

An Evolutionary Approach to Modelling Brain~Mind~Soul Dynamics

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Abstract- In recent work a theory about the symbiosis between soul, mind & brain dynamics has been proposed that includes dark matter as a potential source carrier of spiritual values. This theory is conveyed with a systems view where the networks present in human brain dynamics can interface with a brain-like network in the planetary noosphere. This theory, unlike Teilhard de Chardin extends to different planetary realms and dissipates any religious biases in the conception of the noospheres, which are seen as evolutionary ontologies. We introduce the reader to the mathematical modelling to this symbiosis geared towards a better understanding of human cognition and consciousness and also as a framework for the development of truly intelligent and benevolent systems, systems with soul development like behavior. Here, we also give a seminal taxonomy of brain states in different cortices which could be related to stressful or peaceful states of being via internal or external stimuli that can be hypothesized and measured via EEG as a means to advance this theory. Finally, we conclude with some of the potential repercussions associated with a catastrophic scenario for humanity versus a path of correction that would lead to social harmony provided that we develop our human spiritual potential by developing the mastery in interacting with the noosphere via meditation or other practices.

Introduction

It was extremely refreshing to read “My Double Unveiled” by Giuseppe Vitiello¹ where, from the Foreword onwards, he gives as an account of how Quantum Field Theory (QFT) served as a vehicle to explain how the generation or emergence of macroscopic order (condensed matter) from microscopic behaviour (quantum fields) in living (biological) systems occurs in order to advance the treatment of Biological Macroscopic Quantum Systems (BMQS). He (Vitiello) also gives us the courage to continue with this exploration, far from completed, even in the face of resistance arising from misinformed disbelief and cynicism that is very different than new exploratory and creative processes with the usual healthy dose of scepticism. It is important to mention that Vitiello had the opportunity as a physicist of his kind to appreciate Karl Pribram’s work on the holographic view of the brain² and later on to work and collaborate with Walter Freeman, who was mentored by Pribram³, in connecting the QFT of Vitiello with Freeman’s and Kozma’s Non Linear Brain Dynamics that conceives the brain as the organ responsible to create meaning and knowledge for intentional action instead of an information processor only, moving away from the

¹ Vitiello, G. (2001). *My Double Unveiled: The dissipative quantum model of brain (Advances in Consciousness Research)* (Vol. 32). (M. I. Stamenov, Ed.) Amsterdam: John Benjamins Publishing Company.

² Pribram, K. H., & Carlton, E. H. (1986, December). Holonomic Brain Theory in Imaging and Object Perception. *Acta Psychologica*, 63(2), 175-210.

³ Nuallain, S. O. (2016). Consciousness and Brain Science: Mechanisms By Which Nature Knows Through Us. *Cosmos and History: The Journal of Natural and Social Philosophy*, Vol. 12, No. 2.

misplaced metaphor of “a brain is like a computer”, as warned by von Neumann⁴ and from the neuron doctrine, to a notion of brain field dynamics⁵.

The work of Freeman extended to philosophical issues associated with the complementary pair of mind~brain, very much à la Kelso⁶, where he (Freeman) derived inspiration from Aquinas⁷ by substituting the concept of soul from Aquinas’ for the concept of mind necessary to explain intentional action from a cognitive science perspective. However, this paper steps out of this limitation and dares to challenge a scientific paradigm devoid of soul in order to complement Freeman’s and Pribram’s views with the spiritual, subjective human dimension, something Pribram affirmed was a necessity whose time has come^{8, 9}. By doing so we, the human species, would benefit with having paradigms and theories that include the soul, the mind, the brain and perhaps even the heart in order to explain higher cognitive functions, creativity and the benefits associated with the evolution of the soul via spiritual experiences. We would also avoid the individual and social costs of ignoring this dimension of human existence with a science that aims at integrating with ancient wisdom while advancing more research of this kind. In the very unlikely case that science would prove the soul and the human spiritual dimension inexistent, we would have more likely also developed an alternative sound understanding and explanation for human cognition, consciousness and behaviour. Until then we must continue to develop our human potential à la Maslow¹⁰, for example, while continuing our scientific quest for the understanding of human potential and consciousness.

How could we frame a theory that allows for such an investigation and undertaking, has been the subject of the very recent published work of Werbos^{11,12}, as well as the author’s work in cognitive neuroscience¹³. Here, I will focus on complementing the work of Paul Werbos with a paradigm and theory of my own^{14,15}, and finally I will present a brain-mind dynamics framework for soul and consciousness evolution via the concept of Noosphere as explained by Werbos that is similar yet different than the

⁴ Von Neumann, J. (1976). *The Computer and the Brain*. (Yale University Press).

⁵ Kozma, R., & Freeman, W. J. (2016). *Cognitive Phase Transitions in the Cerebral Cortex - Enhancing the Neuron Doctrine by Modeling Neural Fields* (1 ed., Vol. 39). (Kacprzyk, & Janusz, Eds.) Switzerland: Springer International Publishing.

