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The NeuroPhilosophy of Physics: A Grand Unification of How Brain and Mind Shape Our Perception of the Universe

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Abstract

The advancement of modern science, particularly in neuroscience and physics, may have reached the level of knowledge that enables us to be at the cusp of a new grand unified theory of the nature of our mind and how it shapes our perception of reality and evolution of science itself. This grand leap forward requires a paradigm shift towards greater integration of different scientific disciplines under the emerging new field of complex, dynamic systems, such as our brain and the universe, describing how the complex organization of matter is driven by energy flows. This new paradigm enables us to build a new scientific framework by exploring theories in philosophy, physics, biology and neuroscience; weaving them together into a holistic view of the human mind and the nature of physical reality, as in complex systems the whole is greater than the sum of its parts. Throughout the history of philosophy the fundamental question of how the mind perceives reality has shaped its fundamental branches: metaphysics, considering the nature of reality, and epistemology, studying how our mind gains knowledge of reality. This article shall apply new theories in neuroscience, including neuroendocrinology and how it regulates the sociocultural evolution of civilization (Barzilai, 2019; 2023), and cognitive neuroscience, particularly the predictive mind paradigm and free energy principle, to explore the rise of modern science and physics since the Enlightenment, and gain better understanding of both neuroscience and physics.

Key Words: philosophy of physics, chronosociobiology, free energy principle, predictive processing, temporo-spatial theory of consciousness

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Introduction

The Enlightenment period has led to the rise of modern science, with the Newtonian view of physics that envisions the universe as orderly, composed of recurring patterns of bodies in motion, driven by natural forces, which are intelligible to the objective and rational human mind. Similarly, Enlightenment empiricist philosopher John Locke determined that the human mind understands reality through perception of empirical observations of world that brings to our

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conceptualization of the nature of reality. This highly potent view of the human mind and the objective nature of reality define this Enlightenment worldview known as English empiricism. This reductionist, materialist view of individual objects as the fundamental unit of existence also pertains to our social order as individualism and individual liberty became the foundations of society rather than the collective whole. Hence the rise of western ultra-reductionist paradigm in science began with Newtonian mechanics.

Hence, this rational mindset that shaped the rise of western civilization also led to the ideas of human liberty based on individual rights, national independence, and the rise of modern science, capitalist system, and industrial revolution powered by high-energy utilization of natural resources to build the modern world. The articles mentioned on neuroendocrinology and civilization suggest that these sociocultural trends were powered by rise in sex and growth hormone regulated by the hypothalamus, the master hormone regulator in our brain, due to rising solar activity during the Enlightenment.

However, this Enlightenment philosophy trend that shaped the rise of modern science changed course during the counter-Enlightenment period starting with the German philosopher Kant who published the Critique of Pure Reason in the 1780's, a paradigm shift challenging the previously held notion of the rationality, objectivity and power of the human mind to know reality and hence command over nature.

This German Idealist philosophy of mind determines that our mind is limited by the innate structure of our brain's top-down perception of reality, upending the rational conception of cognition based on bottom-up integration of empirical observations of reality. This counter-Enlightenment social trend has shaped both our civilization since and the evolution of modern science and philosophy. This article suggests that studying the powers driving these sociocultural trends may uncover the clues to fundamental questions in philosophy, neuroscience and physics, which have for the last centuries intriguing scholars in the quest for the advancement of modern science. This idealist view is more holistic, determining that the observer cannot be separated from observed object. Hence, the dualism of mind-body, matter-energy, and atomism-connectionism countered the Newtonian, materialist worldview.

As energy is the fundamental force that drives the changes and motion of objects in our physical universe, energy, in the form of solar energy, or light, also drives the rise and fall of human civilizations, as complex biological systems driven by energy flow. Energy also shapes our brain and mind's perception of reality. Furthermore, a new unifying paradigm has emerged in theoretical and computational neuroscience, called the predictive mind, or predictive processing, which proposes a theory of brain function, which postulates that the brain is constantly generating and updating a "mental model" of the

environment. In 2006, Karl Friston published the groundbreaking article, *a free energy principle for the brain*, suggesting that free energy is the principle that can explain how the brain's adjusts its model of reality based on empirical evidence:

> By formulating Helmholtz's ideas about perception, in terms of modern-day theories, one arrives at a model of perceptual inference and learning that can explain a remarkable range of neurobiological facts: using constructs from statistical physics, the problems of inferring the causes of sensory input and learning the causal structure of their generation can be resolved using exactly the same principles. Furthermore, inference and learning can proceed in a biologically plausible fashion. The ensuing scheme rests on Empirical Bayes and hierarchical models of how sensory input is caused. The use of hierarchical models enables the brain to construct prior expectations in a dynamic and context-sensitive fashion. This scheme provides a principled way to understand many aspects of cortical organization and responses.
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> In this paper, we show these perceptual processes are just one aspect of emergent behaviours of systems that conform to a free energy principle. The free energy considered here measures the difference between the probability distribution of environmental quantities that act on the system and an arbitrary distribution encoded by its configuration. The system can minimise free energy by changing its configuration to affect the way it samples the environment or change the distribution it encodes. These changes correspond to action and perception respectively and lead to an adaptive exchange with the environment that is characteristic of biological systems. This treatment assumes that the system's state and structure encode an implicit and probabilistic model of the environment. We will look at the models entailed by the brain and how minimisation of its free energy can explain its dynamics and structure (Friston, 2016).

