strong relationships between ocean currents and the calculated observable field variation. Other researchers propose the variation in observation as due to internal mechanisms. Su and Konradi (1975) have illustrated magnetic field depression as also related to the same daily geomagnetic variations. Expanding the observations made by the Explorer 12 satellite boundary observations, Su and Konradi found a linear relation between the inverse cube of the Earth's magnetosphere distance, and the hourly 'Disturbance Storm Times' (DST) index of the magnetic activity, as measured from the network of near-equatorial geomagnetic field variabilities.

The relationships of influence upon the Earth's magnetic field variability are both internal and externally derived. Even back in 1968, Siscoe, Formisano, and Lazarus published on the relationships between the Earth's magnetic field and solar influences. Seasonal variation contributed to the changing variability within the geomagnetic fluctuations. The observations of resonance were also presented as an external factor by Nishida, Kobayashi, and Fukao (2000), citing that non-Earthquake ground oscillations would resonate with the Earth's atmosphere, estimating the amplitude source as being just above the Earth's surface.

Public online access to daily geomagnetism observations and predictive geomagnetic models are made available throughout the World Wide Web. The National Centers for Environmental Information (NCEI), formerly the National Geophysical Data Center (NGDC), host file transfer protocol (ftp) databases as part of the United States Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Environmental Satellite, Data, and Information Service (NESDIS). The NCEI's mission is to provide broad, public domain data management for research, and observation of Earth's global changes (NCEI, n.d.). The possible sources of these geomagnetic fluctuations remain as undetermined. The wide breadth of user access and academic publications span into private industry, governments, and mass media formats.

1.2.2 External Solar Influences on the Earth's Geomagnetic Fluctuations

The boundary of the geomagnetic field is where the Earth interacts with the external universe. The most prevalent and immediate of possible interactions is from solar influence. An interaction between the solar wind and the Earth's geomagnetic field can then impose secondary effects upon the Earth's internal systems. Stamper and colleagues (1999) investigated a range of solar influences, including interplanetary magnetic field strengths, solar wind concentrations, and solar wind speeds upon the Earth. The Sun can alter the annual means of any index of measurement, surmounting to a quantified increase in geomagnetic activity. The greatest cycle of solar influence upon the Earth is the drift over a 20 to 22 year solar cycle, explaining a large portion of the Earth's geomagnetic variability over time.

Neto and colleagues (2012) studied the core relationships between daily geomagnetic and solar semi diameter measurements from the years 1998 to 2003. Lagged correlation analysis was conducted to further explore the relationships found between solar semi-diameter, solar flare

index, and implicative solar driven Earth system geomagnetic variations. When the Sun is in an active cycle, there are no statistically significant offset relations between solar diameter peaks and geomagnetic field activity. During periods of low solar activity, the solar diameter peaks precede the geomagnetic dips with an average found to be 61 ± 9.9 days. Remarkably such a solar influence meant a range as far as 2 months before impacting the geomagnetic activity on the Earth. These results indicate that not only can the Earth's geomagnetic field have daily variability sourced from daily influences, the possibility exists that some components of the daily fluctuations are due to temporal phenomena happening well in advance of observation. Future investigations will have to accommodate such large time variability in order to best approximate the influential impacts upon the Earth system.

Lengths of day variations are changes in the Earth's rotation as measured in milliseconds and are publicly available data from the California Institute of Technology's Jet Propulsion Laboratory via the National Aeronautics and Space Administration (NASA). Gross (2001) published his comprehensive length-of-day investigations and is a corresponding author from the Space Geodetic Science and Applications Group, Jet Propulsion Laboratory, at the California Institute of Technology in Pasadena, California. Richard S. Gross also completed an immense series analysis spanning from the years 1832 to 1997 (Gross, 2001). Gross (2001) confirmed that differences in measurements were robust from a variety of sources, including lunar ephemeris (moon position) and universal time, assuring that the daily time uncertainties were robust and realistic. The importance of Gross's findings provide an understanding of influence within the millisecond range. Such observations as the speed of Earth's rotation are as variable from one day to the next and can potentially add to the already complex fluctuations observed.

Holme & De Viron, (2005) applied the length of day variations as a subtracting factor from atmospheric angular momentum to form a high resolution time series. This novel time series provided the insight into closely occurring geomagnetic jerks of the Earth's electromagnetic field. These processes suggest responsibility for the changes in core angular momentum of the entire planet. The Earth is an open system and is influenced by temporal processes of solar interactions. The geophysical and solar variables under future investigations will have to be systematically appropriate lengths of time to reflect the human phenomena being studied.

1.2.3 Extreme Earth Events

One of the largest energy events that occur on the planet involve the massive release of seismic energy. Variations within the daily occurrence of seismic activity have indicated influential factors. In 1998, Tanimoto and colleagues investigated gravimeter data between 1983 and 1994, finding that the Earth resonant frequencies between 2 and 7 mHz were active on seismically quiet days, suggesting that the Earth is continuously in an oscillating period. The colleagues from the University of California and the Tokyo Institute of technology concluded that possible causes for the oscillations included atmospheric excitation and tectonic motions. Recently, Vares & Persinger (2013) analyzed the daily occurrence of global Earthquake frequency within 0.1 increments of seismic energy release as measured in magnitudes, finding a suspicious paucity within the 3.6 to 3.7 magnitude Earthquake range. The potential implications within this magnitude range were computed to be within the zero point fluctuation force and quantum energies of photon vibrating the smallest physical length (Planck's length equal to 1.6×10^{-35} meters). Persinger later went on (2014) to reflect on the seismic events as potentially equivalent to the velocity of the local solar system around the galactic center (~242 km/s) within the universal pressure ($\sim 10^{-10}$ Pascal) producing energies within the Earth's volume as comparable to

sum of all Earthquakes per measured unit of time. The Earth is not an isolated system and is involved in a dynamic interplay of cosmic, galactic, and solar energies. This implies that human organisms are also susceptible to the variability of universal forces.

The Earth's geomagnetic boundary does experience an influence from the external solar system. Jakubcová and colleagues (1985) reported global Earthquake activity was correlated with the absolute value of the change in the Sun's acceleration, citing the correlation coefficient between deep Earthquakes and the change of the Sun's acceleration with time to be 0.4. The more frequent shallow Earthquakes were not statistically significant. The relationship between solar electromagnetic emissions and global seismic activity preceded geomagnetic activity by 1 or 2 days (Styinskij, 1989). Later in 2007, Odintsov and colleagues from Russia and Bulgaria (2007) indicated that the maximum of seismic energy in the 11-yr cycle of Sunspots, was during the decline period (quieting) and was 2 years behind the solar cycle maximum and correlates with the instant of a sudden increase in the solar wind velocity. These associations suggest greater simultaneity between solar-terrestrial releases of energy than typically assumed.

1.2.4 The Human Organism

Even these cyclical patterns within the Earth's environment can be found to have a role in the cognitive and physical development of the human species. Researcher Volchek (1995) provided evidence that the environmental parameters surrounding the conception or birth of human individuals were seasonal with multiyear variations. Studying the functional asymmetry of the brain in 4,373 subjects between the years 1920 and 1984, Volchek identified a relationship with cosmological fluctuations that followed a 10 year cycle. Impact from interplanetary magnetic fields moon and Sun gravitational forces were highlighted.

Leonard Ravitz (1951) studied day-to-day electromagnetic field alterations by measuring direct-current spot terminations on the bodies of human individuals. Ravitz (1951) was able to establish a seasonal tendency by measuring along the temporal region and mid-clavicular lines. A positive increase during the fall and winter months was reported for most subjects. A decrease in positivity was also noted from late winter to late spring. A marked increase coinciding with full or new moons was also revealed. Ravitz remarked that the absolute daily deviations often appeared like measured deviations in trees, pointing to the concept that environmental patterns can influence multiple organisms.

Cyclical variations in the Sun and Earth's geomagnetic activity are related to the seasonal and even daily variations found within the human body. Investigating the direct comparison to the Earth's geomagnetic field is a prominent component of this literature review. A recent study conducted by McCraty and colleagues (2017) identified synchronizations between the autonomic nervous systems of human organisms with geomagnetic activity of the planetary environment. Their research indicated significant relationships between the human organisms and dynamic changes in the solar, cosmic ray, and ambient magnetic field. In 2012, Persinger published a consideration of the quantitative properties between the electromagnetic activity of the human brain and planetary atmospheric lightning occurrence. Similar chemical productions of nitric oxide are produced with similar calculated current densities. 5 Colombes distributed within a lightning channel at an average of 100 Amperes, constitutes a cross-sectional area density of $3.2 \times 10^{-5} \text{ A/m}^2$. Remarkably the approximately 10^3 ion channels of a neuron, each with one pico amp capacity, equate to a similar cross-sectional current density. Persinger (2012) concluded with similar comparisons made including pulse patterns, mass charge velocity ratios, interfaced times, and signal backpropagation.

Spectral densities of normal human quantitative electroencephalograph activity have been found to suggest a causal interaction with the Earth's electromagnetic field resonance patterns as generated from lightning strikes (Saroka & Persinger, 2014). From these direct comparisons of local magnetic field intensities, human brain activity even exhibited coherence within the first fundamental harmonics of the Earth's atmosphere. Saroka and colleagues (2014) continued to highlight interhemispheric temporal lobe coherence with increased geomagnetic activity, most notably within the alpha frequency activity range (7.5Hz to approximately 12Hz), with complementary differences in the left and right parahippocampal activity also being correlated with increased geomagnetic activity.

Mulligan and Persinger (2012) also experimentally simulated sudden increases in geomagnetic activity in the range of 20 nT to 70 nT and measured the resulting quantitative electroencephalographic activity of human participants. After only 10 minutes of simulated geomagnetic activity, theta frequencies between 4Hz – 7Hz over the right parietal region was enhanced at the 20 nT exposures but suppressed during the 70 nT exposures. Applying these results with the findings of Alonso and Klink (1993) imply that with the approximate ~8 Hz, 2.5 mV oscillations of layers II and III of the entorhinal cortices, a potential geomagnetic and human encephalographic interaction of information may be occurring.

Positing the Earth's geomagnetic activity can have influence upon the brain proper; the question is posed if there is a threshold quantity of influence that must occur in order to produce a recognized trait or mechanism. In 2008, Houweling & Brecht (2008) published results demonstrating how even the stimulation of one single neuron in the somatosensory cortex could affect the individual responses during a behavioural detection task within rats. Remarkably a 25 fold increase over the average spontaneous firing rate was elicited by mostly targeting deep

cortical layers. This result suggests that any form of cortical micro-stimulation can evoke long-lasting behavioural activity. Li and colleagues (2009) even reported that high-frequency burst spiking of a single neuron could influence a change between cortical states resembling slow-wave and Rapid Eye Movement (REM) sleep states. These experimental results demonstrate the power that even one single cortical neuron can have in modulating the behavioural of an entire organism.

Neural circuitry can also be influenced by the structure and composition of social networks. In an article authored by Sallet and colleagues in 2010, published in the peer-reviewed journal 'Science', an investigation into the variability in social network size causes variations in individual brain structure. A total of 23 Macaque Monkeys were drawn from 34 different social groups of a research colony. Comparisons of magnetic resonance imaging revealed that living within a larger social network increases the grey matter in mid-superior temporal, rostral prefrontal cortex, with increased activity in frontal and temporal lobes. Even deep brain comparisons revealed the angular cingulate changes within the limbic system. This signifies adaptive areas for emotion, learning, and memory. The prefrontal cortex and limbic system are largely responsible for an individual's social behaviour. A probable cycle in humanity's social development can be traced to a relationship with the influential environmental cycles and social networks.

The structure of neural networks dictate the functional operation of those neurons within the brain. Various sub-groups of neuronal organizations have been suggested to correlate with the social networks that an individual belongs to. The adaptive brain's primary role of representing reality is to be reflective of the reality of which the individual is situated. Perspective is relative to the space-time location of the reality of which the observer is located. Individual neural

network structure and the representations of reality maintained within the brain would be relative to the individual's environmental conditions. A group dynamic threshold can be observed where a ratio of certain agnostic behaviours is significantly elevated when compared to a control population (Desjardins et. al., 2001). It is also interesting to note that the gray matter differences in similar areas of the brain were also correlated with dominance within its social network. An individual's social identity with respect to belonging to groups, brings protection, self-esteem, efficient use of species resources, and facilitates changes in neural networks within the brain. Prinz (2004) reconciled the status of behavioural emotions as rather precise embodied appraisals or perceptions of the body. If time does play a role in the transmission of sensory information from an individual's body to their perceived experience, then the combination of such information will be relative to the type of stimuli initiating the conscious experience.

The ability to perceive experience and recognize the communicative expressions within the social network are largely founded within psychological processes. These mental processes and behaviours have been shown to be correlated with environmental and geological processes (Persinger, 1987). Observational studies have demonstrated that even the most aggressive behaviours are also increased with environmental geomagnetic activity (St-Pierre, & Persinger, 1998), and complex magnetic fields (St-Pierre, Persinger, & Koren, 1998). In 1999, Persinger conducted the temporal analysis involving annual global geomagnetic activity, solar activity, and global seismic energy as compared to the number of armed conflicts. The moderate relationship again cited that the local geomagnetic activity might contribute to emergent processes of human behaviour, specifically aggressive human behaviours.

On May 29th, 2014, a new global database was released for public access. The database is comprised of political events specific locations and coded for tone of interaction. Leetaru and

Schrodt (2013) used the conflict in mediation event observation codes (CAMEO) to categorize news reports from a variety of international sources. This form of world news media measured categories of "events" as used by the DARPA-funded Integrated Conflict Early Warning System (ICEWS) project and includes such social network occurrences as riots, protests, and diplomatic exchanges. Hammond and Weidmann (2014) further evaluated the global database of events, language, and tone (GDELT), providing caution that the local level bias exists in how events are reported. The age of big data analysis can provide insight into the social psychology of the human organism.

Looking at how the Earth influences Human behaviour is not a novel investigation. Grigoryev, & Vladimirskiy (2005), concluded similar observations between the temporal frequency occurrence of acts of terrorism and solar Earth physical measures, so coined as "Heliogeophysical". Tchijevsky published in 1926 a study comparing the approximately 11-year Sunspot activity since the 5th century, with phenomena of societal excitation. Such revolutions were reported to be synchronous with the solar peak cycles, leading to the claim that if the Sun was active then the local geomagnetic field was variable, and human behaviour was affected. Mikulecky (2007) later investigated the 11 year solar cycle through the 500 year cycling, finding agreement with Tchijevsky's published hypothesis.

While the observed correlations between Earth processes and human aggressive behaviours are temporally apparent, mental health submissions to acute care units have also been demonstrated to be positively related to global seismic activity (Anagnostopoulos et. al., 2013). A true adaptive process must always be in place for humans to evolve within a local environment that is in constant perturbation. The effects of environmental behaviour have only recently been published to investigate the problems of adaptation (Calhoun, 1983). Publications identifying

the seasonal mood variations across cultures around the globe (Golder & Macy, 2011) are providing further theoretical perspectives of environment influenced behaviour research. Urban stressors such as noise and close social proximity have been investigated (Glass & Singer, 1972). Moser (1988) conducted an experimental manipulation on the environmental effects of noise interfering with the helping behaviours in humans. These observations have also revealed disruptions in a participant's momentary self-control when conducting a Stroop colour naming task.

1.2.5 Human Health

Researchers Palmer, Rycroft & Cermack published in 2006 on the extremely low frequency effects of magnetic and electric fields concerning the health of humans at difference elevations of the Earth's surface. The author's three conclusions were (1) geomagnetic effects are greater at higher magnetic latitudes, (2) extreme values of geomagnetic activity have adverse health effects, and (3) 10–15% of the human population seem to be genetically predisposed to adverse health due to geomagnetic variations. The last conclusion indicates that 700 million people are susceptible to adverse geomagnetic variations. The Earth's open system be influenced by external forces thus changing the cyclical environmental patterns. Interactions of these external forces can be propagated through environmental effects, influencing the human organism.

While external forces are apparent, a crowded population density can also create forms of stress upon the organisms inhabiting a region. Roger Milkman from the University of Iowa published an observation on the erratic behaviours of *Drosophila melanogaster* (common fruit fly) before later dying (Milkman, 1975). Milkman noticed that healthier flies kept distance and minimize crowding, while a resourceless chamber implicated a socially induced death of the flies. This population density research has been applied to human populations including cancer incidence

(Howe, Keller, Lehnerr, 1993), (Nasca, Mahoney, Wolfgang, 1992). This literature finds that the rates of cancer incidence increase as the population density increases (Muirhead, 1995).

Societal excitations (Tchijevsky, 1926) and even individual attentiveness (Moser, 1988) can be impacted from planetary open system measures. The necessity to identify impacts of human disease from the global cyclical and seasonal shifts become apparent. Even emotional and mental capacities can be influenced, causing a depression correlating to the human immune system. In 2014, Vissoci Reiche, Vargas Nunes, & Morimoto (2014) published their work on the psychological features of cancer and disease. They concluded that a more precise understanding of the communications involved between the neuroendocrine and the immune systems was needed.

A culminating meta-analysis recently conducted by Geesink & Meijer (2017) served to investigate the electromagnetic decoherence of cellular states within living organisms. 197 different electromagnetic frequency data publications were investigated, where both cancerous disease states and electromagnetic decoherence were identified as correlates. In 1968, Fröhlich illustrated the ability of biological systems to possess the characteristic of long range coherent vibrations of electrically polar macromolecular structures (Fröhlich, 1968). This research posits the notion that discrete wave frequencies can induce not only behavioural changes within organisms, but DNA confirmation or epigenetic changes. Observational measurements are beginning to illustrate the interactions of neuronal and cellular functions. Persinger (2010) postulated upon the underlying associations due to the neuromolecular quanta of energy that is prevalent within numerous biological processes. The revolutionary propositions of these reviewed literatures is that communication of all forms of environmental information is vital to all underlying processes within human organism, including disease and the ability to heal.

1.2.6 The Concept of Entropy

Leibnitz & Kroegeer (1871) understood the universe as a living machine of force. Under the descriptions of entropy, the amount of living force within the universe will be always be conserved. A universal system of physical forces will have impact upon the homeostasis of an individual.

Boltzmann (1878) investigated the universal system by abandoned certainty and working with theories of probability. The concentration of energy in a single system's ordered state is always distributed to an unordered state. As disorder increases, entropy must necessarily increase. A small change in thermo-entropy can contribute to a vast change of the information. Dotta and colleagues (2016) were able to model the distal changes in information with the quantity of energy as 10^{-20} J as multiplied by the inverse diffusivity from the wave impedance and magnetic susceptibility of space and the electron orbital.

The suggested fundamental physical process of entanglement (Dotta et al., 2013) (Dotta & Persinger, 2012) between physical and chemical reactions is observed to be dependent on the point durations of the shared rotating magnetic fields at $0.5 \mu\text{T}$. With changing angular velocities acting upon the quantitative cosmological solutions for electrons (1 ms) and protons (3ms) (Rouleau, Carniello, & Persinger, 2014) the operation yields to a universal process. The equivalent point durations for the bulk velocity of cortical fields (~ 4.5 m/s) moving through the cerebral cortices (Nunez & Cutillo, 1995) are determined to be also operating upon the very same informational processes. If the calculated quantal energies (Persinger & Lavallee, 2012) exerted on a neuronal ion channel charge yields the very same cortical bulk velocity, then even

the conscious processes of a human individual can be influenced by a form of shared field information entanglement with the external environment.

Water has been previously implicated (Rouleau, Carniello, & Persinger, 2014) (Murugan, Karbowski, & Persinger, 2014) as the common denominator that facilitates the complex energy entanglement process from the generated magnetic fields. The mitigating factor of proton mobility within water (Persinger, 2014) has also been suspected. As made clear by cited experimentation, large volumes of water alter the resultant effect via the different energy densities being applied. Similar energy density within the volume of the universe as with the average $6.5 \times 10^{-9} \text{ J/m}^3$ of the human brain (Persinger, 2014), may implicate the point duration as the adaptable variable to satisfy the water thus being affected upon.

Dissociation of water by sunlight is a continual process within the Earth's atmosphere and may be pointed as another form of decisive entropy interaction upon the system of potential human influence. Dixon and colleagues (1999) demonstrated the process of dissociation of water by light at 121.6 nm, via two different channels, resulting in quantum interference. Processes that propagate the phenomena (Aczel, 2002) of entanglement found within the very atmosphere, known to be causing influence upon the human organism, must be taken into the consideration as a means of information communication.

1.2.7 Light

Human cognition is typically built upon continuous external spatial relations that mostly include quantitative, approximate, categorical, or topographical (Tversky, 2005). Even an individual organism's position and dependence upon a key variable in any observed external representation

is empirically confirmed and solidified from the fundamental to all observed representations; that being light.

Light is radiant electromagnetic energy. The properties of light are understood to have vibratory qualities that are measured in wave form and have quantum unit qualities that are detected as the compact photon. The higher the vibration or the greater number of photons signifies a greater amount of radiant electromagnetic energy. The amount of energy that is registered corresponds to intensity. Microorganisms have demonstrated the ability to utilize these quanta of light information to mediate conversation (Trushin, 2004), even down to the cellular level (Fels, 2009), including intra- and intercellular functions (Van Wijk & Schamhart, (1988). Isojima and colleagues (1995) were even able to measure the ultraweak biochemical luminescence emissions coming from hippocampal slices within the rat brain.

Sensory receptors are designed to convert sensory energy obtained from the environment and convert the energy into neural activity. All sensory receptors have a specific receptor field that is specialized towards the part of the world to which it is designed to respond (Schiffman, 2001). The red, green, and blue wave lengths of light correctly corresponded to the large, medium, and small receptors within the retina. The three distinguishable small, medium, and large wavelength-responsible cone receptors contain photo pigments that correspond to the differently registered wavelengths. These photo pigments are chlorolabe, erythrolabe, and cyanolabe respectively (DeRobertis, 1980). The different visible colors are produced by appropriate proportional contributions of these three photo pigments within the trichromatic system. The very nature of human sight sensing is designed to abide by these physical laws of information communication from the local environment.