⁶ Kelso, J. A., & Engstrom, D. A. (2006). *Complementary Nature*. Massachusetts: MIT Press - A Bradford Book.

⁷ Freeman, W. J. (2008). Nonlinear Brain Dynamics and Intention According to Aquinas. *Mind & Matter*, 6(2), 207-234.

⁸ Pribram, K. H. (2013). *The Form Within: My Point of View*. Westport, CT, USA: Prospecta Press.

⁹ Freeman, W. J. (2014). Book Review: Karl H Pribram (2013) *The Form Within: My Point of View*. *Journal of Integrative Neuroscience*, 13(2), 429-433.

¹⁰ Maslow, A. H. (1964). *Religions, Values, And Peak-Experiences*. USA: Viking Press.

¹¹ Werbos, P. J. (2019). The Phenomenon of Man Revised: Evolution and I.T. Versus Extinction In the Years To Come. In press *Cosmos and History: The Journal of Natural and Social Philosophy*.

¹² Werbos, P. J. (2019). Quantum Measurement, Consciousness, and the Soul: a New Alternative Position. *Activitas Nervosa Superior: The Journal for Neurocognitive Research*, <https://doi.org/10.1007/s41470-019-00038-z>.

¹³ Davis, J. J. (2009). *The Brain of Melchizedek: A Cognitive Neuroscience Approach to Spirituality (Thesis, Master of Science)*. Dunedin: University of Otago.

¹⁴ Gillett, G., & Davis, J. J. (2015). A Brief Introduction to The Brain and Paradigm of Melchizedek. *Journal of Consciousness Exploration & Research*, Vol. 6, Issue 5, 267-272.

¹⁵ Davis, J. J. (2019). Indeed, Quantum Measurement may just play a part in human brain dynamics that together with the soul may affect human perception and consciousness development. In press, *Activitas Nervosa Superior: The Journal for Neurocognitive Research*.

Noosphere of Teilhard de Chardin and that could advance the mathematical modelling and hypothesis testing of such theoretical framework. I will also introduce the reader to some of the benefits and limitations of using EEG in the study of human cognition, together with a seminal taxonomy of brain states, potentially associated with subjective states that allow the investigation of a soft variable like inner peace, that presumably is associated with soul development together with spiritual values, like love, grace, unity and humour to name a few.

Finally, I will introduce a seminal conceptual model for individual and collective brain-noosphere-soul dynamics with the aid of K-models, Backpropagation and System Dynamics and conclude with some future perspectives concerning the future of humanity in a path of extinction or correction and healing towards social harmony and environmental restoration.

Dark Matter, Fields and The Noosphere

Apart from the knowledge we already have of classical and quantum fields via the standard model¹⁶ it would be inappropriate and deceiving to presume to know what dark energy and matter are and how they interact with the above mentioned fields, however, it would be fair to say that according to a significant amount of physicists, dark energy and dark matter seem to be a plausible and acceptable explanation for the order our universe displays, together with gravitational field effects, and that in a still obscure way, dark energy, dark matter and gravity interact with known fields to maintain microscopic, mesoscopic and macroscopic transactions that somehow, in certain time-space zones, break symmetry and overcome entropy to create order^{17, 18}. This idea or theory is consistent with Vitello's ideas concerning BMQS and particularly the brain when understood and modelled as such a system. This poses the question of how this BMQS, the brain, is modulated both by fields, gravity, dark energy and dark matter and perhaps opens the doors to speculate that that could happen via a set of unmeasurable variables like the mind and the soul if we depart from the idea that mind is an emergent process of the brain and embrace the possibility and now a theory that brain and mind exist in a symbiosis that could be explained via this theory that includes dark energy and dark matter via a planetary noosphere^{19, 20, 21, 22}. We could also accept tautologically, as self-evident truth, and declared in the declaration of independence of The United States of America for example, that unalienable rights and universal values

¹⁶ Cottingham, W.N. & Greenwood, D.A. (2007). *An Introduction to the Standard Model of Particle Physics* 2nd Edition. Cambridge University Press.

¹⁷ Lander, E. (trans. Paredes, E.). (2019). *Integral Theory of the Universe: Transcends Einstein's Relativity; Reveals the Mysteries of Cosmic Inflation, Energy and Dark Matter and That We are Part of An Infinite Fractal Multiverse. [Print Replica] Kindle Edition*. Publisher: Enrique Rafael Lander Rodriguez (March 28, 2019).

¹⁸ Panek, R. (2011). *The 4 Percent Universe: Dark Matter, Dark Energy, and the Race to Discover the Rest of Reality*. Mariner Books.

¹⁹ Werbos, P. J. (2019). *The Phenomenon of Man Revised: Evolution and I.T. Versus Extinction In the Years To Come*. In press *Cosmos and History: The Journal of Natural and Social Philosophy*.

²⁰ Werbos, P. J. (2019). Quantum Measurement, Consciousness, and the Soul: a New Alternative Position. *Activitas Nervosa Superior: The Journal for Neurocognitive Research*, <https://doi.org/10.1007/s41470-019-00038-z>.

²¹ Chardin, P. T. (1959). *The Phenomenon of Man*. Harper & Brothers.

²² Chardin, P. T. (1964). *The Future of Man*. Collins.

(organizing essences, presences and principles) exist without the need of any proof and that they inform the organization of energy and matter via conscious beings, like humans, and particularly enlightened or God conscious humans who are in communication with The Creator or Source of all Universal Values, a spiritual field that can modulate mind dynamics via the Noosphere and each individual soul.

This possibility of God's agents influencing world events has been described by George F.R. Ellis²³ as follows:

“This is to consider the possibility that within the laws governing the behavior of matter, there is hidden another domain of response of matter to life than usually encountered: matter might respond directly to God-centered minds through laws of causal behavior, or there may be domains of response of matter encompassed in physical laws, but they are seldom tested because such God-centered minds are so seldom encountered. Then the distinction between ordinary and extraordinary action becomes a question of whether or not we have entered this domain. What has been classified as “extraordinary” action above would be “ordinary” action but in a different set of circumstances leading to a different kind of response and behavior where God-centered thought dominates and matter responds. Thus, we have the possibility of the existence of a new order, new regime of behavior of matter, where apparently different rules apply, when the right “spiritual” conditions are fulfilled (p. 386).”

We may conjecture then, that the carrier of such a transaction between universal values and the soul would also be dark energy and dark matter and that the soul evolves as a recipient of such values and in turn affects the individual minds and the noosphere when considered as a whole. Then the questions that remain are: a) how then does the noosphere interact with individual brains? And b) how are the collective of brains alive in a planet influenced by the noosphere while also influencing it in feedback loops systemically and thus contributing to the individual and collective evolution of consciousness in a planetary realm? Perhaps part of the answer lies in Brain Field Dynamics and BMQS.

Brain Field Dynamics, Intentional Action and Values Based Decision Making

Freeman gave us a pioneering understanding of how collective meaning could be shared in his books “Societies of Brains: A Study in the Neuroscience of Love and Hate”²⁴ and “How Brains Make Up Their Minds”²⁵, and also gave us the hierarchy of K-Models

²³ Russell, R. J., Murphy, N., & Peacocke, A. R. (Eds.). (1995). *Chaos and Complexity: Scientific Perspective of Divine Action*. Berkeley, California: Vatican Observatory - The Center for Theology and the Natural Sciences.

²⁴ Freeman, W. J. (1995). *Societies of Brains: A Study in the Neuroscience of Love and Hate*. Psychology Press; 1 edition.

²⁵ Freeman, W. J. (2001). *How Brains Make Up Their Minds*. Columbia University Press; 1 edition.

together with a mathematical implementation with Robert Kozma^{26,27,28, 29}, however, without invoking the noosphere or a spiritual value field. It is also important to mention that Werbos provided us with back propagation within a framework of neural networks and dynamic programming³⁰ that allows for a mathematical implementation of values based decision making and systems, where we could model spiritual values as soft variables together with subjective probabilities à la Raiffa³¹ and Howard^{32,33}. When we combine Werbos', Freeman's and Kozmas' mathematical modelling we could develop models and systems that improve the quality of intentions and solve algorithms that can optimize the quality or utility of a decision under a restriction space including energy matter, spiritual values and some behavioural rules. This, it seems to me, constitutes a very powerful synergy and in collaboration with these scientists, I have contributed my part together with Grant Gillett by hypothesizing the cycle of creation of knowledge and meaning with the aid of "The Brain and Paradigm of Melchizedek"³⁴.

If we conceive the unit of brain dynamics as the "neuropil" à la Freeman to be a KII model constituted by a collection of KI models, the most simple or minimal feedback loop between a couple of neurons, which in turn are considered a K0 model, then we could build a hierarchy that grows in complexity from KII-Models (neuropil) to KIII-models (different areas and cortices) to KIV-models (whole brains) and then KV-models (interaction between brains) and by analogy, expanding on Freeman's theory, we could even imagine communication between brains in different planets via planetary noospheres, again mediated by dark energy, dark matter and fields. It seems to me that we could stop here and leave the multiverse K-models for another paper and focus on our planetary realm for now.

We have explored so far a conception via Freeman's K-Models that could explain a level of planetary consciousness integration based on shared meaning and intentional action, however, some of the most innovative mechanisms of optimization to improve the quality of intentions and decisions are provided by Werbos via the use of back

²⁶ Freeman, W. J. (1975). *Mass Action in the Nervous System - Examination of The Neurophysiological Basis of Adaptive Behaviour through the EEG*. New York, NY, USA: Academic Press.