Visible light is important to the human observation system. Biophoton emissions that emanate from the entire human body are beginning to be understood. In 1979, Popp presented the coherent states of photon field information, later to be related with Shannon entropy (Popp, 1998) as a physical background process of information. Eventually the confirmation of a permanent photon current emission originating from the human body was recorded to be within a few photons per second, per centimeter squared area (Cohen, & Popp, 1997). Van Wijk & Van Wijk (2005) developed specified protocols for investigating the spectral characteristics of human body photon emission, limiting environmental interference. Bieske, Gall & Fisch (2000) published on the seasonal effects of human photons emissions from the hands, noting a summer increase as compared to a winter differential as confirmed in their research participants.

Even a cyclical variation of light emissions from the human body can contribute to the understanding of the communicative and influential nature of light on human beings. The relationship light has to the individual is crucial to the overall structure and understanding of the information communication within the universe. Light is universal and fundamental to reality. Light can reveal truth via the transportation of qubits of information, and humans depend on the very information transmitted.

1.3 Identified Problems within the Literature

For the research investigation to fulfill the identified categorical imperative, some key terms will have to be operationally defined. Before proceeding to understand the phenomena involved, a conclusive identification of the problems that remain will be presented.

1.3.1 Problems with the Physical Nature of Measuring the Environment

Physics describes the universe in either two terms; (1) either our world is subjected to the rules of classical physics and held together with the general theory of relativity, or (2) universe can be described in terms of quantum mechanics and probability statistics. The unexplainable phenomena within reality are easier to contemplate when we understand the mechanism involved. Different universal rules of radiation, gravity, and force interfaced, creating new scenarios of physical reality. If the very nature of existence arose from these interactions, the investigation of human beings that exist within such a defined set of universal rules, will require vested interdisciplinary knowledge.

The primary information carrier within the Universe is radiant electromagnetic energy. This form of energy is understood to have vibratory qualities that are measured in wave form while also having quantum unit qualities that are detected as the compact photon unit. The higher the vibration or the greater number of photons signifies a greater amount of radiant electromagnetic energy. The amount of energy that is registered corresponds to intensity. De Robertis & De Robertis (1980) described these measures of radiant electromagnetic photons of light with photoreceptors within the molecular biology discipline. They commented: “*the liberation of Ca²⁺ ions, in turn, inhibit the sodium current that is characteristic of the photoreceptor and dark condition*” (De Robertis & De Robertis, 1980). The resulting acute sensitivity of

photoreceptors can thus react to a single photon. Each rod that is illuminated by a photon consequently sends an electrical signal of information. The electrical signals are accumulated within an adaptation which regulates the bombardment of incoming stimuli from the environment and controls the light receptive sensitivity.

The human photoreceptors therefore act as energy transducers, transforming the information carried from the radiant light energy into electrical signals. Humanity is rightfully justified for such confusion surrounding light's spooky qualities (Hawking, 2007). The Greek goddess of love was Aphrodite is believed to have created the human eye out of the four elements. According to mythology, Aphrodite lit the flame of sight inside the eye to shine out and allow the humans to see. It was commonly considered by many societies that the powers of sight originated from within the eyeball. The ancient Greeks were not ignorant to the previously mentioned day and night routine. They also had passions for other gods of light including Helios as the Greek god of the Sun (also known as helium), and Pyros lighting the stages as the Greek god of fire (Green, 2008). The introductory knowledge sought is a complete and universal understanding of humanity's relationship(s) with light.

The philosopher Plato was not shy to any questions of light either. Plato was convinced the true explanation of light could be understood by an allegory about a cave. The briefed version of the story includes a fire, some restrictions on humans, and from outside of the cave was the Sun, shining truth over all the confusion (Plato, 380 B.C.). One of the earliest examples of a human considering the truth that light can reveal may not have originated from within the observer.

In 140 A.D. Ptolemy took measurements via the positions of stars to establish a transcendental knowledge of light. Based on these mathematical measures, Ptolemy could suggest that light did

and must bend through the atmosphere. Ptolemy was such a revolutionary human that he also contributed to the impressionable Aristotelian opinion on our picture and relational position in the universe (Neugebauer, 1975). The death of the Aristotelian-Ptolemaic theory ended in 1609 A.D. The new champion was the 1514 Copernicus model supported by Galileo Galilei and Kepler (Hawking, 1988). Supporting the Copernican theory with healthy doses of science, a heliocentric system absolutely shattered any remaining mythological beliefs.

Young (1801) postulated that light could travel as a wave and a particle (Cantor, 1984), and knew that light entered the eye, and not the other way around like the Greeks had dreamed. Young knew that the possibility of a light receptor within the eyeball for every wavelength of light's colors was just a preposterous idea. Building from Sir Newton's 1672 work (Newton, 1979 release) with prisms and different wave lengths of light, Young realized that the human retina could not possibly hold a light receptor for each color of the continuum (Young, 1801). Early in the 19th century, Thomas Young's passions were for conducting experimental research. Young was a professor of natural philosophy and lectured with interdisciplinary style on nearly everything (Darling, 2005). Young suggested a Three-Color Theory where human vision is comprised by mixes of different waves of light to create the observed color. In 1802, Young turned to explaining the very nature of light, devised the double-slit experiment, and confirmed the probabilistic existence of light.

By 1867, Helmholtz (1867) built from Young's work and proposed that human color vision is comprised of three types of receptors. Each one receptor was capable of a different variation of combinations of sensitivity to combine and create the correct replication of the interaction of the light observed. The Young-Helmholtz trichromatic color theory was in full promotion. Although very plausible, the trichromatic color theory was just a theory. Gunnar,

Krattenmacher, & Laufer (1960) were the first to present a scientific proof of the trichromatic color theory. Gunnar and associates examined frog retina by subjecting them to different wave's frequencies of light. What the experiments confirmed was that the frog's retina was sensitive to three different types of wavelengths. Not surprisingly these corresponded to the theorized trichromatic possibilities. The distinctions between the wavelengths of light come in small, medium, and large combinations. Thus, there are cones that specialized for stimulation towards the small, medium, and large wavelengths. Large cone receptors are for the wavelengths of 564 nanometers (nm), medium receptors for the 534 nm, and small receptors for the 420 nm reception. The three distinguishable small, medium, and large wavelength-responsible cones contain photo pigments that correspond to the differently registered wavelengths.

Experiments have expanded into the animal kingdom, and confirmation of a trichromatic color vision system appeared more frequently for primates than not. Trichromatic vision is common for primates but is not a universal quality within the animal kingdom (Jacobs, 2009). This demonstrates that the work by Gunnar and associates (1960) as a driving force in current research.

Lateral inhibition is when neural activity of a photoreceptor is affected by the stimulation of nearby, neighboring photoreceptors. When the neighboring photoreceptors are simultaneously illuminated, each receptor individually will transmit fewer electrical impulses of neural activity as compared if only a single receptor had received the same amount of light. Thus, the greater the illuminations of neighboring receptors, the stronger the inhibitory effects are enforced. The neighboring interference consequently results in less discharge of information from a receptor than if it were alone, raising a limitation on personal accountability of sourced reporting.

This neural inhibitory activity is not a deficiency within the visual system. Lateral inhibition enhances the perception of borders and edges within the visual field. The difference in the neural firing rates of receptors located at the light dark boundary within the eye is exaggerated by this lateral inhibition effect. The receptive fields for the specialized fovea are much smaller than those found in the periphery. The fovea fields and receptors there included all receive the same light illumination. The smaller the fields of light receptors, the more the neighbors are cumulatively included by the exact same amount of illuminating information. But as found within the larger receptor fields of the periphery, the more neighboring receptors stimulated by illumination are inhibited by the competing neural activity, a resultant lateral inhibition is the effect.

Apparent within the light/vision literature is the complex and probabilistic nature of the particle carrying the information from the environment to the individual. Central to all physical investigation of light resides the axioms of mathematical relation. Perlovsky (2006) described the physical mechanisms of human ability within the concepts of perceiving emotion and symbol recognition. Perlovsky's interdisciplinary work has been cited by over 260 other references. Each reference incorporates the research from multiple disciplines including theoretical physics, neural network technology, and information sciences. Such laws included were the conceptualization of nature as 'force', providing constructive validity to the statements of prescribed processing of internal, neural information. Other interactions of particles of matter have also been investigated. The brain operates not only via chemical reactions but also electromagnetic signals. The visual system of humans is limited to only detect a very small portion of the entire electromagnetic spectrum. A physical approach to the interactive forces of electromagnetic fields must be incorporated within the proposed thesis.

1.3.2 Problems with Sensation as the Measurement of the Environment

The act of sensation is considered a form of measurement. The human body senses, records, or measures information collected from the environment which is transferred to the brain for processing. It does take time for a sensory signal to travel from the body to the brain for processing. Therefore, the perception of sensory information is the conscious awareness of neuronal signals that the body has previously measured. The fundamental role of these structures is to pass information of the surrounding environment to the human brain for processing and categorization for possible conscious fruition.

Within the neuroscience and psychology approach, the employment of how the human brain processes and perceives sensory information from the environment will be utilized. The perception of sensory information is therefore understood as the conscious awareness of environmental signals that the body has received and has sent to the brain for processing. The fundamental role of the many sensory pathways that exist is to pass information of the surrounding environment to the human brain.

Structuralism is the pursuit to define our perception has composed by the most basic of elementary sensations. The very structure of the perception is thus based on these rudimentary sensations. Structuralism is considered a bottom-up process such that perception of the stimulating environment is the resulting combination of individual sensations. The summation of these elementary sensations is what constitutes human perception. This form of adding up the individual sensations is a reductionism approach to solving the complexity of understanding the problems with sensation as a measurement.

Opposed to structuralism is Gestalt psychology. The summation of the individual elementary sensations does not include relationships between environmental stimuli. This pursuit to understanding perceptive complexity relies on the fact that we perceive the environment not only by individual elementary sensations, but also by inherent organizational and relational properties. By merely summing the elements involved, the relational characteristics between stimuli are not included. The perception of the relationships between elementary sensations is believed to dominate the perception of just the individual parts.

Gestalt psychology further confirms the importance of relationships by promoting several grouping principles that interact to promote coherence and resultant perception. Proximity is where the individual elements of sensation are grouped by their relative closeness in space. The similarity grouping principal dominates the perception of similar elements such that those individual elements that identifiably similar are grouped based on that relationship. The uniform connectedness grouping principal arranges individual elements that form a perceptual unit to be within relationship among each other. The good continuation grouping principal arranges individual sensation elements in a relationship group such that they all follow the same direction. The common fate grouping principal promotes the relationship that those elements that move together are grouped together. The symmetry grouping principal establishes relational priority over asymmetrical elements of sensation. The closure grouping principal promotes the group relationally favored elements that that are more enclosed than random, sporadic elements of sensation. The reduction approach to structuralism fails to efficiently represent the relational characteristics between individual sensations for the purposes of perception.

Sensory signals can include photostimulation, chemicals and electromagnetic waves, all of which interact with the body, and produce a depolarization for neuronal conduction of signal

information. The synthesis of the sensory signals from the body, provide the human brain the information to form a perception of the surrounding environment. A recent study conducted by Wang and colleagues in 2018 (Wang et. al., 2018) found that participants were able to transduce changes in the Earth's geomagnetic field strength into an active neural response. The body is continually bombarded by sensory information. Only the most pertinent information, or the most emotionally relevant information is provided to the domain of consciousness. The problem with the psychological literature is interpretation is always dependent upon the application of theory.

There remains the possibility that a majority of intuitions are provided to the brain/body, without conscious experience of them. Within the literature of neuroscience, the processes of sensory information proceed conscious awareness (Fried, Mukamel & Kreiman, 2011), and for that matter, conscious decisions. All these forms of information from the environment can be processed before an emotion is evoked within the individual, and before the perception of such an emotion even exists. The application of theory for interpreting the conscious perception is always defaulted to post-hoc analysis.

A great example of an interdisciplinary researcher within the field of space, time and consciousness is Dr. Varela. A biologist, philosopher, and neuroscientist with the University of Paris, Dr. Varela led a research group at the Centre National de Recherche Scientifique (CNRS). Varela wrote an essay (1999) that depicted the perceived 'now' within an individual. The notion that neuronal synchronicity provided the inference that neuronal cells that fire in unison, bring about a unity in mental and cognitive experience. The perception of time was approached via phenomenological analysis and from the approach of cognitive neuroscience. Dr. Varela's work has been received academically by those in multiple fields of academic research, including consciousness and cognitive studies, phenomenology, and brain and behavioural studies. The

manuscript furthers the investigation into the philosophy of mind and provides direct neuroscience aspects on mental activity and temporal representation of information within the discipline of physics. The domains that investigate the roles of consciousness must include an account of the very laws that govern our physical reality.

All sensory receptors have a specific receptor field that is specialized towards the part of the world to which it is designed to respond. The sensory taste system responds to molecules of food, turning chemical energy into neural action potential. The visual system reacts to photons of light. The minimum stimulus from the external world that is necessary to promote detection is known as the absolute threshold. However signal detection is not perfectly 100% accurate. The same stimulus magnitude could sometimes be detected and sometimes not. Because there is always variation in the similar stimulus intensity, the threshold value of sensory receptors are variable and change over time. In 1978, John Swets and colleagues (1978) investigated the relationship of signal identification as compared to signal detection, culminating the understanding of the Signal Detection Theory (SDT). Within this theory, there are developed reasons for explaining why signal detection is not always 100% accurate.

The first reason explains that the signal detection threshold may be dependent upon the observer's sensitivity. As a signal is made more intense, it becomes more detectable. When the signal is weaker, the threshold value for stimulation of the sensory receptors is less detectable. Considering that an observer is continually bombarded by sensations from their environment, the sensitivity of signal detection may be hindered by background noise. Aside from extraneous environmental noise, unpredictable neural noise can act like background static, making the detection of the specific stimulus difficult. Consider the effects after leaving a rock concert. Many people comment that their ears are ringing, and with this background neural activity, weak

signal detection can be variable. Even though the observer may normally respond to specifically weak stimulus, the added noise that is accompanied by the bombardment of signals within the manifold of reality may account for the lack of 100% accuracy.

Another possible reason for explanation of the identified problem of signal detection variability is that the observer may have a response bias. This is considered a non-sensory factor. Examine the familiarity of language detection. When an observer is fluent with their native language, the identification and separation of words from the stream of verbal stimulating flow is subconscious. When presented with a foreign language, the observer exhibits a noticeable difficulty distinguishing and separating words the same flow of stimulation. Another form of non-sensory response bias comes from the observer's personal expectations and motivations to respond. While sitting in a Doctor's waiting room, the observer may have an expectation of hearing the name being called and can affect the accuracy of signal detection. The perception of common versus uncommon words leads to a criterion of bias within a statistical decision making model (Broadbent, 1967). Personal motivational factors involving nutrition and food can also demonstrate variability.

The subjective experience of the individual demand an interdisciplinary approach. The role of conscious in piecing together the sensory information also necessitates such a degree of synthesis. Balas & Sinha (2007) published research conducted from the Department of Brain and Cognitive Sciences from the Massachusetts Institute of Technology (MIT) in Cambridge, USA. The authors provided the appreciated research as cited by consciousness and cognitive sciences, and vision/optics researchers. Their research investigated the subjective experiences of an individual in a world of full colour and their conscious role of 'filling-in' missing colour (with a grey center) of natural occurring scenes. The brain actively tries to 'fill-in' gaps in the

environmental information it receives from the body. This research would strengthen the resolve to promote the brain's processing of information before conscious awareness. As indicated by Balas & Sinha (2007), the human conscious experience can be misleading, especially when it comes to the visual perceptive system.

Another form of sensory information prone to perception error are sounds. This form of mechanical energy is a succession of compressions and decompressions of air molecules. These patterns of the air molecules create changes of successive waves in the air pressure. The physical properties of sound waves are comprised by measuring their frequency, amplitude or intensity, and complexity. Because the physiological dimensions of sound ultimately affect the psychological perceptions of sound, an alteration in these physical dimensions will produce alterations to appropriate subjective perceptions.

Frequency is how rapidly the cycle of air pressure changes occur. The cycle consists of a full alteration from compression to decompression back to compression. The wavelength is thus an interlinear distance between successive compressions which can also be measured by successive decompressions. The number of cycles per second is equal to one Hertz (Hz). The standard humanly audible range of frequency perception ranges from 20 Hz – 20,000 Hz. Frequency is therefore proportional to velocity and wavelength such that the measure of wavelength is $\lambda = \text{velocity} / \text{frequency}$. The comparative psychological dimension of frequency is the perceived pitch of the sound. The perceived pitch by the listener is how high or low sounds experienced. The larger the frequency, the greater the number of cycles per second the sounds wave has, and thus the higher the sound's pitch is perceived. The lower the frequency, the lower the number of cycles per second the sound wave has, and thus the lower the sound's pitch is perceived.

Amplitude or intensity is the amount of change in air pressure the sound wave exerts. The amplitude therefore physically depends on the force per unit area and can be measured as a dynes/cm² or equivalently one Newton/m². This mathematical representation of changes in amplitude and air pressure can be represented by a logarithmic scale of pressure that is collectively measured as a decibel (dB). The formula for calculating the number of decibels is = $20 \log (\text{sound pressure}) / (\text{standard reference pressure})$. The corresponding psychological dimension of amplitude is loudness. Loudness is the auditory perceived sensation of sound intensity. A sound that has high amplitude sound waves is psychologically perceived to be a loud sound. Sound that has low amplitude sound waves is psychologically perceived to be a soft or quiet sound.

Mechanical energy of sound can also be physically described by its complexity. Because some sounds do not vibrate at a single frequency, additional vibrations involved in the sound wave are frequency multiples. These multiples are called harmonics of the fundamental frequency of the sound. Because single sound waves are rarely heard in isolation, the psychological dimension of complexity is called timbre. The combination of the multiple frequencies within a musical note is also called the harmonic tone complex. The tones blend together into one perceived sound due to the complexity of the timbre.

When considering humans are living within an environment that is continually bombarding the sensory system, trying to understand the complexity of such a manifold is best dealt with by a notion of error for these elementary sensations. Two different realms of scientific research have produced distinguished understandings of the fundamental problems with sensation and perception complexity. The culmination is the production of the complimentary three-dimensional effects of the three-dimensional world we live in. The replicative associations are

therefore prone to an error term that limits the exact understanding of the measurement of reality. In short, human organisms do not perceive reality as it perfectly is.

1.3.3 Problems with Measuring Human Behaviour

Throughout Psychology, measuring human behaviour is inherently a difficult problem. An individual can be presented with a myriad of sensory signals that have variable impact and variable processing times by the individual. The observable behavioural traits are complex and can present difficult interpretations when attributing causal effect. Measuring human behaviour has been an ongoing problem of consensus within the literature and scientific community. In 1921, Thorndike reported in the *Journal of Educational Psychology* (Thorndike, 1921) of a symposium where 17 leading psychologists attempted to define intelligence by answering the questions: What is intelligence?, How can it best be measured in group tests?, and What should be the next steps in research?. The results of the symposium were no two psychologist agreed on any of the answers.

Personality testing therefore relies on a probe into the aspects of human behavior that can be referenced to the individual in general, and how the human individual then interacts with their environment. Ability testing is used to understand how an individual is capable of achievement and is tested via situational settings, referring to an individual's strengths as it is applied within a certain domain of abilities and capable accomplishments. Personality tests are often broad and are typically administered through questionnaire techniques. Personality traits describe how an individual's behavior is typically to be expressed over an estimated average of time. A trait is a mode of behaving that the individual exemplifies my certain attributes of their behavior. Differences in personality are categorized by different personality traits, and these can differ from cultures and vary within a multitude of dimensions. Objective self-report assessment

methods of personality are designed to reduce the individual to answer objectively towards a pre-determined category. These tests are convenient to administer due to their restrictive answering nature and are thus convenient to score. The projective method of answering behavior questions grants the individual freedom to express themselves without restrictive limitations.

Binet was a founding contributor to the first tests of a subject's mental capacities. Binet collaborated with Simon in 1905 to develop the Binet-Simon scale which consisted of 30 problems arranged in order of difficulty. The purpose for developing a mental test was to have method of classifying problem learners in school. It was thought that children could not respond successfully in a normal school setting and should be examined and possibly assigned to special classes. Future tests concentrated on judgment comprehension, reasoning and included more verbal content. Binet's attempts to test the intelligence of human beings spawned a cascade of revisions and efforts to develop a scale that would truly represent intelligence.

Galton (1869) believed that intelligence was related to sensory ability. Galton attempted to assess intelligence by measuring sensory abilities such as sensitivity to sound, color perception, and reaction time. Galton pioneered the normal distribution application to intelligence results and measuring psychological attributes. Although failing to correlate intelligence with these sensory abilities, Galton's work paved the way for subsequent research on assessing mental abilities.

Cattell, a student of Galton's, later coined the term "mental test" in the year 1890. This was the first time the world of psychological science was introduced to the concept of administering a scientific test to measure intelligence. Cattell assured that the measurement technique of mental testing should be primarily comprised of sensory and muscular tasks. These included measures of muscular strength, speed of movement, tenets of vision and hearing, sensory discrimination,

and reaction time. Cattell developed tests, founded laboratories rooted in experimental psychology, and aided the influential testing movement of the human psyche. The methodological contribution to testing used masses of data questionnaires ratings and statistical methods to introduce the use of the normal curve to psychometrics.

The advantages of administering a forced choice format technique in psychological testing are the results obtained demonstrate common-place social acceptability and social desirability. The individual is judged within the forced choice of formats, and this shows positive correlation in describing personality with the average of agreeable population answers within society. Forcing the individual to choose between two or more terms, from answers that are all acceptable within society, creates a master association of personality and social desirability. There is no chance right or wrong answer, but a channeling of opinion into the description of how the person would behave within a questionnaire situation.

Heiner (1983) reasoned that many of the techniques used for predicting behaviours are simply revisions of older predictions. This proposes the notion that there is no perfect prediction of behaviour. Ideas about predicting and understanding human behaviour have been around for a long time, and no model has presented as consistent. A realization occurs that the objectives of predictions are rather to maximize efficiency and reduce unnecessary energy consumption. The sensations of human experiences are apprehended through the intuitions of space and time which are structured as causal connections via the concepts of a priori categories of the understanding. Understanding the degree to which a human being behaves must consider multiple aspects of such an existence.

H. J. Eysenck's theory of personality (2012) is described in terms of emotional dimensions. The dimensions include choleric, sanguine, phlegmatic, and melancholic and are described within a two dimensional space, categorized in summery as based on how one person might score off of a psychological assessment. The combination of traits and the modeling of personality is within a wide spectrum of possible emotions and possible personalities. It is possible to have conflicting results of introverted-extrovert or ironic-stable combinations of human personality.

People vary widely in the performance of psychological testing, personality traits are associated with activity and distinct cerebral regions. The differences in cerebral organization are created by the combination of genetically predetermined structures and environmental factors. These differences form the basis for different human personalities and create a vast variability in human behaviour and interactions with their local environment. The assertion then follows that not everyone interacts with their environment in the same way.

A clear problem in investigating this core question is how does one attempt to research something that is variable across individuals? When researchers attempt to investigate what produces a certain emotional behaviour in a subject, the researcher is faced with cascading and exponential imposing factors on a scientific study. The possibility exists that two or more stimuli could be present at the same time. Both can be the effect of the corresponding outcome, mounting to an observable behavior.

Osgood (1952) proposed the potential degrees of measuring semantic meaning by utilizing a dimensional rating scale. The categorical definition of emotion presupposes that there is one system for each emotion, with no spectrum of possibility. Whether it be dimensional or categorical, the theory in question is attempting to grasp an understanding of emotions within a

subjective individual. Examples of optical illusions and visual phenomena also demonstrate the vital role the brain plays in providing the individual with a complete picture of the immediate environment.

This review of the literature then leads to the question; in what role does the environment influence an individual's conscious perception? Research of peer-reviewed literatures on the topic by Shirley & Langan-Fox, (1996), provided a detailed overview of hypothesis about how such an environmental intuition works. Cited by such disciplines as the science of learning, imagination, cognition and personality journals, the paper commented on how researchers and scholars do not have a fundamental and agreeable definition. Elaborate and historical investigations already conducted within the 'intuition' framework further the resolve that the role of intuition is an interdisciplinary question, which will require an interdisciplinary approach.

Von Glaserfeld & Ackermann (2011) categorized the role of consciousness from research they conducted within the Design Lab from the Massachusetts Institute of Technology (MIT) in Cambridge, USA. Utilizing their combined backgrounds in psychology and epistemology, Glaserfeld & Ackermann indicated a gap in the literature pertaining to the nature of subjective experience and the role of consciousness. By investigating a child's origins of the development of an experience, a categorization was evident and was more distinguished between a learned pattern of behaviour than a cognitive recognition. The implications of this research further the conversation on the development of human experience and the intricacies of consciousness.

The Institute of Psychology from the Braunschweig University of Technology, the Department of Psychology from the Dresden University of Technology, and the Department of Psychology from the University of Osnabrück, all provided the setting for a collaborative investigation.

Bolte, Goschke, and Kuhl (2003) published research with citations from over 303 further peer-reviewed publications involving cognition and emotion, personality, and social psychology. The authors concluded through two experimental designs that the ability of mind and memory within a participant is dependent upon their mood at the time of consolidation. This finding would further resolve that information processing within the brain is temporally (time) dependent upon emotional underpinnings. Not only does the current mood state of the participant and their social environment play a role in an individual's cognitive capacity, but also in their subjective experience of events.

Concepts surrounding information and signal transmission should also be incorporated into the interdisciplinary approach to investigating the role of environment upon influencing a human individual. Colombetti (2013) recommended an integrated 'affective neurophysiophenomenology' to investigate first-person methods, which would aid in the investigation of emotion and how experiences relate to brain and body activity. The outlined literatures have developed a conceptual framework of the role of consciousness. The framework now includes the binding of sensory information and the dependency of consciousness on the emotional state of the individual.

Svaetichin, Krattenmacher and Laufer (1960) confirmed that the amplitude of a visual stimulus response is proportional to the logarithm of the intensity of the light stimulus. The research made an impact in such disciplines as vision research, biology, and even military electronics. These results imply that information received from the eye (body) is representative of the external environment. The problem with the current literature is the in-ability to consider the vast array of stimuli that may be influencing the human organism, at any given time.

1.3.4 Problems with the Time of Measuring Human Behaviour

Time is always a constant throughout the presentations of stimuli to an individual for the purposes of studying the response behaviours. Another problem identified in what we know about the influences of the Earth's environment on human behaviour is the apparent lag or lead of the time of presentation of the stimulus event in question.

With such vast cascades of variability and degrees of freedom, stimuli interacting with human organisms have been in motion long before individual sensation and processed perception. Even when an influence from the Earth's environment reaches an individual human, formulation of the measurable behaviour is not always immediate. Internal processing of the information also takes time. The forethought, planning and execution of behaviours indicate significant resources of the individual are dedicated to future expectations of how the environment will be inevitably changed. These expected influences from the environment are often difficult to measure.

Self-control of an organism is when the organism chooses a large delayed reward over an immediately presented small reward. The value discounting function is represented as a mathematical formula that illustrates the parameters of self-control such that: $V = M/(1+KD)$; where: V = the value of the reinforcer, M = the reward magnitude, D = the reward delay time, and K = discounting rate parameter. The value of the reinforcer is reduced by how long one must wait to receive a reward. Should the reinforcer be delivered with no delay, then $D = 0$. The larger reinforcers introduced to the organism have larger values of magnitude and are therefore proportional. The element of time delay is included in the equation. The longer the reinforcer is delayed, the smaller the value of the reinforcer. Because the reward value decreases rapidly with the amount of time delayed, the potentially perceived value of a large delayed reward is smaller

than the value of the immediately presented small reward. Kollins (2003) reviewed the spectrum of reward-discounting functions, noticing that overt and risky behaviours could be measuring an important feature of behaviour, especially within relevant self-control scenarios comprising broad ranges of situations.

Behavioral regulation is the focus on how an organism's activities can be limited by the implementation of the instrumental contingencies. It is the focus on how the extent of a response reinforcer contingency forces the organism or restricts the organism from the preferred distribution of regular behavioural activities. The introduction of the response reinforcer contingency therefore forces the redistribution of an organism's behavior. When an organism is free to distribute their responses among their available methods of behavior, it occurs within an optimal response period. This optimal response distribution of behavior is called the behavioral bliss point. This bliss point is identified by frequency of occurrence of all the organism's responses within an unconstrained, free situation.

The preferred distribution of activities is before any instrumental conditioning procedure is introduced. With the implementation of an instrumental conditioning procedure, constraints and influences are set upon the organism's response and any allocations of potential responses. The introduction of the response reinforcer contingency by the implemented instrumental conditioning procedure forces the redistribution of behavior between instrumental and contingent responses. Considering that the bliss point is always the preferred distribution of an organism's behavior, the redistribution caused by response reinforcer contingency minimizes the total deviation away from the bliss point.

There are shortcomings of the behavioral bliss point approach to describing behavioral regulation. Choices or responses in the previously free operant time period, cannot be compared to have the same values as the responses that occur as part of the arranged instrumental contingency. Predictions of the organism's behavior are therefore affected and cannot be adequately compared. This again presents a fundamental problem when measuring human behaviour and inferring potential influences from the local environment. This approach may provide an understanding to the trade-offs an organism makes between alternatives. However this approach does not explain the processes involved in making those trade-offs. Solutions to behavioral problems must consider the complex content of which reinforcement procedures are implemented.

Describing behavioral regulation within organisms assumes that individuals have preferred distribution of activities. Humans will continually seek to maintain these preferences despite disruptions (analogous homeostatic mechanisms). When the optimal goal behavior is unattainable by restrictions imposed, the redistribution of behavioral responses is a matter of compromise. The assumption of such mechanisms is another shortcoming. The differences in response patterns of an organism should not matter. An efficient definition of the behavioral bliss point would therefore require information about the molecular patterns of choice within the animal's brain, and the timing of all stimuli from the environment.

1.3.5 Problems with the Understanding of Understanding

An alternative view of consciousness is that it plays the role of a buffer, only making aware to the host the bits of information that are deemed necessary and most vital to survival. The illusion that consciousness is a direct comparison to the external world is very commonly accompanied with causality associations. There is a relative time shift in what the unconscious

processes and what is made aware consciously. There is approximately 350 milliseconds of delay between brain activity and conscious volition (Grey 2004). Any form of measurement (sensation) is an extension of the human perception, from which the structure of the perception is temporally reliant.

Rene Descartes in part three of *Rules for the Direction of the Mind*, a development for proper method for scientific and philosophical thinking affirms that intuition is most definitely needed for human understanding (Descartes, 1684). In the earlier *Discourse on Method*, Descartes implies that intuition is understood as a background factor for deductive reasoning (Descartes, 1637). The purpose of Descartes' philosophy was to produce a method of solution that gives the individual a better way of life by conducting our human reasoning capabilities to its full potential. Descartes admits the usefulness of intuition when searching for certain knowledge. The use is limited for numerous simple methods of understanding basic principles, as compared to the complex reasoning of deduction that yields conclusions.

Baruch Spinoza identified three kinds of knowledge in part two of *The Ethics* (Spinoza, 1677). Spinoza defined intuition as that which is necessary since having emerged from reason for the purpose of activity and freedom. Baruch Spinoza declares mathematics as the understanding of both causal connections and essential relations within reality. Unlike Rene Descartes who considers these things of the mind and body to be separate, Spinoza displays a monist outlook. "*The order and connection of ideas is the same as the order and connection of things*" (Spinoza, 1677). It is through the similar connections of our body and our mind that we can understand ourselves as human beings.

David Hume in an *Enquiry Concerning Human Understanding* interprets the two most basic elements of the mind are ideas and impressions. Hume disliked the thought of intuitive impressions stating that all forms of knowledge are rooted in past experiences (Hume, 1748). Hume presents a skeptical approach to the literature of understanding and concludes that the human understanding gains knowledge via ideas and impressions. The relation between these two elements of the mind is that of dependence; impressions come first, and ideas follow. It is important to distinguish Hume's understanding of impressions as that which are emotionally determined by the body (a problem previously presented). As the body receives emotional impressions cast on it by reality, they are immediately associated to past ideas of resemblance, continuity, and causality. The relation of cause and effect are not based on reason and therefore cannot present anything a priori; certain knowledge cannot come before any experience.

Immanuel Kant in the *Prolegomena to Any Future Metaphysics* formulated the understanding that such things as pure intuitions (space and time) are necessary preconditions for there to be any experience at all (Kant, 1783). Without experience there is no longer the ability to pursue any form of certain knowledge. Every experience a human being will have will be within a spatial temporal context (space and time) and every knowledgeable claim will match up with the pure categories of the understanding within the mind. Immanuel Kant wrote: "*Here intuition, being an intuition a priori, is inseparably joined with the concept before all experience or particular perception*" (Kant, 1783). The pursuit of certain knowledge does require the use of pure intuitions about the surrounding environment, including those of space and time and the a priori problems surrounding such an understanding.

It is therefore cautioned to assume that because knowledge arises from experience that it is therefore grounded in experience. Some certain knowledge of the Earth's influence upon the

individual is acquired a priori. The identified problem that sensation is already dependent upon a systematical understanding of the nature of reality and the surrounding environment, implicates nearly all previously published research. Humanity does not have the mental capabilities to think outside the framing concepts of the cognitive brain. These sensations or human impressions from the effective local Earth environment are apprehended through the intuitions of space and time. Structured as substances in causal connections via disciplinary concepts form the a priori categories of the understanding. It is through the categories of the understanding and the language used within disciplines, which all knowledge is acquired, and a true understanding of reality resides.

1.4 Proposed Investigation

The theme of '*measurement*' is the underlying issue of what is lacking from the reviewed literature. The modern age of digital technology have seen notable increases in the personalization of an individual's experience and interaction with their immediate environment. The advent of the ability to predict human behaviour therefore comes with a powerful aspect. It has been postulated that the eventual ability of political parties to broadcast influential messaging to specific households, based on their party affiliation. The interest of corporations into the purchasing habits of individuals and the mass capitalistic advantages of big data analysis involving human behaviours is now apparent. Predictability research has been advancing and data acquisition has focused around the individual and their behavioural habits. What has been lacking from the literature is an understanding of the variable nature of which the human organism operates.

The wildly unpredictable human behaviour covers vast degrees of freedom. Developing a predictive model or an equation of variables that will predict one hundred percent (100%) of the outcomes of human behaviour is theoretically difficult to obtain. There is only a slight ability to predict even the smallest percentage of human behaviour variance. Industries such as education institutions (Robbins et al, 2004), market research for phone companies (Choujaa & Dulay, 2010), politics and violence prevention (Monahan, 1984) and even risk assessments for insurance companies (Rasmussen et al, 1990), spend a great deal of time and money researching predictive models.

Heiner (1983) reasoned that techniques for predicting behaviours are revisions of older predictions. The ability to know when an aversive event will occur enables an individual to

predict the absence of aversive stimulation. Signals that enable an individual to predict the absences of an aversive attacking stimulus are considered conditioned inhibitory stimuli. Through inhibitory conditioning, individuals learn to predict the absence of such unconditioned stimulus. The research reviewed was lacking implementation of various techniques to investigate the potential for predicting human behaviours that are based on the influences of the local Earth environment. The process of logic and the requirement of comparisons needed for decision making are constructed from the residual representations of patterns of reality between largely distributed networks within the brain. The coupling involved in episodic memory requires associated space and temporal referents to the experiences that have occurred within the environment, specifically at the time of occurrence.

The synchronization of excitatory phases of different frequencies is known as cross-frequency (CF) phase coupling (Pletzer et al., 2010). Rhythmic synchronization of activity initiates a cascade of firing signals of information to spread throughout a neural assembly. In the case of an inactive brain state, spurious cross-frequency synchronization may occur and is characterized as an unwanted or erroneous synchronization between the two unassociated frequencies. The spurious cross-frequency synchronization of two different oscillating fluctuations of activity does still play an important and active role for information processing (Pletzer et al., 2010). Different fluctuating frequencies as recorded by an electroencephalograph are related to the timing of different parts of the brain network.

The importance of quantum information processing was lacking and is necessary to be present within the constructs of consciousness. The various patterns and sequences within the universe not only contain information about a system (classically activity and location), but some patterns can also carry complex procedural information. This indicates that information required to make

a prediction about a system may not be restricted to the physical measurement alone. The necessary information required to make a prediction is also contained within the totality of the system. Quantum Stochastic Processes theoretically enable matter decoherence within brain space. Such limitations concerning the information contained within the individual must be carefully confounded to the Bekenstein Bound (Bekenstein, 1981) which is the maximal amount of energy required to perfectly describe any such physical system.

The Universe is constructed with measurable information. Energy and Matter can be considered as residuals from the information sharing processes. The representation of recognized patterns represent reality. Pattern recognition must depend upon acquisitions and recollections of complex procedures. This process is thus subject to the limitations of the brain. Conveniently, the brain specializes in entropy recollection. In cognitive tasks such as memorization, retrieval and decision making, there are a multitude of information processing steps that are characterized by specific signal transmission patterns. When two different frequencies are compared (f_1, f_2), their numerical ratio determines the occurrence of synchronization. An efficient use of energy for memory retrieval must involve the recollection of correctly associated patterns for representational reconstruction.

The interference of spurious cross-frequency synchronization is best characterized as the least desired of all processing states within the brain. In a mathematical sense, the two frequencies involved in the spurious interference should have never synchronized if the frequency relationship (f_1, f_2 ; where: $f_2 > f_1$), was irrational (Pletzer et al., 2010). Therefore, the classical excitatory bands would never have met, and this is representative as the optimally efficient use of energy and resources.

The highest de-synchronization state would be the most optimal for neuronal information processing. A mathematical example is the un-obtainable and irrational value of Phi [$\Phi = 1.618033988749895\dots$]. This ratio provides the highest de-synchronization state, provides spontaneous irregular coupling & uncoupling, and provides the opportunity for transition from a resting brain state into activity (Pletzer et al., 2010).

The efficient use of harmonics in multivariate pattern recognition has not nearly been utilized in the literature. The combining of information across extended regions of the brain strongly increases sensitivity for enhanced pattern recognition and recollection (Pletzer et al., 2010). Assuming the whole numbers 1 – 9 as equivalents of the harmonics in the sense of wave theory, the power spectral density E is the eigenstate energy-frequency relationship $E = nf$ ($kT \ln 2$), where f is frequency (Hawking, 2007). Thermodynamic measurement of 1 bit of information entropy is perceived within the 1 perceptual moment of the harmonic. This means 1 break of symmetry and 1 phase reversal after each zero-crossing of an electroencephalographic wave corresponds with a possible 1 bit decision between the choices of two alternatives (Weiss, 2003).

Intentions and memories are not stored in single neurons but are in a whole spatial-pattern of brain activity. It has been proposed that the hippocampus establishes the ‘time’ occurrence of simultaneous and coordinated neural activity (Cheng & Frank, 2008). The cooperation of the rhythmic oscillations throughout the brain is utilized by the bit of information contained in the harmonics of the residually stored, reverberating cortical circuit. With over two hundred million columns, the neocortex contains substantial combinatory possibility, with variability, that is not nearly presented enough as contributing to the relativity of individual perspectives.

Possible innate and adaptive uses of stochastically evolving dynamic stimuli can help refine estimates derived from internal timekeeping mechanisms (Ahrens, 2011). This would provide the most efficient use of encoding information across the various areas of the neocortex and could be the underlying capacitance operations of the hippocampal formation.

What is lacking from the literature is the foundational understanding that human behaviour can be influenced by the individual's local environment. Cycles upon cycles of compounding influences have been observed throughout historical academics. Recent publications on the topic of synchronizations between human organisms include geomagnetic activity of the planetary environment (McCraty, et.al., 2017). An experimental design that would seek to understand how the entire population is influenced by the environment is limited by the very individual aspects and degrees of freedom of human emotional behaviour. The likelihood of developing a global survey that records the moment to moment human behaviour is unattainable. Language differences make communication between humans a daunting task. Even a live record of human emotional behaviour is limited by sleeping patterns where half of the Earth is likely asleep at any given moment.

The nature of human behaviour spans definition into many disciplines. An interdisciplinary synthesis of research methods is required to investigate the problem. A single discipline by itself could not accomplish the same comprehensive understanding of the problem of predicting human behaviour. The combination of quantitative and qualitative research provides alternative insights into investigative queries. Such an interdisciplinary approach to research methodology is considered wholesome and of greater value than any one individual method of research and analysis on itself.

1.4.1 Research Methods

The presented paper serves to provide structure to the complexity of human understanding. When the ‘big picture’ of similarities and patterns are revealed across the specialized disciplines, predictions can be developed. The limitations of known measurements of Human behaviour are abridged by the thesis investigation of how the global environment influences objective and summative measures of the entire population. When a discipline presents a limitation in one aspect of the operational definition, it is not due to a limit of phenomena. Reviewing a lack of a language to explain phenomena will be utilized as insight into the aspects of the discipline that have yet to be resolved and understood.

The functional operation of the human brain takes in sensory information from the surrounding local environment and binds these definitions to create the functional consciousness of what has previously transpired. The sensory signals to the brain are encoded with the sensory information of the body itself. There is logically going to be a direct relation between the brain, behaviour, and the stimuli from the local organism’s environment. The brain must construct consciousness external awareness from what is available in the non-conscious neurological processes of sensory input. The conscious mind results from neurological communications inside the brain and body. This research proposes to bring the subtle environmental influences into mainstream focus. Investigating what relevant influences of the Earth’s environment exist on human behaviour, extending to disease incidences and relative perspectives of reality.

The collection of global data pertaining directly to human behaviour permits inferential examination. Pattern recognition and interpretation of mechanisms are also involved without the confound of subjective-objective limitations. The communication and translation of behavioural

subjective perspectives permits an insight into domains that are otherwise not observable. without an individual's willingness to share their internal states. The interdisciplinary methods of observation and interpretation enable an understanding of complex topics. The intuitional state of the individual Human organism will be assumed. The following research project will promote different methods of data analysis that will examine the variable ways of techniques of observation, communication, interpretation, and measurement of human behaviour on global scales. As the research proceeds, parallel patterns will begin to emerge, defining the interdisciplinary nature of the human interactions with their local influencing environment. It is therefore important to take note of the overlaps and the combined use of similar 'operational' terminology that is used among certain disciplines.

Retrieving global news as a sample of global human behaviour can accurately portray the behaviours of the general population, including individuals. Analytical power will be increased, and the variability of the individual can be accounted. General unrest, conflict, violence, success, appreciation, and glorification can be studied across the globe. Instantaneous communication of the news will be utilized from the internet. News from around the world can be useful in supplementing the otherwise unattainable insight into the behaviours of a global population and the time limitations of sensation and perception previously described.

A synthesis of the literatures and disciplines from neuroscience, psychology, and physics will be utilized. The large variability of the Earth's system is also dependent upon the interactions within the solar system proper. These relations can have temporal delays upwards of 61 days, (Stamper, et. al., 1999) (Neto et. al. 2012). A control implemented over the data collected will be to investigate the temporal relations between the recorded measures. Even the Earth takes

time for Solar influences to propagate and become visibly measurable. The influences of the Earth's system upon Human behaviour and disease must also be taken under the same regiment.

The collection of data pertaining directly to human behaviour permits inferential examination and interpretation of mechanisms involved. These behavioural perspectives provide insight into domains that are otherwise not measurable without an individual's willingness to share internal states of consciousness. The interdisciplinary methods of observation and interpretation enable this understanding.

Continually reviewing the literature of human behaviour will provide an insight into the aspects of the language used to understanding of such behaviours. Terminology can vary across disciplines. A focus of the specific words used in the articles will be identified with etiological definitions for each key term. The author's demographic information will serve to provide relative evaluation of the author's work, while considering how such background information is reflected within the article. This type of analysis is a blend of traditional and biographical literary criticisms.

The progression of understanding will also be facilitated by the identified associations of relative observations. The term 'default argument' will serve to represent the commonalities and terms utilized within each discipline, especially when an empirical observation is unexplainable. When one recognizes the use of such words, the familiarity of the 'default' terms will serve to purport the expanse of the unknown (i.e. 'non-universal' terminology) within the discipline. The result of progressing through presented terms within each discipline is an interdisciplinary insight into the human understanding of reality and how that reality is shaped by environmental influences.

It is also important to note that the use of metaphors to deal with complex information will also provide insight into the similarities across the disciplines. Most of the processes, operations and associations that will be presented are metaphorical in structure. Each metaphor will define a group set with structured or organized terms and will attempt to relate an explanation of phenomena that is complicated, so it is able to be comprehended. The operational definitions will therefore be the integrators across the multiple disciplines and will provide a synthesis of parallel patterns that exist across the specialized silos of humanity's understanding of complex reality.