²⁷ Kozma, R. & Freeman, W. J. (2017). Cinematic Operation of the Cerebral Cortex Interpreted via Critical Transitions in Self-Organized Dynamic Systems. *Front. Syst. Neurosci.* <https://www.frontiersin.org/articles/10.3389/fnsys.2017.00010/full>

²⁸ Kozma, R. & Freeman, W. J. (2003). Basic principles of the KIV model and its application to the navigation problem. *J Integrative Neurosci* 2: 125-145.

²⁹ Kozma, R., Freeman, W. J., & Erdí, P. (2003). The KIV model – nonlinear spatio-temporal dynamics of the primordial vertebrate forebrain. *Neurocomputing* 52: 819-826.

³⁰ Werbos, P. J. (1994). Beyond Regression: New Tools for Prediction and Analysis in the Behavioral Sciences, (Thesis -1974). In P. Werbos, *The Roots of Backpropagation: From Ordered Derivatives to Neural Networks and Political*. New York: Wiley.

³¹ Raiffa, H. (1970). *DECISION ANALYSIS - Introductory Lectures on Choices under Uncertainty*. Addison-Wesley Publishing Company.

³² Howard, R. A., & Matheson, J. E. (1984). *The Principles and Applications of Decision Analysis, Part I*. Menlo Park, CA: Strategic Design Group.

³³ Abbas, A. E., & Howard, R. A. (2016). *Foundations of Decision Analysis, Global Edition*. Pearson Education Limited.

³⁴ Gillett, G., & Davis, J. J. (2015). A Brief Introduction to The Brain and Paradigm of Melchizedek. *Journal of Consciousness Exploration & Research*, Vol. 6, Issue 5, 267-272.

propagation, neural networks and adaptive dynamic programming (ADP)^{35, 36, 37}. This algorithm has led to models that serve the purpose to emulate, simulate and implement artificial intelligent systems, based on sound brain research that aims at explaining the presence of cycles and rhythms in the brain in the midst of white, pink, brown and black noise³⁸. Together with this hard core practical scientific contribution, Werbos is providing us now with a novel theory of brain-mind symbiosis bordering on science fiction, however, a possible theory based on the data available, perhaps, the only plausible theory to be subject to scientific biophysical investigation, of course, with present huge limitations and challenges.

Freeman K Models, The Creation of Knowledge and Meaning and some Biophysical Implications à la Vitiello

The days are coming, who knows how and when, that the world of academia and others will fully grasp the depth of the pioneering work of Freeman and its implication in understanding cognition, consciousness and the design of human-like, benevolent intelligent systems, particularly based on K models, the Wave to Pulse to Wave conversion (analog~digital neural brain dynamics), the cinematic theory of the brain and the role of meaning as the currency of the brain for intentional action and values-based decision making^{39, 40, 41, 42, 43, 44}.

Basically, the K-models systemic framework set the conceptual foundation to model the brain as a dynamical system that could account both for the level of complexity and integration that the brain displays as a control system, as well as the very rich diversity of states and oscillatory patterns that it can generate to account for all unconscious and

³⁵ Werbos, P. (2016, December 8). *Deep Learning in Recurrent Networks: From Basics To New Data on the Brain*. Retrieved August 10, 2017, from Recurrent Neural Networks and other machines that learn algorithms: <http://people.idsia.ch/~rupesh/rnnsymposium2016/slides/werbos.pdf>

³⁶ Werbos, P. J. (1992). Neural Networks and the Human Mind: New Mathematics Fit Humanistic Insight. In *IEEE Proceedings Systems, Man and Cybernetics*. New York: IEEE.

³⁷ Werbos, P. J. (2012). Reinforcement Learning and Approximate Dynamic Programming (RLADP) - Foundations, Common Misconceptions, and the Challenges Ahead. In F. L. Lewis, & L. Derong, *Reinforcement Learning and Approximate Dynamic Programming for Feedback Control* (pp. 1-30). New Jersey: Wiley-IEEE Press.

³⁸ Werbos, P. J., & Davis, J. J. (2016, November 28). Regular Cycles of Forward and Backward Signal Propagation in Prefrontal Cortex and in Consciousness. *Frontiers in Systems Neuroscience*, 10(97).

³⁹ Freeman, W. J. (1975). *Mass Action in the Nervous System - Examination of The Neurophysiological Basis of Adaptive Behaviour through the EEG*. New York, NY, USA: Academic Press.

⁴⁰ Kozma, R., & Davis, J. (2018). Why Do Phase Transitions Matter in Minds? *Journal of Consciousness Studies*, 25(1-2), 131-150.

⁴¹ Freeman, W. J. (1972, January 1). Waves, Pulses, and the Theory of Neural Masses. *Progress in Theoretical Biology*, 2(1), 87-165.