The expected results will provide a detailed insight into the terminology within the 'human behaviour' research community. It is also expected that the biographical criticism will enable a clear understanding of how different researchers use, and operationally define the language on human behaviours. Such examples expected will be a combination of explaining physical actions and observable emotions that are directly related to individuals. Differences within sub-groups of the human population are also expected to be identified as the variability of beliefs within different cultures can influence the local literature.

The process of an individual's social categorization is an efficient use of the species energy and cognitive resources. This process of outside awareness for an individual is typically through unconscious avenues. The automatic processing of implicit thinking is effortless, habitual, and usually without individual cognitive awareness. The evolutionary advantages of identifying group membership from observable global behaviours is for the determination of shared responsibilities within the group dynamic. Territory defense, available resources, and sexual reproduction, etc., are factors that depend upon the Earth's environmental and social network. Social network size is therefore found as a contributing factor to brain structure and function,

relating back to the unique relative perspective of the individual's reality within the group's observable, collective behaviour.

This research will serve to identify the operational definitions of human interactions and the influences of the environment through each major discipline. Each respective discipline will use language to explain phenomenon within certain aspects of the various operational definitions. These operational definitions will then provide the grounding basis from which an interdisciplinary synthesis can be made. The culmination is an insight into the fundamentals of knowledge and understanding of reality. The variable multiple perspectives within each discipline are then able to be related through the concluded operational definitions.

Variations of human behaviours are so diverse. Investigating the problem of predicting and understanding human behaviour from subtle environmental energies must utilize an interdisciplinary method of investigation. A single discipline by itself could not accomplish the same comprehensive understanding of the problem of predicting human behaviour.

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Chapter 2 - Inverse Correlations between Daily Average Energy of Global 0.01 to 1 M Earthquakes and Solar Flux Units: Possible Source of Coupling

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2.0 Abstract

The potential coupling between discrete releases of solar energy within the 2.8 GHz band and increments of seismic energy could suggest alternative mechanisms for solar-terrestrial interactions. Daily measures of Solar Flux Units (SFU) and the average energy of global earthquakes between 0.01 and 1 M for a 5 year period (2009-2013) shared about 25% of the same variance ($r=-0.50$). Average energies from the other successive 1 M intervals did not display the strength of this effect or were not statistically significant. The slope of the association indicated that for every $10^{-22} \text{ W/m}^2\text{Hz}^1$ decrease in daily SFUs the average energy per earthquake in the 0.01 to 1 M range increased over the earth's surface area on average by $\sim 3 \times 10^{-12} \text{ J/m}^2$. The discrepancy in of $\sim 10^{10}$ in energy density was accommodated by multiplication of the solar unit by the frequency equivalent ($1.39 \times 10^{10} \text{ Hz/T}$) of the Bohr magneton and its intrinsic magnetic field strength. Although the results and the convergent quantification suggest a coupling between the mechanisms responsible for fluctuations in 2.8 GHz power from the sun and the energies of the smallest magnitude earthquake activities as predicted, the presence of a third factor related to time or to the sun's movement through space must still be accommodated.

2.0.1 Keywords

Solar Flux Units; Small Magnitude Earthquakes; Solar-Seismic Equilibrium Energies; Bohr magneton Transposition

2.1 Introduction

Most models of solar-earth mass interactions employ classic Newtonian solutions where the modal force between the two bodies is in the order of 10^{22} N. If one assumes this change of force was applied over the earth's surface (5.1×10^{14} m²) equally the proportion within the area occupied by an ionic bond ($\sim 6 \times 10^{-20}$ m²) would be equivalent to about 10^{-12} N. On the other hand the electric force between two charges at the distance of an ionic bond is more than 10^5 times greater ($\sim 4 \times 10^{-9}$ N). Consequently gravitational changes are often considered negligible. The increasing and decreasing variation in force as earth completes its annual revolution is 2.3×10^{21} N or about 10^{14} N/s. The apparent minimal contribution from gravitational phenomena at these intervals of temporal change compared to electromagnetic interactions is particularly poignant when the rate of change for gravitational force over the earth's surface per second during the orbit ($\sim 1.4 \times 10^{-1}$ N/m²s) is compared to the analogous units for an ionic force (4×10^{-9} N) per second (6.58×10^{15} Hz the Bohr frequency) divided by the cross-sectional area of the bond.

There may be other approaches that demonstrate a quantitative coupling between solar activity and specific increments of energy release by terrestrial seismicity. Persinger (2014) calculated that conversion energy from the movement of the solar system through universal pressure (Persinger, 2009) would be equivalent to the energy emission from global seismicity. Vares and Persinger (2013) have shown that discrepancies in the distribution of magnitudes of earthquakes, particularly the 3.6 to 3.7 M increment, could be related to potential coupling to Zero Point Fluctuation forces and quantum energies. The relationship between solar activity, as inferred by electromagnetic emissions and global seismic activity has been assumed to be unidirectional as originating from the sun. However, Sytinkij (1989) found that earthquakes preceded

geomagnetic activity by 1 or 2 days. This association suggests greater simultaneity between solar-terrestrial releases of energy than typically assumed and perhaps a shared source of variance yet to be discerned rather than causal connections.

The possibility that solar-terrestrial coupling is an equilibrium process such that increases in solar energy are associated with diminishments of energy release within specific magnitudes of seismic activity could alter the current cause-effect models. The inverse association would suggest that the system exhibits a form of homeostasis or “equilibrium” and that this condition of the system could be influenced by third factors as the sun moves through a different space around the galactic center. Here we present evidence that a moderately strong inverse correlation occurs between daily solar activity, as measured in Solar Flux Units, and the small magnitude earthquakes that constitute almost 40% of all seismic events on the planet.

2.2 Methods and Materials

The Advanced National Seismic System (ANSS) global composite earthquake catalogue of the U.S. Geological Survey (USGS) was accessed and any earthquake registering above the minimum 0.01 magnitude value was queried from January 1, 2009 until December 31, 2013 for a total number of days $N = 1826$. MatLab software was utilized to compute daily average Earthquake radiated energy, daily total Earthquake radiated energy, and daily total number of recorded Earthquakes for each the orders of magnitude (0.01-1M, 1.01-2M, etc.). The following table depicts the daily seismic average activity with standard deviations in parentheses.

Table 2.1 Total numbers of events, the average energy of the events and the total energy per day for global earthquakes within 1 M increments of magnitude for five years (2009-2013).

Magnitude	Days	Total Number	Average Energy (J)	Total Energy (J)
0.01 – 1.00 M	1826	108.73 (33.24)	7.04E5 (9.01E4)	7.57E7 (2.28E7)
1.01 – 2.00 M	1826	100.07 (41.69)	1.44E7 (2.05E6)	1.46E9 (8.22E8)
2.01 – 3.00 M	1826	35.65 (33.50)	4.38E8 (1.12E8)	1.57E10 (1.71E10)
3.01 – 4.00 M	1819	8.70 (10.04)	2.21E10 (1.14E10)	1.87E11 (1.69E11)
4.01 – 5.00 M	1826	26.72 (22.22)	5.57E11 (1.30E11)	1.49E13 (1.43E13)
5.01 – 6.00 M	1725	3.85 (6.01)	1.05E13 (8.00E12)	4.32E13 (8.73E13)
≥ 6.01 M	487	0.36 (1.02)	2.50E15 (1.33E16)	1.18E16 (1.42E17)

The NOAA Penticton Solar Flux Unit ($\text{W}/\text{m}^2 \text{ Hz}$) F10.7cm index is measured daily at local noon (2000 UT) in a bandwidth of 100 MHz centered on 2800 MHz at the Penticton site of the Dominion Radio Astrophysical Observatory (DRAO), Canada, where one solar flux unit is equivalent to $10^{-22} \text{ W}/\text{m}^2 \text{ Hz}$. The mean and standard deviation for the five year interval was 101.35 and 27.36 SFUs, respectively.

2.3 Results

The results of the correlation analyses (parametric and non-parametric) between the variation in daily solar flux units (SFU) and the daily average energy per event released within the successive 1 M increments of earthquakes are shown in Figure 1. The strongest and most statistically significant association was between the lowest magnitude (0.01 to 1 M) quakes and the energy associated with SFUs.

The daily solar flux units displayed a strong negative relationship [$\rho = -0.51$; $r = -0.48$, $p < .001$] with the daily average event energy for those recorded magnitudes between 0.01 – 1.00 M. In other words about 25% of the variance between the daily fluctuations in solar flux units and average earthquake energy within that band was shared. The strengths of the associations between the power of the solar flux activity and the other intervals of earthquake magnitude were much less, and although statistically significant ($p < 0.05$), accommodated less than 1% of shared variance.

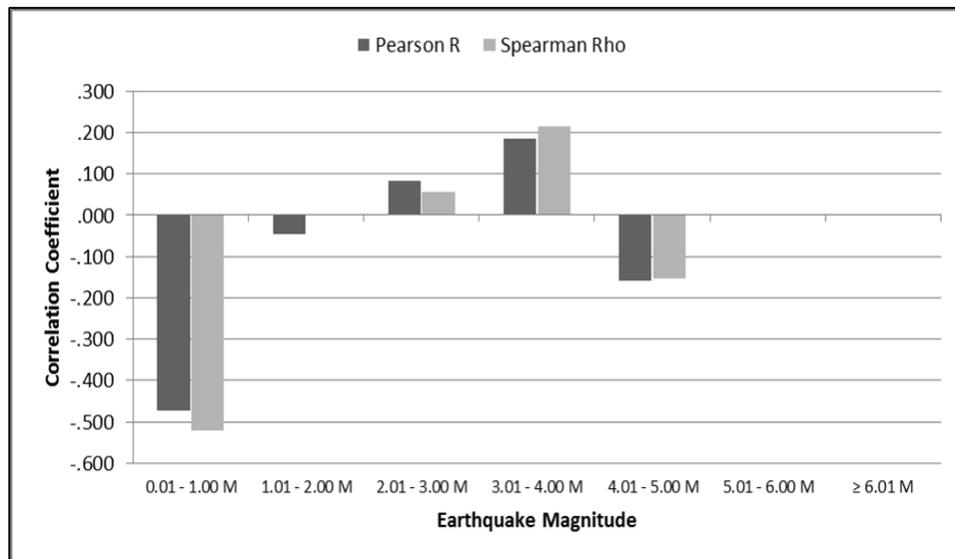


Figure 2.1 Correlation coefficients (Pearson R, Spearman Rho) between the daily power in Solar Flux Units and the average energy of a seismic event within various 1 M intervals of earthquakes for the five years analyzed in this study.

A scattergram with the results of regression analysis of the significant relationship over the 1826 day period from 2009 – 2013 between the average seismic radiated energy (J) for those Earthquakes of magnitude 0.01 – 1.00 M and the daily solar flux unit is shown in Figure 2. The slope indicated that for every 1 SFU unit decrease there was an increase of 1.55×10^3 J per average earthquake within that interval of magnitude. To visualize the temporal development of

the two major variables the actual values over real time for the five year period were graphed. Figure 3 shows the average energy per seismic event within the 0.01 to 1.0 M range over the five year period. Note the negative slope that is evident visually. Figure 4 shows the average power flux density for SFU units over time during the same period. In addition to the general positive slope there were conspicuous positive fluctuations.

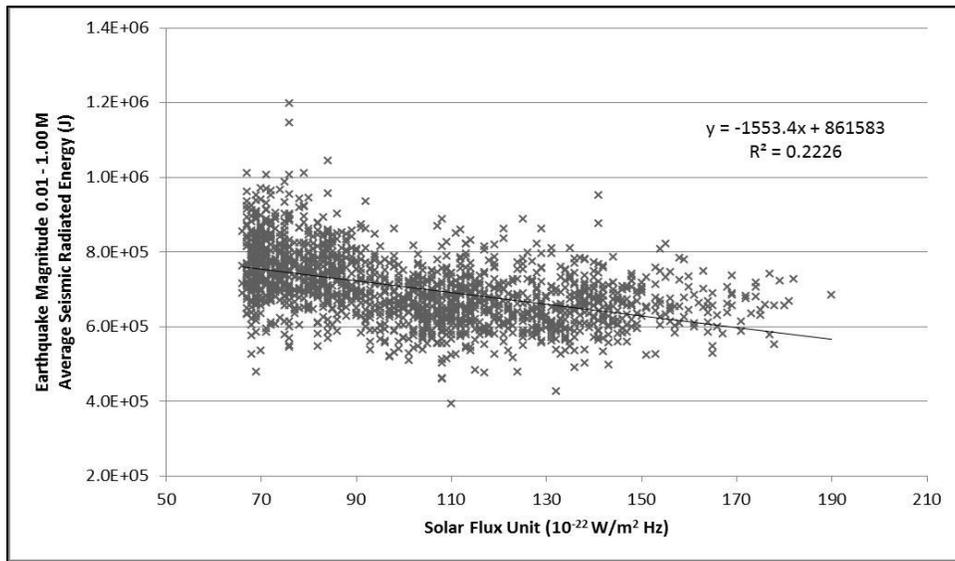


Figure 2.2 Scattergram showing the inverse correlation between the values of Solar Flux Units and the average magnitude of seismic events (in Joules) per day for the earthquakes between M 0.01 and 1.00 M).

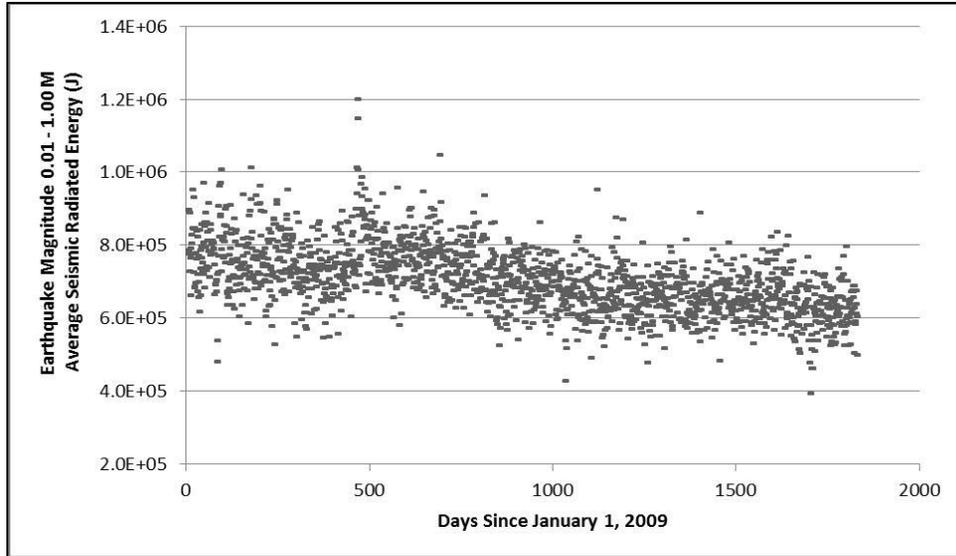


Figure 2.3 Average energy per event within the 0.01 to 1.0 M range per day for the five years involved in the analyses.

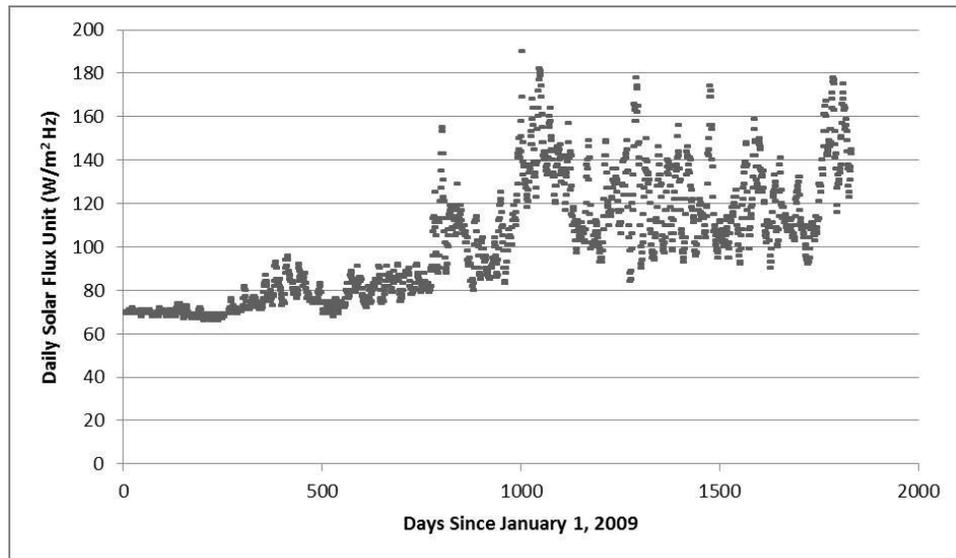


Figure 2.4 NOAA Penticton solar flux unit (W/m2 Hz) F10.7cm index as measured daily at local noon (2000 UT) for each day between 1 January 2009 and December 2013.

The potential that the relationship was due to a shared source of variance associated with temporal progression, most likely movement through the galaxy was investigated. The

correlation between SFU and days (over the five years) was $r = 0.77$. The correlation between the average energy per earthquake within the 0.01 to 1 M range was $r = -0.55$. This inverse relationship effectively reflects the vector of the association observed for the bivariate correlations. It is unlikely that monitoring sensitivity was the source of an artefact because, if they were valid, one would expect the numbers of these very low magnitude events to increase with more sensitive instrumentation. That did not occur. To accommodate the potential contribution from the shared time for SFU and seismicity, symmetrical partial correlation analyses were completed. The results are shown in Table 2.

Table 2.2 Zero order correlation (R) between the fluctuations in Solar Flux Units (SFU), average energy per earthquake in the 0.01 to 1 M range, and time (days) for the 5 years of the analyses. ΔR refers to the partial correlation and absolute change in the coefficient after shared variance for two variables with the remaining variable was removed.

Correlation Variables	R	Control Variable	Partial	ΔR
SFU + EQ	-.472	Time	-.088	.384
EQ + Time	-.552	SFU	-.338	.214
SFU + Time	.768	EQ	.690	.078

That energy rather than numbers of events were the source of the association with solar activity was shown by the maintenance of the significant correlation (-0.44) after the zero order correlation ($r = -0.47$) was controlled for the shared relationship with numbers of these small magnitude events. In fact the weak correlation ($r = 0.22$) between the numbers of small magnitude quakes and SFUs was eliminated when the variance associated with the average energy for those events was first removed (partial $r = 0.08$). What was clear was that *a priori* removal of the shared correlation between SFUs and average energy markedly reduced the

shared variance between solar activity and seismic energy release within this interval of magnitudes.

2.4 Discussion and Implications

These analyses clearly demonstrated that solar activity within the range of 50 to 150 SFUs and the average energy from the 1 M band of the weakest earthquakes (0.01 to 1 M) were negatively correlated. The two phenomena shared about 25% of their variance. The correlations between the daily fluctuations in SFUs and seismic energy release for any of the other increments of earthquake occurrences were not correlated in a statistically significant manner. Even accommodating and encouraging the contributions from outliers, such for the largest seismic events during this interval, there was no significant correlation with solar activity as defined by 2.8 GHz power fluctuations.

These results are consistent with a process of equilibrium between a proportion of energy associated with solar power within the GHz band and the release of increments of energy within the MegaJoule (MJ) for earthquakes. Usually such inverse associations suggest both phenomena are related to a third factor such that $A + B = k$. In other words if quantity B increases quantity A must decrease and vice versa. The most likely model would involve a resonance coupling.

The average energy of the magnitudes within the range (0.01 to 1 M) that was significantly and negatively correlated with solar activity was about a MJ. The equation indicated that for every 10^{-22} W/m²Hz (kg/s²) decrease in solar activity within the 2.8 GHz range, the average energy per unit event within the 0.01 to 1 M range quakes over the surface of the earth increased by 1.55×10^3 J or, over the surface of the earth (1.5×10^{14} m²), 3.05×10^{-12} J/m² (kg/s²). If an equilibrium system is operating the approximately 10^{10} difference in magnitude must be accommodated.

We would expect the coupling to occur within the quantum level of matter. The Bohr magneton, in Hz (μ_B/h), where μ_B is the magnetic moment of the Bohr magneton and h is Planck's constant, is 1.40×10^{10} Hz/T. The estimated magnetic field strength (B) according to:

$$B = \frac{(\mu I)}{(2\pi r)} \quad (1)$$

where μ = magnetic permeability in a vacuum (1.26×10^{-6} N/A²), I is the unit charge (1.6×10^{-19} As), and r is the (Bohr) radius (5.29×10^{-11} m), multiplied by the frequency of orbits (6.58×10^{15} Hz) is 3.99 T. So, (10^{-22} W/m² Hz) x (1.4×10^{10} Hz/T) x (3.99 T) is 5.6×10^{-12} W/m². Over 1 unit second this would be equivalent to 5.6×10^{-12} J/m² which is within measurement error range of the value predicted by the equation. We suggest that the source of this energy would be contained within the sub-matter space and its structure within which matter from the sun and the earth are immersed.

The presence of a “resonance” that could serve as the shared source of variance for the reciprocal relationship between average energy per seismic event within the 0.01 to 1 M range and solar activity might be supported by a quantitative solution involving relevant parameters. The strong dependence of both daily flux density and average earthquake energy within the smallest interval upon time could indicate the contribution from the movement of the solar system around the galaxy. Assuming the functional rotational length (circumference) of the earth (4×10^7 m) and the typical value of 2.42×10^5 m/s for the sun's orbital velocity around the galaxy, the duration would be 165 s. If this were an average inter-event interval, this means there would be about 520 events between 0.01 and 1.0 M per day where the empirical value was ~110 per day. The

discrepancy may simple reflect the current relatively fixed density of instrumental coverage over the earth's surface.

Consideration of the contribution of convergence between gravitational and electromagnetic energies may be revealing. The $\sim 10^{-10}$ N in an area of an ionic bond from the gravitational attraction between the earth and the sun when applied across the linear distance is within the range of 10^{-20} J. This quantity of energy is one solution could intercalate domains within Planck's Length to forces and energies that could "bind" all components of the universe (Persinger, 2014).

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Chapter 3 - Spectral power densities and whole body photon emissions from human subjects sitting in hyper-darkness

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Authors: David A. E. Vares, Blake T. Dotta, Kevin S. Saroka, Lukasz M. Karbowski, Nirosha J. Murugan and Michael A. Persinger

3.0 Abstract

The human body emits a continuous field of photons that may exhibit holographic-like properties. If this concept is applicable, then the appropriate technology and quantitative methods would have the capacity to detect anomalous sources anywhere within the volume of the body. To discern the feasibility of this concept we tested the capacity of four photomultiplier units to discriminate the presence or absence of a human being within a hyperdark ($10^{-12} \text{ W}\cdot\text{m}^{-2}$) small room specifically constructed for this purpose. Only 100 s of measurements of photon emissions (50 Hz sampling, 20 ms bins) were required to obtain 100% accurate discrimination. Spectral Power Densities (SPD) for the photon counts when human subjects were present or not present were sufficiently complex to allow potential discernment of different health states. Preliminary data have already suggested that this particular method has the potential to function as a sensitive and early indicator of anomalous cellular activity.

3.0.1 Keywords

biophotons; human presence; photomultiplier units; hyperdark environments; spectral power densities;

3.1 Introduction

All living systems display ultraweak photon emissions (UPE) that can be easily discerned by modern photomultiplier units. The human body is composed of several tens of trillions of cells and bacteria. Several researchers (Trushin, 2004), (Fels, 2009) have suggested that the primary communication between cells and bacteria involves UPE. The typical median value for the flux density of biophoton emissions is in the order of $10^{-12} \text{ W}\cdot\text{m}^{-2}$. Photonic fields have the capacity to mediate large amounts of information that reflect the states of the human volume. We have been pursuing the possibility that the appropriate measurements of spectral power densities (SPD) from different positions around a human body sitting within a hyperdark environment might reflect the cellular conditions anywhere within that volume. Rather than improving the techniques of imaging, our focus has been enhancing the precision of early detection.

Quantitative electroencephalographic activity has been employed for decades to infer the dynamic status and deviation from normality of relatively small volumes of cells deep within the human cerebrum. Even though the primary source of this activity originates from neurons within the outer regions (the cortices) of the cerebrum and millions of individual neurons are involved with the complex signatures that are measured by the array of surface sensors, the quantitative information can be both remarkably precise and revealing. We have adopted this approach for whole body UPE. Our operational model is the photon densities generated from the human body surface, which are in the order of 10^6 to 10^7 photons per second per meter-squared or about $10^{-12} \text{ W}\cdot\text{m}^{-2}$, display a field or holographic-like property. This means that with the appropriate mathematical tools and precision, the smallest component or unit that contributes to the whole field should be discernable.

Biophoton emissions with the properties of a field or a dynamic matrix whose configuration changes systematically in space-time (a tensor) have been inferred or measured for at least 100 years. The imaginative research with substantial diagnostic potential by Kilner (1911) during the late 19th century required viewing the human body through solutions containing coal-tar derivatives such as Dicyanine A (Palkin, 1923) whose chemical composition was later found to be difficult to verify and to duplicate. The subsequent development of the photomultiplier unit which removed the involvement of the human visual system from the process allowed quantitative measurements. The quintessential researcher F. A. Popp (1979) and his colleagues (Cohen & Popp, 1997), (Popp et. al., 1988) have both articulated the theory and the technology for measuring these “permanent photon currents” within the spectral range of 200 to 800 nm. The systematic and innovative research by the Van Wijks (Van Wijk, Schamhart, 1988), (Van Wijk & Van Wijk, 2004), (Van Wijk & Van Wijk, 2005) employed a highly sensitive charge-coupled device camera to discern the range of UPE within various regions and symmetries of the human body. Their approach emphasized imaging rather than detection.

Here we demonstrate that a relatively inexpensive technique that requires only 100 s of measurement of photon emissions from the three spatial planes involving four photomultiplier units can readily discern if a human being is either present or not within the detection volume. The spectral density profiles of the amplitude distribution of the flux densities are sufficiently complex, in a manner similar to that obtained from mass spectrometry for complex molecules, to allow the degrees of freedom to discern a range of potential dynamic sources. Sampling a photonic field with only four units does not saturate the surface area. This may not be a limit. We consider this like listening to a conversation in a room. One can be anywhere within that

volume and hear the same conversation. The critical feature is discerning the “voiceprint” or the information within the energy.

3.2 Methodology

Human biophoton measurements were recorded within a specially constructed chamber. It housed all photomultiplier tubes (PMTs) or units and maintained a consistent background dark count. The dimensions of the dark box chamber were 1.70 m in height, 1.27 m width and 1.32 m in length. Four photomultiplier tubes were permanently housed within the dark box chamber. Each was positioned on a direct plane with which the participant, approximately 15 cm from where the participant would sit. The PMT known as the *Front* PMT was located directly in front of the participant’s torso. The *Back* PMT was located directly behind the participant’s torso. The *Head* PMT was located next to the right temporal lobe of the participant. The *Z-plane* (or top) PMT was located directly above the participant.

Figure 1 illustrates the dark box chamber and locations of the PMT measurement devices. To maintain a consistent background dark count, the entire chamber was draped with high stitch count fabric during data collection. Human participants were instructed to sit inside the dark box and relax for approximately 5 minutes. Multiple measurements were collected for 100 seconds at 50 Hz from 4 simultaneously running PMTs. Measurements were always recorded from all four PMTs simultaneously (± 500 msec). All PMTs were ~ 15 cm away from the subject. All data from each PMT are standardized and averaged per trial.

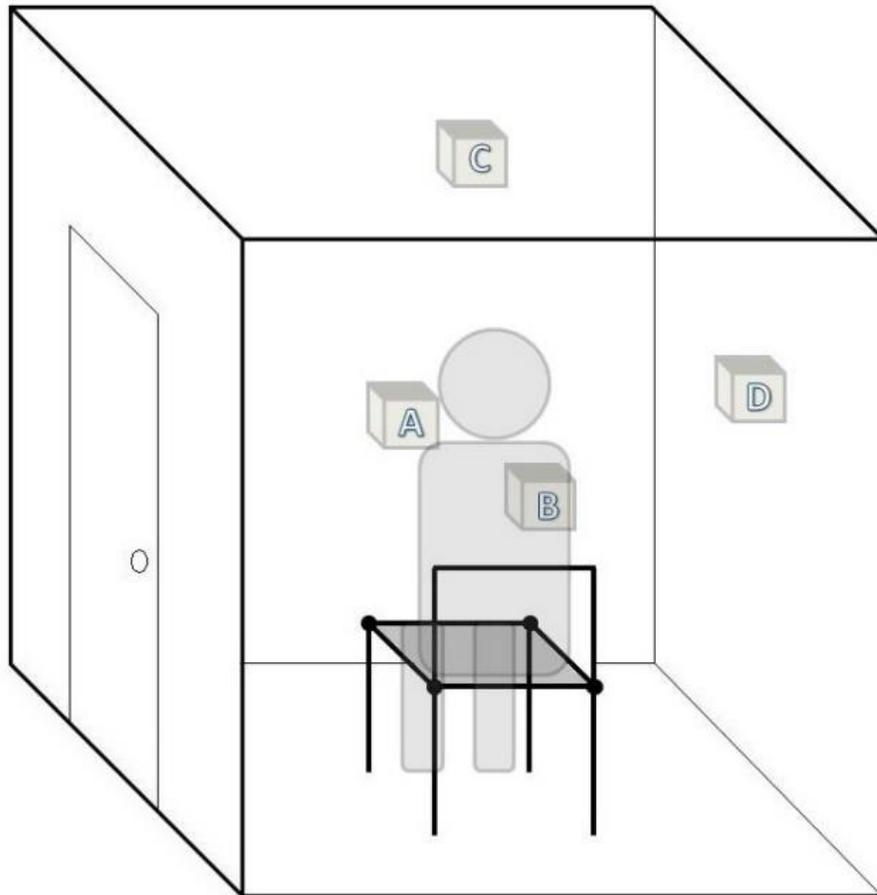


Figure 3.1 Positions of the light sensitive units (grey boxes) within the hyper dark room. The Front PMT is indicated by grey box (A), the Back PMT by grey box (B), the Z-plane (or top) PMT by the grey box (C), and the Head PMT by the grey box (D).

3.3 Results

3.3.1 Human Biophoton Classification

The four values (from each PMT) per trial were summed and averaged to create a single aggregate score for each trial (as opposed to 1 average from each of the 4 PMTs). This aggregate score produced 100% classification between human and no human hyperdark conditions. Additional aggregate score variables that were associated with significant differences between

conditions (human vs no human) were: trial mean, variability of the variability, maximum photon counts, and the absolute separation between maximum and minimum photon counts (effect sizes ranged from 45% - 76%). The effect for the absolute separation between maximum and minimum photon counts is presented in Figure 2 [$F_{(1,6)} = 15.1$, $p = 0.012$, $\eta^2 = 0.76$]. It is evident that there was no overlap between the two conditions. This was also clear for overall means. This produced perfect classification accuracies for both variables.

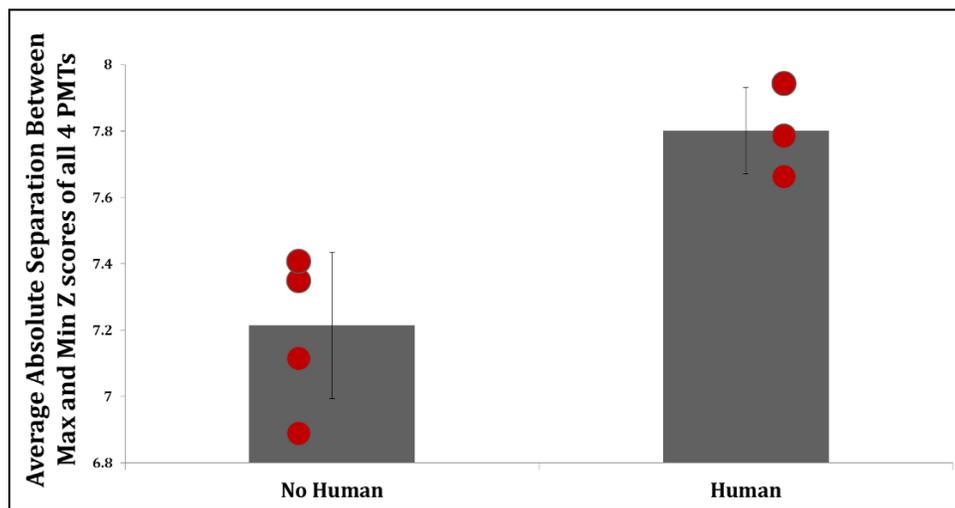


Figure 3.2 Average absolute separation between max and min Z scores of all 4 PMTs for human and no human conditions. Dots are the actual raw values with means and standard deviations presented.

3.3.2 Human Biophoton Spectral Characteristics

To investigate spectral signatures, human biophoton sessions were completed for nine (9) individuals within the hyperdark environment. Each individual completed at least two (2), 100 second sessions of PMT recording at 50 Hz. Background empty chamber PMT recordings were also taken for a combined total of $N = 74$ sessions (34 Human + 34 Background). PMT recordings were z-scored, and spectral analyses were completed with SPSS. One-way analysis of

variance for the spectral density variance was conducted on all 2,500 frequencies to discern the greatest F statistic between the empty chamber and human PMT condition (Figure 3).

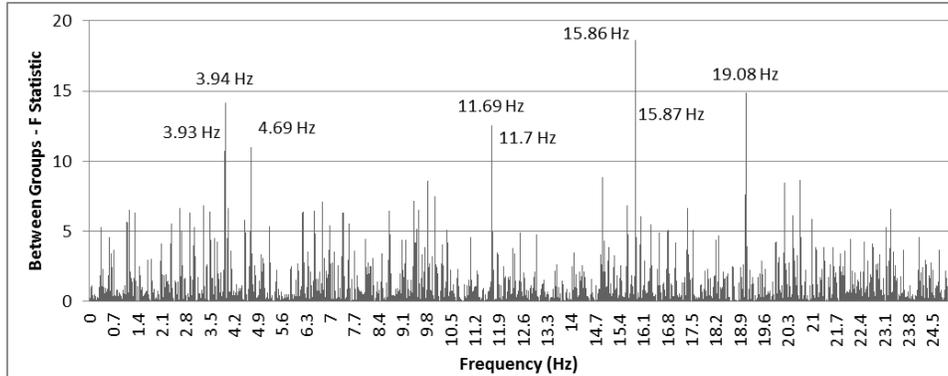


Figure 3.3 The F statistics are visually presented for the nine (9) individuals completing the N = 74 sessions (34 Human + 34 Background), with the top eight (8) corresponding frequencies labelled.

The top corresponding frequencies were entered into a further discriminant analysis and revealed one function which explained 78.4% of the classification (canonical $r = .669$). The combination of four (4) discriminant function coefficients significantly differentiated the chamber condition [$\Lambda = .552, X^2_{(4)} = 41.561, p < 2.06 \times 10^{-8}$] with the function given by the equation: Function = $.066*(3.93\text{Hz}) - .052*(11.7\text{Hz}) - .064*(15.86\text{Hz}) + .062*(19.08\text{Hz}) - .208$. It should be noted that this was not the only characteristics of a human biophoton signature. It was the most frequently consistent configuration. The visual representation of the discriminant function is presented in Figure 3.4.

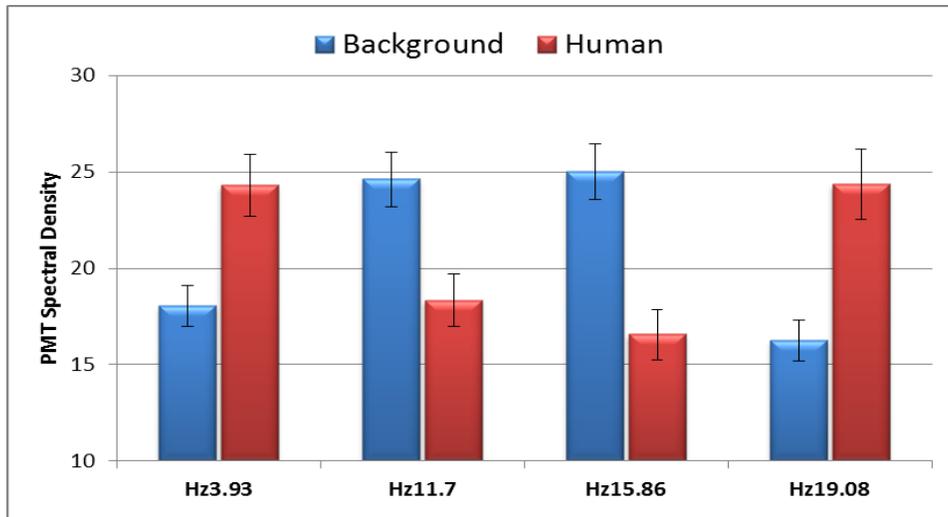


Figure 3.4 Displays the average PMT spectral densities for the nine (9) individuals completing the N = 74 sessions (34 Human + 34 Background), of the discriminant function coefficients with standard error of the mean error bars.

3.4 Discussion

The results of these experiments indicate that a relatively inexpensive technique can discern the presence or absence of a human being within a closed space by measuring the ambient photon emissions for only 100 s. An aggregate score was able to produce 100% classification between human and no human hyperdark conditions. In a further discriminant analysis, the top four (4) spectral frequencies revealed one function which explained 78.4% of the classification between the presence of a human within the dark environment as compared to an empty chamber.

Such durations of measurements of photon emissions over cultures of malignant cells or non-malignant cells have produced similar levels of very accurate discrimination (Karbowski et.al., 2015). The presence or absence of a living system such as a mouse within a closed chamber has been verified as well by direct photon measurements (Dotta, 2016). Our unpublished studies indicate that the SPD of the photon emissions from C57 mice that have been injected with mouse

melanoma cells allowed reliable and discriminable differences from non-injected reference mice within 48 hr. That is more than 10 days before the tumors become visibly discernable. The application of SPD mathematics for this low sampling rate (50 Hz) and duration (20 ms) is simple, efficient, and fast.

3.5 Conclusion

The average discrepancy between human present and not present conditions (Figure 3.2) was approximately 7.27 spectral density units. Taking the square root of the average discrepancy yielded a value of approximately 2.7 spectral units. Multiplying the average photons per spectral unit (0.27) by the average discrepancy between conditions (2.7) resulted in a difference of about 0.727 photons. Assuming the 100 seconds of recording for each session, the average photon per second difference between the empty chamber and the human occupied condition would have been 0.007. Assuming the average photon energy was about $3 \cdot 10^{-19}$ J, the energy equivalent difference between the empty chamber PMT background and the occupied human PMT signature was about $2 \cdot 10^{-21}$ J.

The discriminating energy value is within range (including variance) of the product of the Boltzmann constant (1.38×10^{-23} J·K⁻¹) and room temperature (298 K), or approximately 4.11×10^{-21} J. This value is within range of relational amplitude of thermal fluctuations. This value is also within the range of the Landauer Limit for the dissipation of energy from a single bit of information into entropy or the convergence of two quantum operations. It may also be relevant that $0.4 \cdot 10^{-20}$ J is within the range of energies that is equivalent to the default Nernst solution (~26 mV) for the resting potential of the plasma cell membrane (Persinger, 2010). This quantity

has been considered to be the pivotal value for processes involved with the differentiation between normal and malignant cells (Persinger & Lafrenie, 2014).

3.6 Acknowledgements

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Chapter 4 - Correlations between US county annual cancer incidence and population density

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4.0 Abstract

Population density implicitly involves specific distances between living individuals who exhibit biophysical forces and energies. Objective was to investigate major data bases of cancer incidence and population data to help understand the emergent properties of diseases that become apparent only when large populations and areas are considered. Correlation analyses of the annual incidence (years 2007 to 2011) of cancer in counties (2,885) of the U.S. and population densities were convergent with these quantitative predictions and suggested an inflection threshold around 50 people per square mile. The potential role of subtle or even “non-local” factors coupled to averaged population density in the viability and mortality of the human species may serve as alternative explanations to the attribution of malignancy to “chance” factors. Calculations indicated average distances between the electric force dipole of the brains or bodies of human beings generate forces known to affect DNA extension and when distributed over the Compton wavelength of the electron could produce energies sufficient to affect the binding of base nucleotides. An inclusive science of human ecology might benefit from considering subtle forces and energies associated with the individual members within the habitat that could determine the probability of cellular anomalies.

4.0.1 Keywords

Cancer incidence, population density, coulomb forces, dna extension energy, public health

4.1 Introduction

The emergence of Human Ecology as exemplified by Bressler's (1966) seminal text of that name altered the perspective of the contributions from the interactions between large populations and subtle environmental stimuli upon adaptation and biological viability. Although the effects of population density upon the development of disease and pathology have been documented since the time of Calhoun's (1832) famous "galaxy" studies and there is a rich history of both correlation and experimental work involved with the contributory effects of different spatial proximities to a plethora of medical conditions (Glass & Singer, 1972), the relationship between one of the most enigmatic anomalous conditions, cancer, and human population density has been explored (Nasca, Mahoney, & Wolfgang, 1992), (Howe, Keller, & Lehnerr, 1993), but not thoroughly beyond select regions (Muirhead, 1995).

The importance of population density for both morbidity and mortality was examined experimentally in *Drosophila* decades ago by Milkman (1975). Flies maintained in population cages displayed higher proportion of mortality than was facilitated if empty spaces were provided. If placed in uncrowded conditions the flies were fertile and lived for several weeks. He found that this interesting phenomenon was dependent upon neither light nor age of the flies and that crowding was clearly the most important predictor. Here we present a potential contribution and the quantitative support to the variation in cancer incidence that could reflect recondite variables mediated by basic physical forces.

Cancer is often considered to be a disorder evoked by myriad stimuli that affect the DNA sequence of the cell's genome during replication or disrupts the active transcriptions to RNA equivalences that ultimately affect the protein structure and enzymatic function of the cell

(Alberts et. al., 2002). DNA damage can even occur during reversal apoptosis (Tang et.al., 2012). At the level of the molecular structure of double helical DNA the energy involved with the sequential addition of a base nucleotide is in the order of about 10^{-20} J. Gu, Xie and Schaeffer (2007), reported that nucleobases have small electron affinities of 0.1 eV ($\sim 10^{-20}$ J) for thymine and cytosine. The vertical electron attachment energy for 2'-deoxycytidine-3',5-diphosphate, an important contributor to electron-capturing ability of single strand DNA, is 0.02 eV, or in the order of 10^{-21} J (Gu, Xie, & Schaeffer, 2007). According to Avila, Gomez-Ramos and Soriano (2014) insertion of a single base into a newly synthesized strand of replicating glia cells which does not match the antecedent ("parent") strand generates a mutation. Glia cells, particularly astroglia, constitute the greatest proportion of intrinsic brain tumors.

The quantities of energy associated with second shell hydrogen bonds that mediate the proton movement between hydronium ions, the action potential of the neuron, and the resting membrane potential of the cell are located within a narrow range of coefficients within the 10^{-20} J order of magnitude (Persinger, 2012). This quantity is associated with the sequestering of many ligands to receptors (Moy, Florin, & Gaub, 1994). The emergence of the importance of 10^{-20} J as a fundamental increment of energy essential for living systems and its potential derivation from cosmological sources, derived from its emergence when the total force within the universe per volume of Planck's Length is multiplied over the distance of the neutral hydrogen line (21 cm), has been calculated (Persinger, Koren, & Lafreniere, 2008).

More than 20 years ago Smith, Finzi and Bustamante (1992) and later (Cluzel et.al., 1996) it was demonstrated that the DNA molecule was extensible. The former researchers found that a force of only 2 to 3 pN (10^{-12} N) could stretch the DNA to 90% of its rest contour length. Previous estimates had indicated that DNA elasticity can sustain stretch forces of about 500 pN. A force

of 2 to 3 pN applied across the width of a plasma cell membrane (10^{-8} m) would be approximately 2 to $3 \cdot 10^{-20}$ J. Applied across the somewhat thicker nuclear membrane, the energy would be increased by a factor of ~ 2 . In principle forces that could initiate such “distension” could affect transcription. There would be no requirement for protracted or permanent application of the force. Durations in the order of 1 or 2 kiloseconds, the critical periods during cell cycle, could be sufficient.

Excess correlations from “non-local” processes between distal clusters of malignancies have been demonstrated by recent experiments (Karbowski, Murugan, & Persinger, 2015). To accommodate any excess correlation between non-traditional distances between human beings that could affect these energies involved with the DNA components that contribute to anomalous divisions and ultimately to malignancy, we hypothesized that some variant of de Broglie’s matter-waves (Aczel, 2002) might exist that allows the interconversion between the width of the classical electron particle ($r = 2.8 \cdot 10^{-15}$ m) and its energetic waveform, the Compton wavelength of $2.4 \cdot 10^{-12}$ m. If a specific range of quantities of weak forces were applied over the latter distance the resultant energy of about 10^{-20} J would have the potential to affect DNA stacking or the serial quantifications of energy mediated through signaling pathways (Persinger, Murugan, & Karbowski, 2015) that influence DNA activity.