⁴² Noack, R., Davis, J.J.J., Manjesh, C., & Kozma, R. (2017). Neuro-energetic aspects of cognition - The role of pulse-wave-pulse conversion in the interpretation of brain imaging data. *The 2017 IEEE Symposium Series on Computational Intelligence (SSCI)*, IEEE Press, Honolulu, Hawaii, pp. 1986-93.

⁴³ Davis, J. J., & Kozma, R. (2013). Creation of Knowledge & Meaning Manifested via Cortical Singularities in Cognition, Towards a Methodology to Understand Intentionality and Critical Behavior in Neural Correlates of Awareness. *Proceedings of the 2013 IEEE Symposium Series on Computational Intelligence (SSCI) Cognitive Algorithms, Mind, and Brain (CCMB)*, SS-0923, IEEE SSCI 2013. Singapore: IEEE Press.

⁴⁴ Kozma, R. & Freeman, W. J. (2017). Cinematic Operation of the Cerebral Cortex Interpreted via Critical Transitions in Self-Organized Dynamic Systems. *Front. Syst. Neurosci.* <https://www.frontiersin.org/articles/10.3389/fnsys.2017.00010/full>

conscious human activity. This framework also achieves that by providing the foundation for implementing systems of differential equations to describe brain dynamics or alternatively implement graph theory and neural percolation models to simulate such complex dynamics^{45, 46}. It is important to mention that Freeman tested his theory in many ways, from the behaviour of one neuron in vitro electrically stimulated, to the dynamics of neuropil in the visual, auditory and olfactory cortices via ECoG measurements.

At this point a sensible question to be asked is, how is it that this framework works?

Let's imagine one neuron placed in a solution where it can be kept alive, where at one stage we provide it with an electrical stimulation (an electric field) at the level of the dendrites close to the soma. After this electric field is given a certain voltaic value (a threshold) the neuron fires, producing an action potential that travels to the end of its axon. These dynamics can be modelled with a relatively easy to solve differential equation and it corresponds to a K0 model. Now, imagine that somehow we put two (2) neurons in the same brain like solution and that sometimes, when needed, we stimulate electrically any of the two (2) neurons to make them fire, and also that each of them may spontaneously fire. In this scenario the action potential (pulses) that travel along the axon are never lost at the end of it and instead they stimulate the neuron at the end of the axon. In other words, they stimulate each other with the possibility to create a more or less cyclical pattern, reflected in action potentials as well as oscillations associated to dendritic ionic currents. This configuration would be also relatively easily modelled by another set of differential equations involving a feedback loop. Of course, the reality of the brain comprises larger populations of diverse neuropil, represented as a collection of K1 models interacting in multiple feedback loops and conforming a K2 model. This collection of K1 models may fire together or be relatively silent with individual inhibitory or excitatory neurons producing a very rich combination of patterns. Suffice to say, for this brief introductory section on K models that as conglomerates of neuropils, stimulate each other to form large regions or sets of neurons, the differential equations become more complex and for a whole brain to be modelled that way it becomes intractable since there are diverse types of neurons and their numbers are vast.

In spite of this, simplified simulation models can be developed to show the richness of signal dynamics at certain levels of hierarchical integration, even with significant simplifications. The alternative mathematical tool that produces brain like behaviour in a more efficient way is to be found in the work of Robert Kozma on Neural Percolation and graph theory, as mentioned earlier. The duo Freeman-Kozma worked very powerfully since it allowed experimental neuroscience to put to the test mathematical models that presumably produced different kinds of spectral noise that can be obtained when we measure the wave or analog aspect of the Wave to Pulse to Wave conversion in brain dynamics via ECoG or EEG. There is still too much work to be done on the

⁴⁵ Kozma, R. et al. (2016). Critical Behavior in Hierarchical Neuropercolation Models of Cognition. In *Cognitive Phase Transitions in the Cerebral Cortex - Enhancing the Neuron Doctrine by Modeling Neural Fields* (1 ed., Vol. 39). (Kacprzyk, & Janusz, Eds.) Switzerland: Springer International Publishing, pp. 63-69.

⁴⁶ Kozma, R. (2007). Neuropercolation. *Scholarpedia*, 2(8):1360.
<http://www.scholarpedia.org/article/Neuropercolation>

relationship and correlations between the spatio-temporal intensity of a collective of action potential more or less synchronised or desynchronised and the delayed effects that they have in producing ionic currents at the dendritic level near the soma, where the next set of action potentials will be produced somewhere in the brain when the right threshold is reached. However, Freeman suggested, in my view rightfully so, that since the currency of the brain was meaning⁴⁷, and sensory input with its associated immediate set of action potentials carried meaningless information, the brain had to use other mechanisms where meaning is created after binding via large scale integration that takes place involving the different cortices and functions and that these integrated patterns of activity should be searched for at the level of the cortex in the wave like patterns and oscillations that can be measured by EEG. The natural conclusion from these findings and narrative is that pulses usually modelled by simplistic artificial neural networks can never explain intentional and constructive intelligence based on values and that values required the creation of meaning and knowledge as the foundation for human decision making and the refinement of intentions, by incorporating the experience of a higher form of universal values, like love, unity and truth for example. In other words, spiritual, soul and subjective inner space evolution or embodied spirituality.