According to the classic measurement of electric force between two sources, the relationship can be described as: $F = (q \cdot q) / (4\pi\epsilon)r^2$. Here q is the functional charge in A·s (Coulombs), ϵ = the permittivity of free space ($8.85 \cdot 10^{-12}$ F·m⁻¹) and r is the distance between loci, in this instance brains. For the human cerebral electroencephalographic activity, the typical variation involved with cognition is within the range of 40 ± 1 Hz (Kahn, Pace-Schott, & Hobson, 1997). Given about $1 \mu\text{V} \cdot \text{Hz}^{-1}$ (Saroka & Persinger, 2014) the functional value would be $3 \mu\text{V}$. The

extracellular fluid within which the cells are immersed, the resistivity is $\sim 2 \Omega \cdot \text{m}$ (Barnes, 2000) which results in $10^{-6} \text{ V} \cdot \text{m}^{-1}$. When applied across the average linear distance of the human cerebrum ($\sim 11 \text{ cm}$), the net current would be $1.1 \cdot 10^{-7} \text{ A}$. Assuming this is the more or less constant current across one second, the value would be $1.7 \cdot 10^{-7} \text{ A} \cdot \text{s}$.

4.2 Materials and methods

In our preliminary analyses, annual new cancer rates per 100,000 people for all races, sexes, and ages for approximately one-fourth (831) of the counties within the U.S.A. (12 states and one district) were obtained from the State Cancer Registry and the Centers for Disease Control and Prevention (CDC) National Program of Cancer Registries Cancer Surveillance System (NPCR-CSS) for the period 2007 to 2011. The five-year trend in cancer incidence rates was age adjusted to the 2000 U.S. standard population. The average incidence rate in the U.S. for the period 2007 to 2011 was 459.8 cases per 100,000 per year. The U.S. Census Bureau was queried for Counties Database (CenStats) 2010 archived information. The average population for the U.S. was 87.4 per square mile.

4.3 Results

Because we expected a non-linearity (in order for the force and energies to overlap with the properties of DNA activity) between population density and incidence rates per 100,000, Spearman rho as well as Pearson r values were calculated for successive decreases of population density in this order (total numbers of counties in parentheses): < 1000 (795), < 500 (766), < 400 (746), < 300 (721), < 200 (678), < 100 (575), < 80 (517), < 60 (441), < 40 (329) and < 20 (130). We found that the correlation (Spearman rho) between all cancer incidence rates per 100,000 people and the population density of the county peaked ($\rho = 0.40$, $P < .001$) for only those

counties with population densities of less than 100 people per square mile, or, when the average distance between people was ~160 m. The average force between human brains for this average distance is $0.96 \cdot 10^{-8}$ N. When applied across the Compton wavelength ($2.4 \cdot 10^{-12}$ m), the energy for potential translocation of any two loci would be $2.3 \cdot 10^{-20}$ J. This is certainly within the range of the stacking energies associated with base nucleotides in DNA (Gu, Xie, & Schaeffer, 2007) and RNA (Persinger, 2012) sequences or within the second shell energies strongly associated with the movement of protons from the hydronium ion (Decoursey, 2002).

However, there are fluctuations in potential differences across the hemispheres that occur per 40 Hz. Consequently, the product of $1.7 \cdot 10^{-7}$ A ($2.5 \cdot 10^{-2}$ s) would be $4.25 \cdot 10^{-9}$ A·s per brain. As a result, the force per 20 to 25 ms, the time required to add a base nucleotide to a DNA sequence, for that distance between brains would be $\sim 6.3 \cdot 10^{-12}$ N or about 6 pN. This value is within the range, for both coefficient and order of magnitude discussed (Cluzel et.al., 1996) to stretch the DNA molecule *in vitro*. However the functional potential difference could be $> 10 \mu\text{V} \cdot \text{Hz}^{-1}$ if the contribution from the relative permittivity (dielectric constant) associated with water (the primary component of cells in the human body) within the range of 25 to 40 degrees C were considered. Accommodation of this value (about 74 for water at this temperature), when the appropriate frequency is considered, would result in comparable values of force.

Consequently, for both steady state and frequency-dependent averaged voltages, the optimal distance between human beings within these counties that displayed the strongest correlation between population density and the incidence of cancer per 100,000 people resulted in equivalent energies. They would satisfy the involvement of applying a force across the Compton wavelength to obtain the stacking energy and the intrinsic force involved with stretching the

DNA molecule when applied at a frequency whose duration matched the time required to add one nucleotide.

The human brain is an organ within which representations from other organs and cells are localized and hence could contribute indirectly to the probability of proliferation of malignancy within the remainder of the volume of the body. “Stress” which is an over-inclusive metaphor for large numbers of biochemical changes, many of which are dependent upon the perception of the experiment, has been correlated with development of cancers through presumably suppression of the complex reactions of the “immune system” (Reiche, Nunes, & Morimoto, 2004). However, there should be quantitative convergence between the dipole potential difference of the entire human organism and intrinsic resistance and that of the brain.

Over 35 years ago, in the tradition of Leonard Ravitz (1951) and Robert Becker (1961) and while pursuing the frequently reported altered states by 19th century physiologists (Herin, 1968) when weak polarized steady-state (d.c.) currents were applied across the rostral-caudal axis of the skull we measured steady state potentials (with μV meters) between the cephalic or cervical regions and the distal portions of the four appendages of several dozens of supine human volunteers. As reported by Becker and his colleagues (1961), the typical voltage between the rostral or caudal location in the center of the skull and appendages is about 30 mV. This was not a fixed value but could vary over the month and with the “state” of the participant to between 10 and 100 mV as initially reported by Ravitz (1951).

Traditional estimates of internal resistance, which occupy a range of at least 10, exhibit a median value of about 1000 Ω . Consequently the current would be about $3 \cdot 10^{-5}$ A. Assuming the 40 Hz intrinsic vibration of muscle as the denominator, this equivalence would be about $7.5 \cdot 10^{-7}$ A·s.

Assuming the more typical rest median frequency of 10 Hz for whole body muscle vibration, the order of magnitude would be the same. This is within the range of values sufficient, given the average distance between people where the correlation with population density and prevalence per 100,000 people was maximum, to be associated with 10^{-20} J if the Compton wavelength of the electron was involved.

To discern if the relationship was evident with the population density (adjusted to year 2000) and annual incidence of all cancers, the total numbers for all counties (2,885) were obtained from the NCI CDC data base. Successive correlations (Spearman Rho and Pearson r) were completed for serial 100 person per square mile decrease from 3000 to 100 and then 10 persons per square mile decreases from 100 to 10 persons per square mile. The correlations between the mean population density and annual incidence rates of all cancers as a function of the average distance (in meters) between people for those densities are shown (Figure 1).

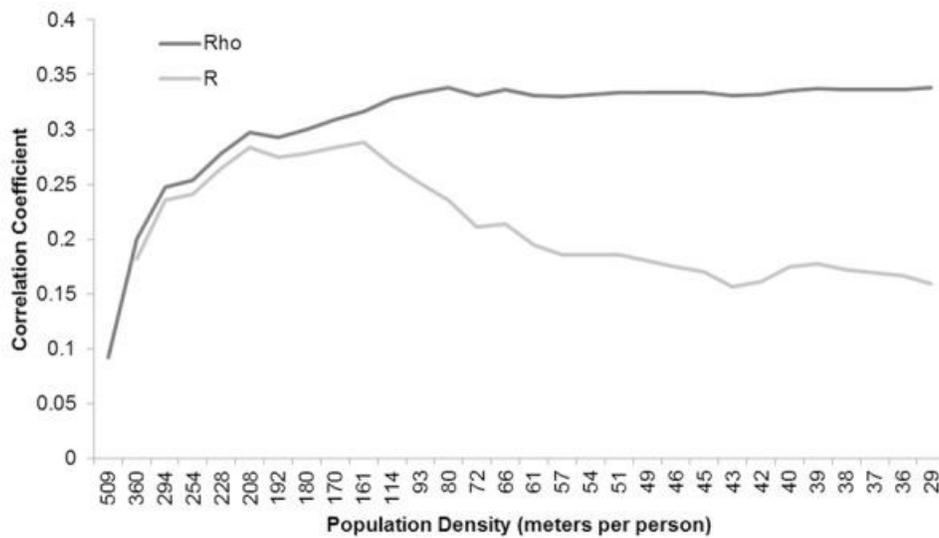


Figure 4.1 Significant ($P < .001$) Pearson R and Spearman's Rho correlation coefficients between United States County Incidence Rates of Cancer (per 100,000) and U.S. County Population Density (per square mile). To illustrate the relation of density, the x-axis square mileage has been converted to meters per person.

For Pearson r values the maximum is about 90 to 100 people per square mile or an average of 160 to 170 m between people. According to the z-score transformations comparison, the $r = 0.288$ at 100 people per square mile was significantly ($P < .05$) stronger ($z = 2.6$) than the $r < 0.182$ values at population densities less than 20 per square mile or the r values < 0.180 for densities greater than 1100 per square mile. The inflection is not noted in the Spearman rho data. Rather the asymptote for no greater increase in correlation between annual incidence of cancers and population density occurs with distances less than 160 m (population density > 100 people per square mile).

If the range of the peak containing the correlation coefficients were significantly higher statistically ($P < .05$) than the coefficients below or above that range was considered, the effective population density would reflect average inter-person distances between 360 m to 57 m (20 to 800 people per sq mile).

This range does not change the order of magnitude of the force or energy levels. Considering the multiple degrees of freedom involved with the actual dynamic frequencies of the cerebral cortices the “critical” values required to produce the criterion forces and energy could be achieved frequently but not constantly.

Closer inspection of the scatter for population densities of less than 100 persons per square mile (Figure 2), revealed a conspicuous anisotropic distribution of residuals around the regression line in the range of 50 persons per square mile or an average distance of about 228 m between individuals. Given the above parameters, the inter-cerebral electric force would be approximately $3.1 \cdot 10^{-12}$ N. The electric force between body dipole strengths would be $9.7 \cdot 10^{-8}$ N. If the force were applied over the Compton wavelength the energy would be in the order of $2 \cdot 10^{-19}$ J which

is within the near infrared range. If only 3 mV constituted the potential difference between the head and appendages and the A·s equivalents were obtained, the value would be within the $2 \cdot 10^{-20}$ J range that is significant for stacking of base nucleotides, action potentials, resting membrane potentials, and many ligand-receptor sequestering energies.

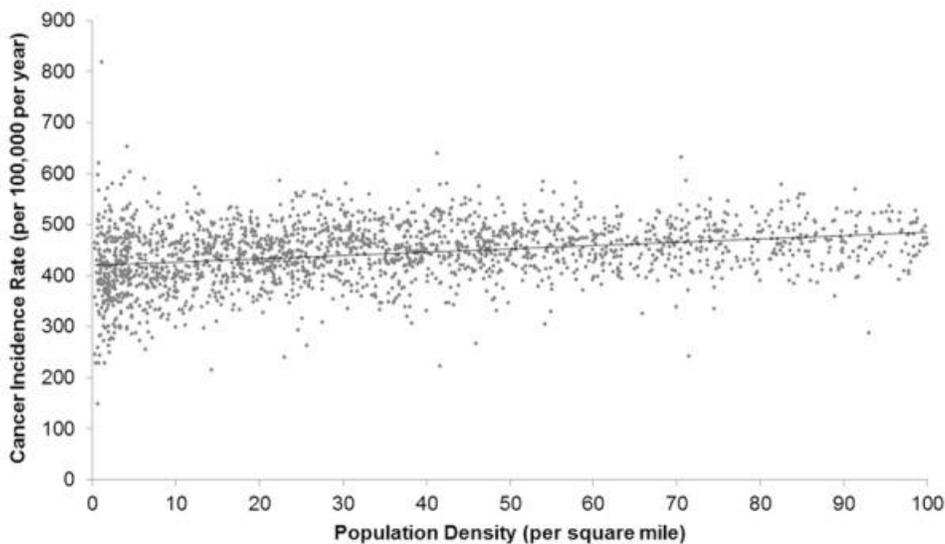


Figure 4.2 Scatter plot of Cancer Incidence Rates (per 100,000 per year) and counties whose Population Density is less than 100 (per square mile) with linear best fit shown.

To pursue greater precision of the characteristics of these non-linearities for the increase in cancer incidence within narrow bands of population density, iterative polynomials were completed using MatLab curve fitting software. A four degree polynomial revealed the “best” fit equation with coefficient within a 95% confidence boundary (Figure 3). The inflection point of the regression polynomial was computed to be 48.54 people per square mile (inter-person distance of 230.99 m).

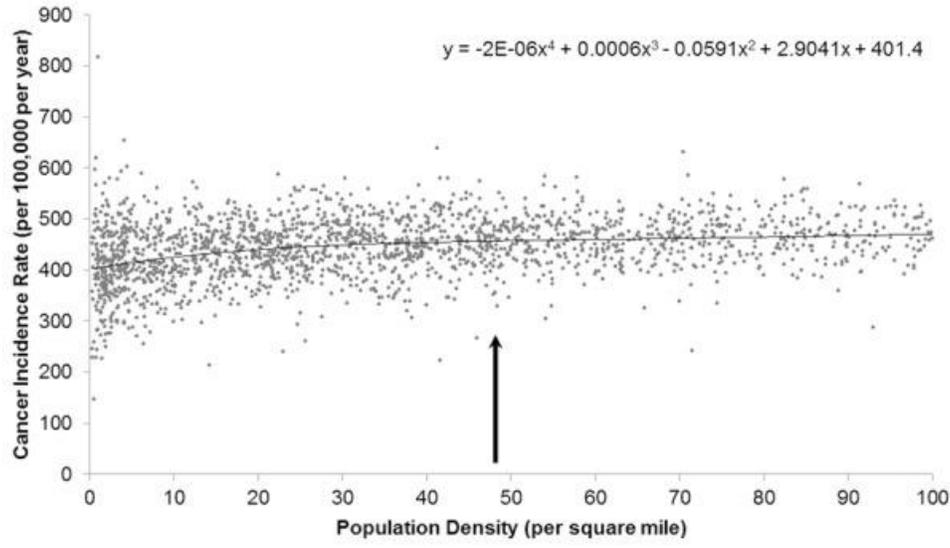


Figure 4.3 Scatter plot of Cancer Incidence Rates (per 100,000 per year) and counties whose Population Density is less than 100 (per square mile) with a polynomial of degree four (4) best fit shown. The inflection point (arrow) solved for population density of 48.54 (per square mile) or 230.99 meters per person.

4.4 Discussion

The results of these analyses were within the range we predicted by Coulomb forces between individuals who can be modeled as electric dipoles either across the cerebrum, with or without time-variations, and between the cephalic regions and distal appendages. We appreciate there is a likelihood that the marked convergence between the predicted values and the ones derived from actual average distances between people from which the forces were obtained could be fortuitous. However, the different solutions all occurred within the predictable ranges and one might argue reduces that probability. Application of basic biophysics to ecologically relevant contexts has been shown to be revealing and to open innovative possibilities by Cameron, Skofronick and Grant (1992). The forces and energies at which essential biochemical processes occur are extraordinarily small and within the range that could be created by these subtle forces.

There are several implications that emerge from this convergence between the predicted distances between human beings, the incidence of cancer rates per 100,000 people, and the energies and forces derived from simple Coulomb processes. First, the results indicate that very subtle forces based upon the average Euclidean distances between individuals of our species may be more influential upon the processes that control the population than previously assumed. Mortality by aberrant cell proliferation, although there are many other equally viable explanations, may be considered an adaptive process by which population growth is modified or selected. The significance of the development of malignant cell clusters within human beings and death from cancer has become more apparent as the average life span of the human being has increased. Before this extension of viability other factors, such as disease or nutritional limitations, controlled the longevity and selectivity of the members of the species.

Second, the non-linear relationship between the population density and the increased annual incidence of cancer rates would be consistent with a potential intrinsic process for modulation of population selection. During the expansion phase of a group the average distance would be significant for potentially influencing which expressions of DNA occurred or which RNA transformations were manifested. The convergence between the actual intensity of the force for the intermediate population density and that required to affect the expansion of the DNA molecule (at least *in vitro*) would be consistent with that interpretation. At larger population densities this mechanism would be less effective because the “fluidity” to adapt to the particular biological niche had been reduced and the configuration of gene expression is more “stabilized”.

Third, the Compton wavelength for the electron in the production of 10^{-20} J permits the possibility for matter-wave interactions that could involve non-local processes. Excess correlation, where by the change in one system is correlated with the change in another system at

distances where local or serial causal mechanisms are not obvious, has been shown for separated reactions involving photons (Dotta & Persinger, 2012) and shifts in pH (Dotta et.al., 2013) in water with physiological characteristics. Recently Karbowski, Murugan and Persinger (2015) demonstrated that pairs of dishes containing melanoma cells demonstrated excess correlation for toxicity-induced necrosis if both shared the same circularly rotating magnetic fields with a specific rate of change. In their experiments the injection of hydrogen peroxide into the local dish of melanoma cells that was sufficient to produce about 50% mortality was associated with a comparable mortality in the non-local cells at a distance of either 3 m or approximately 1.3 km within 24 hr. The duration of the shared exposure was only 12 min. The effect required the viability of at least some cells in the local plates; necrosis of all the cells in the local dish did not result in the non-local mortality.

That these experimental conditions could be simulated within the human being by natural processes is very likely. There is a recurrent rostral-to-caudal integrating wave of potential changes over large areas of the cerebral cortical manifold every 20 to 25 ms or ~40 Hz (Llinas & Pare, 1991). Our recent measurements (Collins & Persinger, 2014) employing LORETA (Low Resolution Electromagnetic Tomography) and QEEG (Quantitative Electroencephalography) indicate that the well documented “default mode network” involved with “resting cognition” in a relatively external stimulus-free environment, may move in the (opposite) caudal to rostral direction, thus completing the quasi-circular pathway or “circuit”. If the precise physical parameters for one person whose body contained malignant cells were shared by another within the normal distribution of all people for places with optimal population density, then theoretically non-local induction or cancellation could occur. If this interpretation is valid, then

the transfer of the condition for malignant cells would be a novel form of “contagion” mediated by an unanticipated type of vector.

The role of relative permittivity (dielectric constant) of essential substances that could influence the solutions for interpersonal force and energy is important. If water is the medium through which the interpersonal forces occurs, then less intense dipoles would be required to result in the optimal force or energy levels to affect the DNA and RNA within the cell. On the other hand, the potentially impeding effects from culture-related electric fields, such as power frequency gradients from transformers or sources of 50 Hz or 60 Hz line transmission, would be expected to be strong modulators of this phenomenon. According to our model, extraneous fields that alter the forces at specific population densities could increase that population’s refractory response to the formation of malignancies. We suggest that the increased odd-ratios for brain tumors, for example, for individuals within the electronics professions may not be due totally to the effects of the extraneous man-made power frequency fields but to the fact they shift the intra-organismic parameters to values that produce the forces and energies we have calculated to be effective.

Clearly the limiting application of this approach is that the position of a person in his or her lifetime is not fixed. The average distance between people within a county is likely to display a standard deviation (depending upon time of day and the occupation of the person) that is equal to the mean distance between persons. Assuming that only about 1 ksec is required (during a typical replication or transcription) to produce an altered gene sequence, one would expect the relatively weak correlation measured here. From this perspective the development of cancer would not be due to “bad luck” as recently suggested (Tomasetti & Vogelstein, 2015). If the specifics of the person’s timeline and location were known for every second per day, of every day, the specific probability could be estimated within practical levels of precision.

The small but quantifiable forces and energies that contribute to significant changes in the molecular structure or sequencing of DNA or RNA may be responsive to basic electric forces due to average distances between organisms. Assuming realistic quantitative values for “electric dipoles” between human beings as a function of population density per county, the range of interpersonal distance that would produce energies and forces that could affect intermolecular activity was associated with increased incidence of new cases of cancer per 100,000 people. The convergence of the predicted forces and the greater cancer incidence per 100,000 people in counties that might display these interpersonal distances indicates there may be very basic physical forces that might contribute to aberrant cell formation or function.

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4.6 Disclosure of conflict of interest

None.

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Chapter 5 - Correlations between a New Daily Global Indicator of Human Behavior, Threshold Seismicity, and Solar Activity: Congruence of Energy and Implications

Published in Global Journal of Human-Social Science Research, 2015

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5.0 Abstract

We correlated the daily average energy per earthquake for global seismicity within successive 1 M increments (<1.0 to >6.0 M), solar activity as defined by Solar Flux Units (SFU) and a new indices for Reports of Human Conflict Behavior for the years 2009 through 2013 (1,826 days). Events associated with intent (e.g. mobilization) and preparation for confrontation were positively correlated only with the average energy per event for 0.01 to 1 M seismic events and negatively correlated with SFU. The statistical significance of this seismic-behavior correlation was no longer significant statistically if the shared variance with solar activity was first removed. Actual events of force and confrontation displayed the opposite relation (positive correlation with SFU and negative correlation with only earthquake energies in this magnitude range). The shared variance between the behavioural categories and geophysical variables ranged between 4% to 10%. Lag/lead correlations indicated that the daily concordance expanded to about three days before or after the behavioural events. In particular average earthquake energies peaked ~3 days before the behaviors associated with intent for conflict. The total seismic energies from the 0.01 to 1 M events when distributed over the surface area of the earth and the fluctuations in SFU are within the intensity range of energies associated with the type of neuronal activity coupled to human cognition. Implications for this convergence are discussed.

5.0.1 Keywords

GDELT Project, Earthquakes, Solar Flux Units, Human Conflict Behaviour.

5.1 Introduction

Although the direct impact of releases of large magnitudes of seismic energy upon human behaviour have been obvious historically and cross-culturally, the influences of more subtle releases of seismic energy upon human cognition have not been systematically explored. Persinger (1999) employed techniques of multiple regression to show an intermediate strength association between yearly estimates of global mortality from “social expenditures” (wars and armed conflicts) and the lagged values for variations in the global release of seismic energy in conjunction with geomagnetic indices. The research was inspired by the original thinking by A. L. Tchijevky from the early 20th century (Mikulecky, 2007) who reported the strong association between peaks in solar activity and major conflicts and the persistent yet infrequently investigated moderate strength between solar activity and global seismicity (Jakubcova and Pick, 1986; Odinstov et al, 2007). Recently, Anagnostopolous et al (2013) reported a positive correlation between *daily* numbers of admissions to psychiatric facilities and the numbers of small ($M < 3$) earthquakes within the region of Crete, Greece. More specifically abrupt increases in the numbers of small earthquakes were followed within two days by increased admissions.

A direct real-time coupling between the physical substrates within the human brain that support and generate cognition and environmental events, particularly very low magnitude earthquakes and solar flux density has not been fully considered. Yet the physical potential is feasible. For example the energy associated with the smallest magnitude of earthquakes, 0.01 to 1 M, is in the order of 10^6 to 10^7 J (Joules) per day. For comparison the energy available from the metabolism

of 1 Mole of glucose is about 2×10^6 J and the average human being utilizes about 2 to 3 M of glucose per day. The brain, as an organ, utilizes about $20 \text{ J}\cdot\text{s}^{-1}$ (Watts) or 1.7×10^5 J per day. However the total amount of energy associated with one estimate of the *electromagnetic* substrate of cognition (rather than the supportive cell metabolism) is more likely to be in the order of 10^{-13} J per second. This is based upon the assumption that an action potential involves units of energy of $\sim 10^{-20}$ J (Persinger, 2010) and that approximately 10^7 neurons are involved with networks associated with “cognition” and awareness.

When 10^{-13} J per second is divided by the average cross-sectional area of the human cerebral cortices ($\sim 10^{-2} \text{ m}^2$) the radiant flux density would be about $10^{-11} \text{ W}\cdot\text{m}^{-2}$ which has been measured as photon emissions in several experimental sittings (Dotta et al, 2012). Similar flux densities of photons have been measured from hippocampal slices (Isojima et al, 1995) and were correlated with the strength of theta (4-7 Hz) activity. During years 2009 and 2013 the daily average numbers of M 0.01 to 1.0 quakes was ~ 108 per day with a total release of $\sim 8 \cdot 10^7$ J per day. This is equivalent to $10^5 \text{ J}\cdot\text{s}^{-1}$ (on average). If the power was distributed equally over the surface of the earth the flux density would be $10^{-10} \text{ W}\cdot\text{m}^{-2}$ which is well within the range of the value associated with photon emission coupled with cognition. Although this does not prove coupling exists between cerebral energies of all human beings and the temporally and spatially heterogeneous release of seismic energies actually occurs, the coincidence requires at least cursory empirical assessment.

Our research group has found that relatively subtle changes in environmental stimuli, such as geomagnetic activity, are positively correlated with discrete and intensity-dependent $\mu\text{V}^2\cdot\text{Hz}^{-1}$ shifts in quantitative electroencephalographic activity for more than 250 subjects sampled over three years (Saroka et al, 2014). Similar intensity-dependent shifts above a threshold of ~ 20 nT

for global geomagnetic activity as measured by the aa (average antipodal) index for subjective experiences in a controlled, quiet experimental setting was reported almost two decades ago (Persinger and Richards, 1995). The magnetic energy induced within the cerebral volume from these global geomagnetic fluctuations (0.6×10^{-12} J) approached the quantities associated with cognition. The effect primarily involves the right hemisphere of the human cerebrum and can facilitate the intercalation between the two hemispheres at the level of the temporal lobes (Mulligan et al, 2010). The “geomagnetic” effect has been reproduced experimentally in the laboratory by whole body exposure of volunteers to magnetic field configurations whose intensities and frequencies simulate natural conditions (Mulligan and Persinger, 2013).

We reasoned that if the human brain is sensitive to the environmental energies even crude or indirect estimates of group human behaviour over the planet should be associated with global incidence of the small magnitude earthquakes that approach energies generated by the human brain and body. At this level there should be a contribution from solar activity within the GHz range. For example the average daily solar output is $\sim 10^{-20} \text{ W} \cdot \text{m}^{-2} \cdot \text{Hz}^{-1}$ ($\text{kg} \cdot \text{s}^{-2}$). When multiplied by the potential range of 10^9 Hz (s^{-1}) the potential flux density near the earth’s surface could approach $10^{-11} \text{ W} \cdot \text{m}^{-2}$. Although accommodations for impedance must still be verified, this is within the range associated with photon emission from the right hemisphere while subjects sat in hyper-dark settings and imagined white light rather than mundane events (Dotta et al, 2012). The variations in flux density were strongly correlated (0.9) with beta activity within the left prefrontal region. This region of the brain when activated is associated with self-monitoring and organization behaviors. During period of hypometabolism, the most frequent correlate is severe clinical depression.

We (Vares and Persinger, 2014) have recently shown a clear inverse correlation between daily solar flux units and the radiated energy for an earthquake of 0.01 to 1 M for the five years 2009 through 2013. We found that for every SFU unit decrease the average energy increase *per event* between 0.01 and 1 M quake over the surface of the planet would have been about $3.1 \times 10^{-12} \text{ J}\cdot\text{m}^{-2}$. The change in energy per event within this range rather than the numbers of events was the critical variable. The energy within the soma of a neuron with a cross sectional area of 10^{-10} m^2 discharging at an intermediate frequency of about 40 Hz (the primary frequency range associated with consciousness, Llinas and Ribary, 1993) would have been $\sim 1 \times 10^{-20} \text{ J}\cdot\text{s}^{-1}$, the energy equivalent to a single action potential (Persinger, 2010). Recently two separate groups of researchers have shown experimentally that stimulation of a *single neuron* affects behavioural responses (Houwelling and Brecht, 2007) and can shift the activity of the entire cerebral cortices (Li et al, 2009). Here we present evidence for the supposition that daily changes in global human behaviours according to a new integrated WEB-based system, small magnitude seismic events and solar activity are correlated and may reveal some degree of temporal connection with implications for future causal connection.

5.2 Data Bases

Access to one of the world's largest event dataset was made publicly available on May 29th, 2014. The Global Database of Events, Language, and Tone (GDELT) Project website (<http://gdeltproject.org/>) monitors world news media and compiles hundreds of categories of "events" as used by the DARPA-funded Integrated Conflict Early Warning System (ICEWS) project. Events including riots, protests, and diplomatic exchanges have been utilized for comparative study of political violence (Hammond & Weidmann, 2014). The events are recorded with details, including the physical location, direction of political intention and

comprise the more than a quarter-billion events database, dating back to 1979. As confirmed by the avowal of the database creator (Leetaru & Schrod, 2013), the data are considered as a global ‘signal’ providing insights into changes on the ground. The GDELT Event Database is available in [Google’s BigQuery](#) Developers Console. The cloud-based analytical database service is designed for large datasets. Fast SQL queries against multi-terabyte datasets can be accomplished in seconds, and real-time insights about global human society is accessible. Conflict and Mediation Event Observation (CAMEO) EventRootCodes label events with a key word, (i.e. ‘EventRootCode 02’ = ‘Appeal’) and are accessible from the GDELT website <http://data.gdelproject.org/documentation/CAMEO.Manual.1.1b3.pdf>. GDELT was accessed by BigQuery for six (6) EventRootCodes and extracted for dates from January 1, 2009 until December 31, 2013 for a total number of days $N = 1826$. To normalize and to compensate for the exponential increase in the availability of global news material over time, the percentage of CAMEO EventRootCodes were calculated from the total number of events reported in the GDELT Event Database, across all event types, and broken down by day. The following table displays the EventRootCodes average daily percentages and standard deviations.

Table 5.1 Means and standard deviations (SD) per day for various codes of behaviour classification as measured by the GDELT Event Database.

Code	Description	Mean	SD
15	Exhibit Force Posture (alert/mobilize/police/military)	.33	.10
16	Reduce Relations (halt/withdraw/assistance/aid)	.87	.23
17	Coerce (confiscate/impose/freedoms)	4.96	.56
18	Assault (abduct/kill/bombing/assassinate)	1.65	.30
19	Fight (occupy/fight/territory/arms/aerial)	6.73	1.09
20	Conventional Mass Violence (mass/ethnic/chemical/bio/nuclear)	.03	.02

Earthquakes were queried from the Advanced National Seismic System (ANSS) global composite earthquake catalogue of the U.S. Geological Survey (USGS) for the same N = 1826 dates from 2009 – 2013. The total number of recorded Earthquakes and average Earthquake radiated energy were calculated per day for each order of magnitude (0.01-1M, 1.01-2M, etc.). The following table (Table 2) depicts the average daily seismic activity with standard deviations in parentheses.

Table 5.2 Total numbers of events per day for each interval of magnitude of global earthquake events, the numbers of days involving these events, and the average energy in Joules per event.

Magnitude	Days	Total Number	Average Energy (J)
0.01 – 1.00	1826	108.73 (33.24)	7.04E5 (9.01E4)
1.01 – 2.00	1826	100.07 (41.69)	1.44E7 (2.05E6)
2.01 – 3.00	1826	35.65 (33.50)	4.38E8 (1.12E8)
3.01 – 4.00	1819	8.70 (10.04)	2.21E10 (1.14E10)
4.01 – 5.00	1826	26.72 (22.22)	5.57E11 (1.30E11)
5.01 – 6.00	1725	3.85 (6.01)	1.05E13 (8.00E12)
≥ 6.01	487	0.36 (1.02)	2.50E15 (1.33E16)

Daily solar flux units ($10^{-22} \text{ W}\cdot\text{m}^{-2}\cdot\text{Hz}^{-1}$) were queried from the NOAA Penticton F10.7cm index as measured at local noon (2000 UT). The peak measurement was 2.8 GHz with a 100

MHz band width. For the analysis period the mean and standard deviation were 101.4 and 27.4, respectively. All statistical analyses involved SPSS PC 16 and 17. Spearman rho (non-parametric) and Pearson product moment (parametric) coefficients were obtained and compared to minimize the probability that any effect was due to outliers.

5.3 Results

The analyses of the correlations between each of the integer magnitude levels of global earthquakes and the different classes of reports of human behaviour demonstrated that only the strength of the association with the average earthquake energy for the magnitude 0.01 to 1.0 seismic events were statistically significant ($p < .002$) and consistent. The results of the correlational analyses between solar and the low magnitude seismic activity with the different classes of reports of social behaviour as defined by the GDELT CAMEO EventRoot codes are shown in Figure 1.

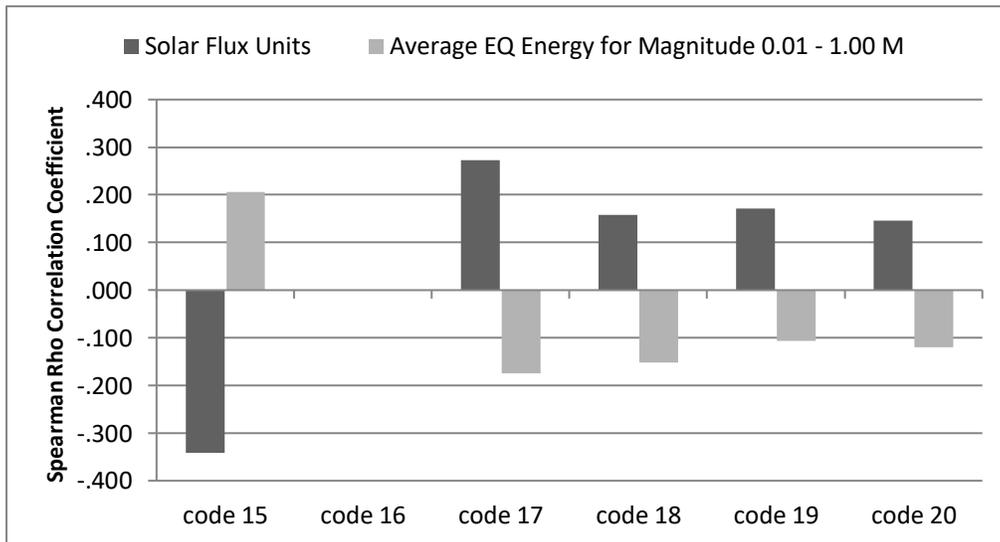


Figure 5.1 Spearman Rho correlations between the daily incidence of each of the behavioural categories and the average energy from 0.01 to 1 M earthquakes and solar activity SFU.

All of the classes actually associated with active behaviour, particularly aggressive behaviour were positively and significantly correlated with the inference of solar power (SFU) for the same day. The class (code15) associated with intention, such as mobilization, was associated with increased average energy for the seismic events but decreased association with solar activity. The relationship between the daily incidence of code17 through code20, all involving actual behaviours and earthquake energy or solar flux units was opposite to that associated with intention. It is relevant that episodes of reports of simply policy changes were not significantly correlated with either solar flux units or seismic energy within the 0.01 to 1 M interval.

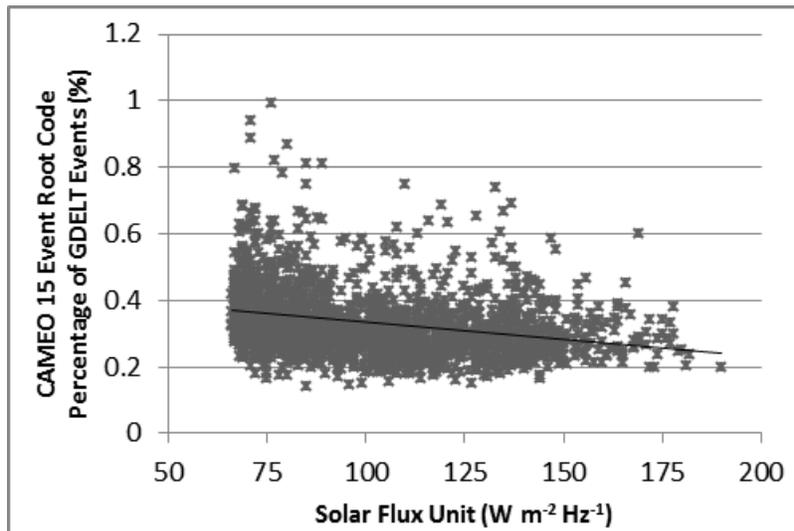


Figure 5.2 Scattergram between the indices for CAMEO EventRootCode 15 class of events (exhibitions of force or posturing) and the daily SFU values.

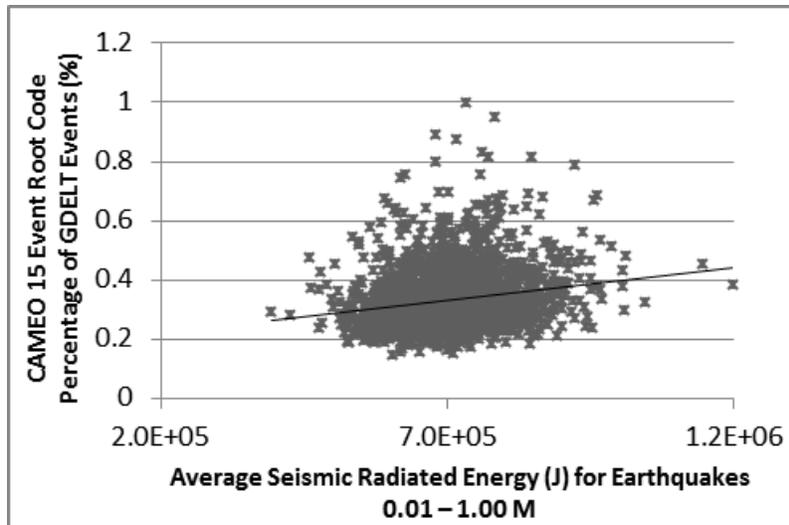


Figure 5.3 Scattergram of the association between daily radiated seismic energy per event of very small magnitude earthquakes and the indices for exhibitions of force or posturing.

In order to discern if there was shared variance between the three key variables, partial correlation analyses were completed with the parametric (Pearson r) values. The results are shown in Table 3 for the strongest association (Code15, intent and mobilization). The elimination of the statistically significant association between the seismic energies and this category of reports of human behavior once the shared variance with daily SFUs was removed indicates that the original association was due to their shared variance with SFUs.

Table 5.3 Zero-order and partial correlation analyses for pairs of variables after the shared variance (with the remaining variable) was removed for solar activity (SFU), average energy per earthquake within the 0.01 to 1 M range and category of reports associated with intent, e.g., alerts, mobilizations of police or military).

Correlation Variables	R	Control Variable	Partial R	ΔR
SFU + EQ	-.472	Code15	-.443	.029
EQ + Code15	.194	SFU	.074	.120
SFU + Code15	-.279	EQ	-.217	.062

Lag, lead analyses were completed for the SFU and average energy per seismic event for each of the five days before and after the key day (day of report) for the various CAMEO Code categories. The most conspicuous pattern is shown in Figure 4 for CAMEO Code 15 reports and our seismic index. The average energy for individual events within the “intent” category increased about 3 days before the behavioral (or reported) occurrence. However a direct test of the difference between the two correlation coefficients if they were treated as parametric values was $z = 1.5$ ($z < 1.96$) and was not significant statistically ($p < .05$). In order to be statistically significant, the sample size (assuming the same effect size) would require a collection of about 10 years of daily data.

The “temporal distribution” of the major category associated with SFU fluctuations per day are shown in Figure 5. In this instance the slow increase in strength of association, although very minute, occurred about 2 days after the day of the reports of coerced episodes. Again the apparent difference between -1 and +2 days for this attractive pattern was not statistically significant, that is there are no significant differences between the correlation coefficients (difference about 1% of the variance). However the shared variance between this category per day and SFUs was about 7%.

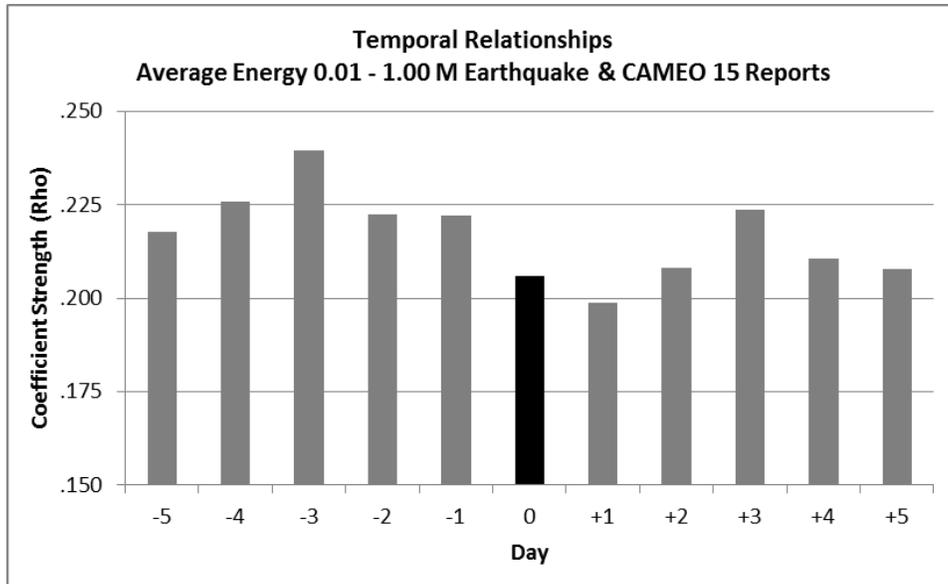


Figure 5.4 Strength of association (rho) between numbers of CAMEO Code 15 reports (intentions) and average energy per unit seismic event in the 0.01 to 1.0 M range as a function of lag/lead or days energy release for each of 5 days before and after the days of the reports (0).

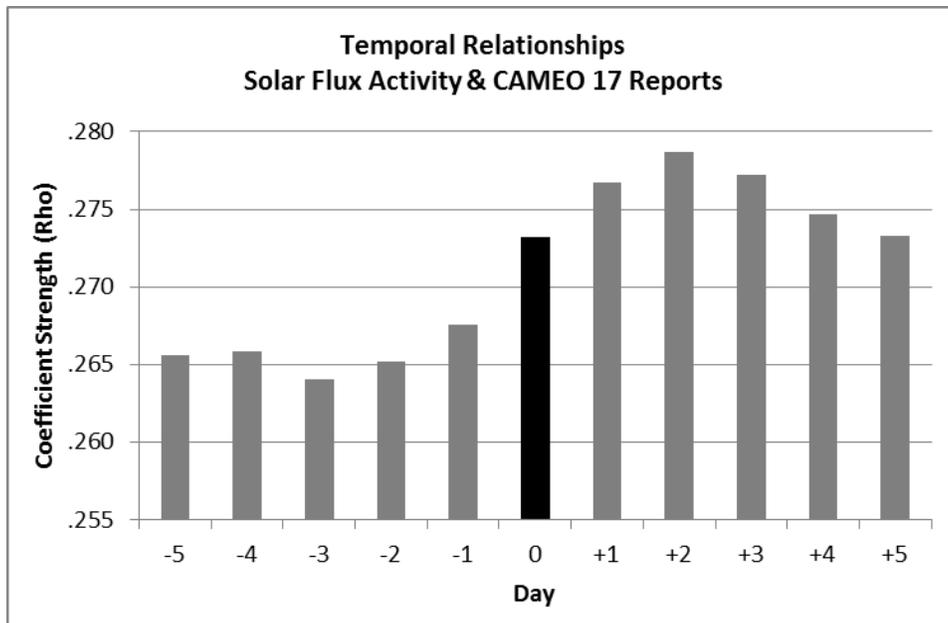


Figure 5.5 Strength of association between solar flux units (SFU) and numbers of CAMEO Code 17 Reports (aggression) and for daily SFU values lagged for each of 5 days before and 5 days the days of the reports.

5.4 Discussion

Most biological scientists would concur with the concept that living systems developed interactively on this planet and that ultimately the majority of the energy from which these systems were constructed originated from the Sun. Some researchers who have developed the concept of quantum biology (Popp, 1979) have suggested that the photon emissions between cells within living systems may actually involve direct communication of information (Dotta et al, 2014) and that these photons are still virtual representations of the original solar source. If even partially accurate, the implications concerning the direct influence of fluctuations in minute power densities on the earth's surface from the sun may require careful reconsideration.