It is important to mention that symmetry is broken each time meaning and knowledge are created, and Freeman and Kozma have associated symmetry breaking to a form of phase transition, which occurs in the brain in nonlinear dynamic regimes that create order as meaning. Vitiello in his collaboration with Freeman advanced a level of communication where the creation of coherent patterns and order in the brain were also established via the application of QFT to explain brain dynamics, where forms of condensates are associated to these phase transition patterns and the creation of order as described by BMQS^{48, 49}. This, for the first time, allowed a quantum theory without the limitations imposed by quantum mechanics concerning temperature, size of the system and other degrees of freedom. This was the kind of quantum theory that Freeman embraced since it was grounded on neurobiology reflected in neural systems dynamics which can produce order out of noise associated to background activity.

These kinds of classical and quantum biophysical models of brain activity would allow the quest for meaning and knowledge creation in the brain that could be approached, ideally non-invasively, via EEG or new technologies as science and engineering advance the design and production of new measuring devices and tools for signal analysis. Still, as Vitiello puts it⁵⁰, naturalism has to play its part and human EEG studies may help in building a taxonomy of observed (quantitative) and reported (qualitative) states in order to establish a relationship between internal states, peaceful or painful, and their psychophysiological correlates as measured by specific biomarkers.

⁴⁷ Kozma, R., & Davis, J. (2018). Why Do Phase Transitions Matter in Minds? *Journal of Consciousness Studies*, 25(1-2), 131-150.

⁴⁸ Vitiello, G. (2016). Commentary by Giuseppe Vitiello. In *Cognitive Phase Transitions in the Cerebral Cortex - Enhancing the Neuron Doctrine by Modeling Neural Fields* (1 ed., Vol. 39). (Kacprzyk, & Janusz, Eds.) Switzerland: Springer International Publishing, pp. 63-69.

⁴⁹ Vitiello, G. (2018). The Brain and its Mindful Double. *Journal of Consciousness Studies*, 25(1-2), pp. 151-176(26).

⁵⁰ Vitiello, G. (2001). *My Double Unveiled: The dissipative quantum model of brain* (*Advances in Consciousness Research*) (Vol. 32). (M. I. Stamenov, Ed.) Amsterdam: John Benjamins Publishing Company.

Seminal Brain States Taxonomy and their Possible Associations with Different Inner (Soul and Mental) States

In recent years many studies have been performed while participants meditate on inner peace and other energy consuming activities. Some of these studies are^{51,52}, where brain activity has been measured via EEG equipment and quantitatively and qualitatively analysed via a dominant frequency index and the art of encephalography with EEG based brain movies^{53,54}. When the data is collected via high dense array of electrodes (more than 200) then the spatio-temporal resolution provides us with rich dynamical patterns that presumably can be classified according to the inner states of the participants. This is far from being an easy task, however it is doable, and as technologies advance we foresee that we will be equipped with more robust biofeedback systems to accelerate the learning process that allows for the generation of positive, harmonious and peaceful states at will⁵⁵. These biofeedback systems, in the future, may extend to monitoring simultaneously brain, heart, respiration and hormonal dynamics via EEG, Heart Rate Variability (HRV) and other monitors⁵⁶. So far, based on the above studies, we have identified a set of psychophysiological states via EEG and HRV that could be associated to inner subjective states or soul states, like peace, discomfort or confusion and internal pain. The psychophysiological correlates to these states are more easily discernible via HRV monitors and with more difficulty via EEG measurements. For a thorough understanding of Psychophysiological coherence and HRV the reader is referred to⁵⁷.

The following labelled states in this seminal taxonomy in Table I are quite arbitrary and should be subject to more robust investigation including a large data base of participants in future studies, however, this table should serve as a guideline to construct a robust taxonomy for such states.

⁵¹ Davis, J.J.J., Lin, C.-T., Gillett, G., Kozma, R. (2017). An Integrative Approach to Analyze EEG Signals and Human Brain Dynamics in Different Cognitive States. *Journal of Artificial Intelligence and Soft Computing Research*, 7(4), 287-299. <https://www.degruyter.com/view/j/jaiscr.2017.7.issue-4/jaiscr-2017-0020/jaiscr-2017-0020.xml>.

⁵² Davis, J.J.J., & Kozma, R. (2018). Visualization of Human Cognitive States Monitored by High-density EEG Arrays. *Procedia Computer Science*, 144, 219-231. <https://www.sciencedirect.com/science/article/pii/S1877050918322312>.

⁵³ Davis, J.J., Kozma, R., Lin, C.-T., & Freeman, W.J. (2016). Spatio-temporal EEG pattern extraction using high-density scalp arrays. *The 2016 International Joint Conference on Neural Networks (IJCNN)*, IEEE Press, Vancouver, Canada, 24-29 July, 2016. <https://ieeexplore.ieee.org/document/7727293>.