A shared variance of between 4% and 10% between the geophysical variables and the behavioural categories may appear minuscule. However, even when controlling for the qualitative nature of the data base and the issues of sampling and ordinal scaling, such shared variance could have significant implications for large populations. Many relevant sociological effects accommodate less than 10% of the effect size for group or "treatment" differences. The effect sizes (amount of variance explained) for changes in weather (Persinger, 1987) are in the order of 10% with respect to fluctuation in daily estimates of mood. When applied to populations of millions of people, this effect can potentially determine the direction of popular opinion, such as votes, and affect economic productivity. The latter phenomenon, including the multiplier effects noted in many large economic systems, often operates for proportions of variability that are less than 10% of the central tendency. The strength of the periodic 10 year cycle in the correlation between cerebral indicators of hemispheric dominance and birth year coupled to solar activity (Volcheck, 1995) is within this range.

The caveat to any interpretation from these data is that it may reflect the factors responsible for the reporting of the different categories rather than the behaviours themselves. However if this were totally responsible for the correlations one would not have expected the reversal of directions with respect to solar activity and seismic energy for the different categories that effectively differ by intent vs action. In addition, the numbers of CAMEO Code 16 reports which were related to neither intent nor behaviour at the time but a simple report of changes in policy were not significantly correlated in any direction with either the solar or seismic fluctuations.

The contribution from changes in GHz output from solar activity upon brain function does not appear to have been considered as a direct influence even though the quantitative solutions are congruent. During the five year period involved with this study the average daily SFU units was 101 SFU with a standard deviation of about 27 units, equivalent to $10^{-20} \text{ W}\cdot\text{m}^{-2}\cdot\text{Hz}^{-1}$. If the central band frequency, $2.8 \times 10^9 \text{ Hz}$, were applied, the effective flux density is approximately $2.8 \times 10^{-11} \text{ W}\cdot\text{m}^{-2}$. Although there is no evidence, primarily because of absence of systematic experiments, to discern the neutral hydrogen frequency in the human cerebrum and its coupling to physical processes, demonstration of this effect would diminish the argument that such small solar variations cannot be cerebrally effective.

The association between the increased SFU and increased numbers of reports of human actions associated with intent or planning whereas the actual execution of aggressive behaviors were negatively correlated with increased solar activity suggests that cognitions or some aspect of aggregate of anticipatory (social) behaviour is related to solar perturbations. The mechanisms are clearly not evident at this time and could involve a third factor through which both are related rather than direct causality. From the context of the emerging discipline of quantum biology and the seminal concepts of Popp (1979) and the very original thinkers Hu and Wu (2006), the

presence of excess correlation between photon interactions within the human brain and the entangled photons originating from the sun would require the consideration of non-locality. That this can occur experimentally at macroscopic and non-traditional distances had been shown by Dotta and Persinger (2012).

The potential for energies associated with seismic energy release within the 0.01 to 1 M range is consistent with the concept that systems that exhibit similar magnitudes of unit energy can potential interact directly or by resonance. For example in computer systems voltages within ± 5 V are potentially influential and can alter the type of information or its direction within the system. Voltages that are lower or higher are either not effective or destructive to the system's constituents. The total energy from the seismic events per day within the 0.01 to 1 M value would have been in the range of 7×10^7 J per day or about 8×10^2 J·s⁻¹ and when distributed over the earth (assuming some distribution around homogeneity) would be 1.6×10^{-12} W·m⁻².

This is the same order of magnitude as our measurements of background photon emissions from the earth (Persinger et al, 2012) and the magnitudes of changes from the right hemisphere of human volunteers sitting in hyper-dark settings and engaging in imagination (Dotta et al, 2012). That the latter are not artefacts of metabolism is indicated by the strong positive (0.9) correlation with the photon flux density variations of the photon output from the right hemisphere and the power density of electroencephalographic activity within the beta range over the left prefrontal regions. This region of the human brain is a major locus of neurocognitive processes associated with self-monitoring, planning, and the feeling of intent.

Previously we (Vares and Persinger, 2014) found a quantitative relationship between daily SFU variations during the same five year period and energy release from 0.01 to 1 M seismic events.

The slope for the application of the energy over the earth's surface was such that for every 1 unit decrease in SFU, the seismic energy from this magnitude interval increased by $3.1 \times 10^{-12} \text{ J}\cdot\text{m}^{-2}$. This is an important value because when applied to the cross-sectional area of an average neuronal soma (10^{-10} m^2) the energy is $3 \times 10^{-22} \text{ J}$. If this fluctuation was around 40 Hz (s^{-1}), the band of cerebral cortical activity associated with consciousness and cognition, the power would be about $1.2 \times 10^{-20} \text{ J}\cdot\text{s}^{-1}$. This equivalent to energy associated with one action potential per second. That a single neuron can affect the state of the entire cerebral cortices has been shown experimentally (Li et al, 2009).

There is still the possibility that the actual stimuli, similar to that found by Anagnostopolous et al (2014), were connected to increased seismic events occurring during the days preceding the aggressive events. Those researchers included a wider range ($M < 3$) of seismic events. The decrease in average seismic event energy on days associated with day of reports of increased actual expressions of aggressive events, if both are partially caused by solar variations in the GHz range, would suggest that the energy is distributed to the processes that ultimately result in either the smallest earthquakes or the cerebral conditions that contribute to aggressive behaviors as measured by the global index. In other words as one class of phenomenon becomes more frequent the incidence of the other diminishes. The observation that the strong correlations occurred with the average energy per seismic event rather than the numbers of events, per se, suggest that there may be an analogue of a “vesicular” or “quantum” of energy coupled so the solar-terrestrial influence that is common to both seismic and cognitive processes.

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Chapter 6 - Aggressive Human Behaviour Jerk from Geophysical and Solar Variables

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6.0 Abstract

Modern neuroscience suggests that all human experiences and behaviours are produced by brain function and this mass of cells is subject to the same physical and chemical phenomena as other systems. Intergroup conflicts involving death, manifested as group homicides or suicides, are frequent phenomena that are usually explained by social political variables. We explored the feasibility of employing the modern data bases containing precise daily geophysical variables to predict numbers of daily conflicts as inferred by the Integrated Conflict Early Warning System of the Global Database of Events, Language and Tone Project. Over an approximately 1.5 year interval when all values were present, multiple regression lag/lead analyses demonstrated a correlation of +0.38 between numbers of daily “fight” behaviours and the third derivative (“jerks”) of the earth’s rotation, global numbers of earthquakes between magnitude 3 and 4, and ground-based background photon emissions. These analyses demonstrate the concept in principle that easily accessible environmental data could be ancillary tools to anticipate “unexpected” behaviours defined as terrorism. Thorough analyses from this perspective may reveal hidden variables within these data bases with even greater potential to predict.

6.0.1 Keywords

Aggressive Human Behaviour, Conflict, GDELT project, Earthquake, Solar Flux, Length of Day, Jerk;

6.1 Introduction

Aggressive behaviours between groups of people, mediated by aggregates or by individual representatives of the group have defined the history of conflict within the *homo sapiens*. Aggregate aggressions have often involved groups such as armies with trained directives and a high probability of individual survival. Single aggressions have resulted in the death of the perpetrator in conjunction with larger numbers of the perceived “other” group through progressively sophisticated ordinance. The causal variables for these clusters of homicides and suicides focused upon the “other” group have been traditionally accommodated by the consequences of instinctual or cultural variables, such as ethnocentrism or religious beliefs when one group’s immortality is potentially threatened by the unchallenged validity of another group’s religious belief. The roles of physical energies and forces upon the probabilities of inter-group conflict have rarely been considered. Here we present correlational evidence that subtle global geophysical variables might be employed to predict aggressive group behaviours in the modern world.

The increased accuracy and precision of measurements in general within the last two decades have clearly changed our capacity to predict human behaviour and environmental changes. That the human brain is the bases to all behaviours, including thoughts and beliefs as well as probabilities of intention and action, has been repeatedly substantiated by modern imaging techniques. The precision and massive data registrations of energetic releases within the

environment such as from seismic events, geomagnetic activity, and subtle shifts in terrestrial dynamics that include microchanges in rotational parameters, are now available on open sites. We (Vares & Persinger, 2015) have shown that human conflict as inferred by daily reports of degrees of political violence (Leetaru & Schrodt, 2013) demonstrate weak to moderate strength correlations with geophysical and solar variations. Although correlations do not imply cause, a reliable correlation might be helpful for altering the confidence of the prediction concerning the occurrence of some measured amount of mortality and morbidity due to “sudden” or unexpected conflict.

The consideration that global environmental factors could affect global human aggression and conflict was a common theme in the tradition of ancient oracles. Tchijevsky (1926) was one of the first to show a strong correlation between solar periodicities and the numbers of wars globally. Persinger (1999) employing lag/lead multiple regression procedures found moderately strong associations between annual “social expenditures”, the metaphor for massive numbers of death due to conflict, and a combination of global seismicity and solar-geomagnetic activity. His model predicted an inflection of change in social organization and associated conflict for the years 2001 and 2012. Increases in global geomagnetic activity were the strongest predictors for human group aggression. Day-to-day changes in global geomagnetic activity were moderately correlated with aggression in groups of rats whose brains had been modified within the limbic regions (St-Pierre and Persinger, 1998). Experimental application of patterned magnetic fields by St-Pierre et al (1998) showed that the extremely intense between male aggression by these rats could be amplified. Within the human brain these areas are associated with meaning, belief, and aggression, particularly coupled to sexuality.

Grigoriev and Vladimirsky (2005) found that the majority of the numbers (n=532) acts displayed by Hamas during 1987-2005 occurred during maximal global geomagnetic activity. These researchers found that behaviours identified as terrorism occurred on days when the solar activity was declining compared to the previous week. However clustered within this observation was the escalating slope (rate of change) of geomagnetic disturbances on the day prior to or the day of the specific acts. The coupling of the geomagnetic component to solar variables was suggested by the increase in the rate of acts described as terrorism when the interplanetary magnetic field shifted polarity in a specific direction. If the human brain determines all behaviour and this approximately 1.5 kg mass is subject to the same physical and chemical processes as other dynamic processes, then its dynamics and subsequent overt behaviours could be influenced by a myriad of small energetic events from the geophysical environment in which the species is immersed.

6.2 Materials and Methods

The Global Database of Events, Language, and Tone (GDELT) Project website (<http://gdeltproject.org>) was accessed similar to our previous analysis (Vares & Persinger, 2015). The GDELT Project compiles world media news and categorizes hundreds of "events" with the DARPA-funded Integrated Conflict Early Warning System (ICEWS) project. Events including riots, protests, and diplomatic exchanges have been the subject of comparative study of political violence (Hammond & Weidmann, 2014). With more than a quarter-billion events dating back to 1979, the GDELT database records include details such as physical location and direction of political intention. As confirmed by the database creator (Leetaru & Schrodtt, 2013), the data are considered as a global 'signal' providing insights into human behavioural changes. Conflict and Mediation Event Observation (CAMEO) Event Root Codes label events with a key word, (i.e.

‘Event Root Code 02’ = ‘Appeal’) and further definitions are accessible from the GDELT website <http://data.gdeltproject.org/documentation/CAMEO.Manual.1.1b3.pdf>.

The GDELT event database was accessed via Google’s Big Query Developers Console, which is a cloud-based analytical database service, designed for large datasets. Fast SQL queries against multi-terabyte datasets were accomplished in seconds, and real-time insights about global human society was made accessible. Only one (1) Event Root Codes was extracted (19 = ‘*Fight*’) for dates from January 1, 2003 until December 31, 2015 for a total $N = 4748$ days. To normalize and to compensate for the exponential increase in the availability of global news material over time, the percentage of CAMEO Event Root Codes were calculated from the total number of events reported in the GDELT Event Database, across all event types, and broken down by day.

Geophysical variables were retrieved within similar time span. 3 hour AA indices (nanotesla) were retrieved from the International Service of Geomagnetic Indices (ISGI) (<http://isgi.unistra.fr>), and average daily measures were computed. Earthquake data were retrieved from the Northern California Earthquake Data Center’s Advance National Seismic System (ANSS) which is a composite catalogue of world-wide earthquake data (<http://quake.geo.berkeley.edu/cnss/>). The earthquake data were entered into Matlab software programming for computation of daily total number of earthquakes within each order of earthquake magnitude (eg. 0.01 M – 1.00 M, 1.01 M – 2.00 M, etc.) Length of day variations (milliseconds) were retrieved from the California Institute of Technology’s Jet Propulsion Laboratory via the National Aeronautics and Space Administration (NASA) (<http://euler.jpl.nasa.gov/keof>). The combined values of polar motion including optical astrometric measurements were selected (COMB) for noon UTC.

Solar measurements were also retrieved within similar time span. Daily solar flux units (SFU) measures ($10^{-22} \text{ W}\cdot\text{m}^{-2} \cdot\text{Hz}^{-1}$) were queried from the National Oceanic and Atmospheric Administration (NOAA) Penticton F10.7cm index as measured at local noon (2000 UTC). The peak measurement was 2.8 GHz with a 100 MHz band width (<https://www.ngdc.noaa.gov/stp/stp.html>). Daily total solar irradiance (TSI) measured (W/m^2) for the Earth's orbital distance from the Sun were retrieved from the University of Colorado Boulder laboratory for atmospheric and space physics, Solar Radiation & Climate Experiment (SORCE) (<http://lasp.colorado.edu/home/sorce/>). Sunspot numbers were retrieved from the Royal Observatory of Belgium's Solar Influences Data Analysis Center (SIDC) through the World Data center - Sunspot Index and Long-term Solar Observations (WDC-SILSO) (<http://sidc.oma.be/silso/home>).

To compliment the variable dataset, local photomultiplier tube (PMT) measurements were included. The sensor of the PMT is contained within a thick wooden black box covered with several layers of high thread count black terry cloth. The varying PMT voltages were recorded by an IBM laptop computer once per minute, 24 hr per day since December 1, 2010. The calibrated range from "background" variations over several days where 1 unit change is equivalent to approximately $5 \times 10^{-11} \text{ W}/\text{m}^2$, and assuming there are no very intense imminent large (Magnitude > 8.0) global earthquakes (Persinger et al, 2012), is within 45 and 55 units. The room in which the PMT was maintained was also sealed from encroaching light.

We have previously demonstrated that solar power (SFU) were positively correlated (parametric and non-parametric) with aggressive behaviours while low magnitude earthquake daily energies were negatively related, each within the same day of the recorded aggressive behaviour (Vares & Persinger, 2015). Because the Earth is an open system and is influenced by temporal processes

of solar interactions, the geophysical and solar variables were lagged and lead by ± 30 days. Stepwise multiple regression analysis was conducted on the lagged and lead geophysical and solar variables with the event root code 19 ('Fight') maintained as the dependent variable. To identify the strength of association, a maximum number of steps was set at four (4) for the regression analysis.

6.3 Results and Discussion

The average incidence of the event code 'Fight' per day was 6.966 with a standard deviation of 1.038. The results of the stepwise multiple regression, with the reported human behaviour 'Fight' as the dependent variable, showed four variables entered into the significant equation [$r^2 = .147$, $F_{(4,577)} = 24.670$, $p < .001$, $R = .383$, $SEE = .962$]. The equation was:

$$\text{'Fight'} = -.525(\text{LOD_lag24}) + .029(\text{PMT_lead11}) + .032(\text{EQ3-4_lead20}) - .028(\text{EQ3-4_lead4}) + 5.99$$

It is the combination of a decrease in the length of day (LOD) variations twenty four (24) days prior, an increase of local PMT measurements eleven (11) days after, an increase of total number of earthquakes between magnitude 3.01M – 4.00M twenty (20) days after, and a decrease of total number of earthquakes between magnitude 3.01M – 4.00M four (4) days after that predict the likelihood of a 'Fight' event during the current day. The prediction equation and the dependant variable were partially correlated by controlling for time (increasing sequence), the coefficient remained within the same magnitude (.416 to .406), indicating that time was not a common source of variance.

The excess length-of-day (LOD) variations (milliseconds) are estimates from the Earth orientation. The rapid and sporadic changes in Earth's orientation are a major source of variance. Gross (2001) found these length of day changes gradual over the course of a year. They also show longer patterns of change that can be decades or centuries in duration. These temporal changes have been attributed to the Sun and seasonal heating effects of the Earth's atmosphere and jet stream.

The time variations have also been attributed to geomagnetic 'jerks' and changes in core angular momentum (Holme & De Viron, 2005). The 'jerk' is the rate of change of acceleration, or the third derivative of physical position orientation with respect to time and has the unit m/s^3 . The entry of the magnitude of the jerk into the prediction may be relevant for several reasons. First, a significant component of the variance is associated with changes in the solar-geomagnetic field as the solar system moves through space around the galaxy (Persinger and Vares, 2014).

Second the magnitude of the jerk in terms of changes in angular momentum and hence force applied across the earth's surface for a very brief (msec) duration would approach the range of energies (about 10 Joules per second) associated with cerebral metabolism and certainly would be within the range of energies (10^{-9} J per s) associated with activity of neurons within the cerebral volume. Their pattern of activity is strongly correlated with cognition and decision (Persinger, 2010; 2012). Although the magnitudes of the jerk-related energies within the brain and the activity associated with cognition could be comparable, this does not prove the energies would be sufficient to produce the specific acts of behaviors described as terrorism.

The entry of the specific magnitude of earthquakes within the 3 to 4 M range over the earth per day may not be spurious. Vares and Persinger (2013) observed the conspicuous paucity of 3.6 to

3.7 M quakes within the cumulative global distribution curves. This energy was considered to be a specific coupling to the zero-point fluctuation force and quantum energies that might be relevant to human activity. The changes in background photon flux density, as a potential predictor, are equivalent to about 10^{-11} to 10^{-10} Watts per meter squared. In comparison the photon flux density associated with human cognition is within the range of 10^{-12} to 10^{-11} Watts per meter squared specifically from the right hemisphere (Dotta et al, 2012). Stimulation of the right hemisphere by weak, physiologically-patterned magnetic fields (very similar to the ones shown by St-Pierre et al, 1998, to produce enhanced aggression in male rodents) has been associated with increased reports of very meaningful sensed presences by normal volunteers. The experiences are often attributed to deities (Persinger, 2003). If these experiences were considered personal validation of beliefs to cause harm to those originating from other groups, then the probability of extended overt expressions might increase.

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6.5 References

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Chapter 7 – Synthesis, Implications, and Conclusion

7.1 Synthesis

Chapter 2 presented the foundational concept of interplanetary influences upon the Earth system. The shared variance of solar activity within the range of 50 to 150 SFUs and the average energy from the first magnitude band of the weakest earthquakes (0.01 to 1 M). The negative relationship identified a quantitative difference in magnitude of 10^{10} between the phenomenon. The suggested source of this energy discrepancy would be contained within the sub-matter space structure within which matter from the sun and the earth are immersed. There exists numerous interplanetary forces on Earth's environment, of which the human species is posited.

Chapter 3 utilized novel technology to further the investigation of subtle energy interactions and measurements within the Earth system, focusing on the human organism. The technology discerned the presence or absence of a human being within a closed space by measuring the ambient photon emissions. An aggregate score was able to produce 100% classification between human and no human hyperdark conditions. The equivalent energy difference between the empty chamber background and the occupied human photon signature was within the range of the Landauer Limit for the dissipation of energy from a single bit of information into entropy or the convergence of two quantum operations.

Chapter 4 observations demonstrated the potential for subtle energy measures emitted from one human being had the potential to interact with another individual. The marked convergence between predicted values of cancer incidence and the ones derived from actual average habitational distances between people. The forces and energies at which essential biochemical processes occur are extraordinarily small. The relationship indicates that these very subtle forces

based upon the average Euclidean distances between individuals of our species may be more influential upon the processes that control the population than previously assumed.

Chapter 5 built upon the subtle energy interaction assumptions of the human species and environmental interactions and produced a novel geophysical analysis of human behaviour, utilizing big data observations on a planetary scale. Shared variance of between 4% and 10% between the geophysical variables and the behavioural categories could have significant implications for large populations. Applied to populations of millions of people, this effect can potentially determine the direction of popular opinion, such as votes, and affect economic productivity. The latter phenomenon, including the multiplier effects noted in many large economic systems, often operates for proportions of variability that are less than 10% of the central tendency. Although presented without experimental evidence, demonstration of this effect would diminish the argument that such small solar variations cannot be cerebrally effective. The manifestation of global human behaviour observations are related to the Sun-Earth system's influences on subjective Human organism measurements.

Having established the ability to account for large variability between the individual, Chapter 6 reproduced the big data geophysical analysis on planetary human behaviours, looking towards other potential indicators. The entry of the magnitude of planetary 'Jerk' (m/s^3) into the prediction of human behaviour is highly associated with changes in the solar-geomagnetic field as the solar system moves through space. The magnitude of the 'Jerk' planetary changes in angular momentum approaches the range of energies associated with cerebral metabolism and activity of neurons within the cerebral volume, strongly correlated with cognition and decision. Accounting for variability between human individuals by taking global measurements and

accounting for the time required of external influences to manifest as observable human phenomena has been established.

7.2 Implications

There exists a vast array of stimuli that may be influencing the Human organism at any given period of time. This research investigated only a fraction of the potential influencing interactions the environment can produce from the human organism. Future research directed towards live, real-time data analysis presents the opportunity to customize individual applications. Personal space-time locations are essential to the subtle interactions that may be influencing the individual, including the dynamic and changing brain structure which gives formation to overt and observable human behaviour. Presenting influential forces that can have even a slight influence upon conscious awareness may be required for future understandings of the human species.

Future socio-political exchanges could be coordinated to the Earth system influences to minimize genetic loss of the species. If subtle energies can influence disease and behaviours, accounting for such undercurrents may provide intellectual and strategic advantages. Geophysical and solar variables under future investigations will therefore require systematically appropriate lengths of time to reflect the human phenomena being studied. Currently the data being collected is stored for public consumption in a linear format. The majority of research executes on the linear scale, assuming interactions are instantaneous. This research presents the resolve to adapting the time of observation to meet individualistic inquiries, which may result in significantly different results. Time is apparently required for external influences to manifest as observable human phenomena.

If dense social habitations of humans increase disease incidence, healthy living policy implementation may be a required mandate for future governments to consider. Limiting the cost of governmental health care with preventative messaging to the public is always a prime directive.

7.3 Conclusion

Behavioural, disease, and radiative measurements of the Human organism are related to external planetary and solar observations. The majority of energy from which these systems were constructed originated from the Sun. If the subtle energy emissions of living organisms contain information about the individual, the potential for a novel communication media is realized. The implications concerning the direct influence of fluctuations in power densities on the earth's surface from the sun may require careful reconsideration.