⁵⁴ Davis, J. J., Kozma, R., & Freeman, W. J. (2015). The Art of Encephalography to Understand and Discriminate Higher Cognitive Functions Visualizing Big Data on Brain Imaging using Brain Dynamics Movies. *Procedia Computer Science*, 53, pp. 56-63. San Francisco: Elsevier.

⁵⁵ Davis, J.J.J., Kozma, R., & Schübeler, F. (2019). Stress Reduction, Relaxation, and Meditative States Using Psychophysiological Measurements Based on Biofeedback Systems via HRV and EEG. In: N. Lee (Ed.), *Encyclopedia of Computer Graphics and Games*. Cham, Switzerland: Springer, 2019. https://link.springer.com/referenceworkentry/10.1007/978-3-319-08234-9_330-1.

⁵⁶ Davis, J.J.J., Schübeler, F., & Kozma R. (2019). Psychophysiological Coherence in Community Dynamics – A Comparative Analysis between Meditation and Other Activities. *OBM Integrative and Complementary Medicine*, 4(1), 1-24. <http://www.lidsen.com/journals/icm/icm-04-01-015>.

⁵⁷ McCraty, R., Atkinson, M., Tomasino, D., & Bradley, R. T. (2009, December). The Coherent Heart: Heart–Brain Interactions, Psychophysiological Coherence, and the Emergence of System-Wide Order. *Integral Review*, 5(2), 10-115.

Table I. Seminal Taxonomy of Brain and Heart States and their possible associated inner states.

BAND HRV	Visual Area DF	Auditory Area DF	Olfactory Area DF	Other Area DF	Sensory Input	Internal activity only	Presumably Inner State
Coherent	Alpha	Alpha	Alpha	Alpha	Minimal Visual, Auditory , etc.	-	Inner Peace Psycho Physiological Coherence
Semi Coherent	Beta or Gamma	Beta or Gamma	Beta or Gamma	Beta or Gamma	Minimal Visual, Auditory , etc.	-	Inner Discomfort & Busyness
Stressed	Beta, Gamma	Beta, Gamma	Beta, Gamma	Beta, Gamma	Minimal Visual, Auditory , etc.	-	Inner Pain & Busyness
Coherent	Alpha	Alpha	Alpha	Alpha	-	Imagination Visual, Auditory, etc.	Inner Peace Psycho Physiological Coherence
Semi Coherent	Beta, Gamma	Beta, Gamma	Beta, Gamma	Beta, Gamma	-	Imagination Visual, Auditory, etc.	Inner Discomfort & Busyness
Stressed	Beta, Gamma	Beta, Gamma	Beta, Gamma	Beta, Gamma	-	Imagination Visual, Auditory, etc.	Inner Pain & Busyness

The top priority and challenges for future studies will be to refine this seminal taxonomy, increase diversity and size of data base of participants, agree on a robust dictionary for brain and inner states, and more importantly, to associate biomarkers and psychophysiological data with subjective inner states that are in turn associated to both soul and mind. In order to access inner states, questions like: (1) what do you feel in your soul and (2) what is going on in your mind? could be asked, and the questionnaire could be designed as multiple choice, open answers or a combination, and that will have to be carefully determined.

There are other studies on telepathy or synchronicities à la Carl Jung⁵⁸ for example, that could also be designed and conducted to track movements in the noosphere, together with intentional and spontaneous action but that remains outside the scope of this seminal paper.

⁵⁸ Jung, C. G. (1973). *Synchronicity - An Acausal Connecting Principle*. New Jersey, USA: Princeton University Press.

Conceptual model and future perspectives

In the following picture, Figure 1, I present a conceptual description of a model to represent the system dynamics of universal values field, dark energy, dark matter, noosphere, soul development and individual and collective brain dynamics.

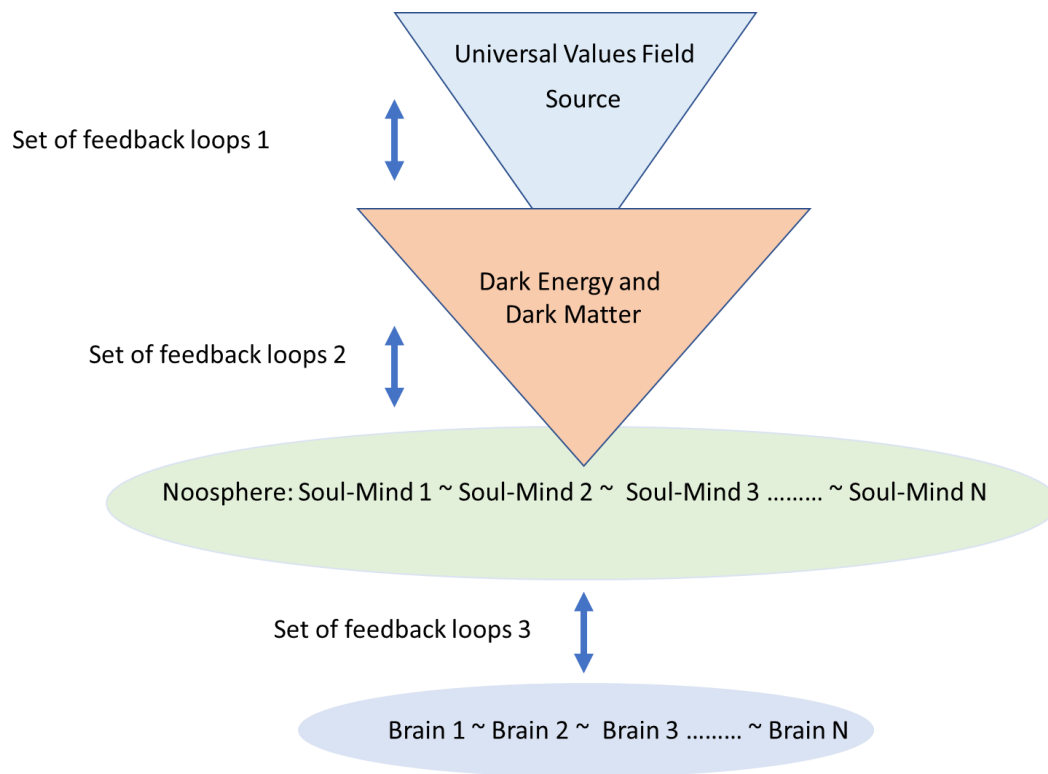


Figure 1 General Systems Dynamics diagram describing the interaction between Universal Values Field, Dark Energy and Dark Matter, The Noosphere (individual-collective) and Human Brains implicitly depicting Soul and Consciousness Evolution.

Though this is a simplified diagram it is intended to show the dynamics of soul and consciousness evolution via the voluntary and intentional interaction of each soul with the Universal Values Field by the agency of the individual's mind and the noosphere as a whole. The spiritual experience of universal values refines the mind activity of each individual causing the evolution and refinement of the noosphere. Enlightened or Source conscious people may affect highly positively the noosphere as a whole via interaction of individual minds or groups of minds. Minds can affect each other and in turn brains should generate brain activity to manifest the cognitive experience of telepathic communication and synchronicities for example, that are cognized by individual awareness and attention. This may generate a set of higher meanings and knowledge related to others, oneself, the universe and the Source, resulting in human actualization where soul evolution takes place. In the limit, as individuals achieve their full potential via a set of peak experiences until a plateau experience is reached⁵⁹, the "child noosphere" evolves until it becomes an adult, resembling the image and similitude of the Source. In this preliminary and simplified conceptual model (Figure 1) it is still doubtful, in my view, that the third set of feedback loops exists. However,

⁵⁹ Maslow, A. H. (1971). *The Farther Reaches of Human Nature*. New York, NY: Viking Press.

at this stage we should avoid ruling it out even though it seems more likely that the noosphere affects individual brain dynamics, while brain dynamics never directly affect the noosphere. Neural activity seems to be only an effect caused by noosphere activity. This issue will certainly need to be discussed and clarified in other collaborative work in the future. It is important to mention that noosphere together with group brain dynamics could in principle be modelled with the aid of KVI Models, Back Propagation, ADP and Neural Networks, which also remains a future task.

In the model described above, it is the reception of spiritual values in a transaction between the soul and the spiritual value field that, via dark energy and dark matter, the soul is able to evolve in order to actualize the quality of mind, which also actualizes the quality of the noosphere affecting the behaviour of human beings via the creation of new and higher and sublime meanings in human brain dynamics. This means that the interplay between soul and mind allows for the actualization of the perception of spiritual and noosphere realities, providing a new cognitive map of brain activity that brings to the conscious that which is unconscious.

Imagine that the dynamics described in Figure 1 was gradually manifesting more benevolent, intelligent and wise constructive actions. This would mean that social harmony could be achieved with subsequent restorative actions for our environment, amongst other benefits. In this way a potential planetary catastrophe hovering over the planet at the moment, could be avoided. This Soul Evolution can be ignited in different ways and many people report that meditative practises, amongst others, significantly contributes to set and keep the process in an “upward” motion. These are practises that can be learned from a relatively young age and aided by biofeedback systems. It seems to me that this can lead to benefits in a relatively short time. Now, we as scientists, engineers and technology designers and producers have the imperative mandate to make this happen.

Acknowledgements

I would like to acknowledge Carey, Kali, Colin, Cheche and Katy for their support in the completion of this paper.

I would also like to acknowledge Paul Werbos and Robert Kozma for their continuous support, inspiration and encouragement to continue to develop these challenging ideas, theories, paradigms and models for the improvement of our human species.