Hence, we shall study the nature of the universe, human sociocultural evolution and how the human mind understands reality from the grand unifying perspective of the physics of energy flow.

The predictive mind

The 2016 article, *The Predictive Processing Paradigm Has Roots in Kant*, suggests that the cycles of energy trends that regulate human history, have created trends in human cognition and philosophy that have shaped our culture since the counter-Enlightenment Kantian paradigm shift:

> Predictive processing (PP) is a paradigm in computational and cognitive neuroscience that has recently attracted significant attention across domains, including psychology, robotics, artificial intelligence and philosophy. It is often regarded as a fresh and possibly revolutionary paradigm shift, yet a handful of authors have remarked that aspects of PP seem reminiscent of the

> work of 18th century philosopher Immanuel Kant. To date there have not been any substantive discussions of how exactly PP links back to Kant. In this article, I argue that several core aspects of PP were anticipated by Kant (1996/1787) in his works on perception and cognition. Themes from Kant active in PP include: (1) the emphasis on "top-down" generation of percepts; (2) the role of "hyperpriors"; (3) the general function of "generative models"; (4) the process of "analysis-by-synthesis"; and (5) the crucial role of imagination in perception. In addition to these, I also point out that PP echoes Kant's general project in that it aims to explain how minds track causal structure in the world using only sensory data, and that it uses a reverse-engineer or "top- down" method of analysis. I then locate a possible source of Kant's influence on PP by tracing the paradigm back to Hermann von Helmholtz, who saw himself as providing a scientific implementation of Kant's conclusions. I conclude by arguing that PP should not be regarded as a new paradigm, but is more appropriately understood as the latest incarnation of an approach to perception and cognition initiated by Kant and refined by Helmholtz (Swanson, 2016).

Hence, Kant can be described as the father of modern neuroscience, as a philosopher who studied the epistemology of how our mind uses its limited resources to form its perceptions of reality. Kant challenged Locke's reductionist, empiricist bottom-up approach to epistemology, suggesting a holistic view of top-down cognitive biases that shape our interpretation and perception of bottom-up information processing.

The article on neuroendocrinology as the driving force of civilization also proposes the top-down view of solar energy trends driving our brain to regulate our levels of hormones, such testosterone, and neurotransmitters, such as serotonin and dopamine, leading to a Kantian, Idealist, top-down view of human cognition shaped by forces of light driving the Enlightenment mindset, versus darkness driving the counter-Enlightenment view of society, environment, and the natural world. Furthermore, Kantian philosophy itself is a product of the beginning of counter-Enlightenment psychological forces that deem the human mind as less than fully-rational and incapable of omnipotent God-like faculty of reason as imagined before.

How the free energy principle shapes epistemology

During the 1950's, a period of high-solar activity that led to rise of individualism and reason again led to rise of Ayn Rand's objectivist philosophy promoting Enlightenment Ideals. In his 2012 book, *The Dim Hypothesis: Why the Lights of the West Are Going Out,* Objectivist philosopher Leonard Peikoff seeks to develop a new theory of epistemology to identify how the human mind integrates data to understand reality:

> In this far-reaching study, Peikoff identifies the three methods people use to integrate concrete data into a whole, as when connecting diverse experiments by a scientific theory, or separate laws into a Constitution, or single events into a story. The first method, in which data is integrated through rational means, he calls Integration. The second, which employs non-rational means, he calls Misintegration. The third is Disintegration—which is nihilism, the desire to tear things apart (Peikoff, 2012).

Peikoff's important work on the history of human thought and epistemological paradigm shifts throughout history, can be integrated with the neuroendocrinology driver of cultural evolution to suggest that that our cultural views on objectivity, rationality, and the epistemology changes according to top-down energy levels regulated by our limbic system, producing trend-changing hormonal-cycles. High-energy periods such as the Enlightenment bring an epistemology of Integration, of rational mind in an orderly universe, such as the Newtonian paradigm in physics. As cognitive energy levels decline begins an attack on human rationality as evident the Kantian epistemology of bounded rationality and innate ideas, which can lead to misintegration of empirical evidence. Denegation of cognitive energy will finally bring an epistemological disintegration phase change in which reality and logic are totally denied. In the Dim Hypothesis, Peikoff analyses the evolution of modern science to suggest that the fall of the Newtonian view of objective reality in modern physics suggests a decline in epistemology towards disintegration, which he assesses as the mark for the cognitive decline of civilization.

As human mind is an emergent phenomena of the complex biological system of billions of neurons in our brain that give rise to cognition and compose an integral part of the world that we perceive, understanding perception of our environment requires to study how our environment effects our perception of it through our senses and also subconscious, limbic processes in the brain, such as our exposure to light through our daily circadian rhythm. The great Enlightenment philosopher, Descartes, determined that the pineal gland, which is tiny endocrine gland in the brain that helps regulate the body's circadian rhythm by secreting the sleep hormone melatonin, is the seat of the human soul (Britannica, 2023) The dichotomy of light versus darkness represents not only physical energy states, but also has shaped human psychology, physiology, philosophy and spiritualty as fundamental forces of human nature that mirror our natural world.

Energy Flow, Thermodynamics, and Life

The free energy principle in neuroscience is rooted in theory of entropy in physics, which applied to biology refers to the process of life as utilizing energy to sustain and further itself to maintain order by acquiring resources to grow in face inevitable decay and entropy. The

2006 *book, Into the Cool: Energy Flow, Thermodynamics, and Life*, describes life as process driven by the energy gradient created by solar energy coming towards earth powering the evolution of life:

> Schneider and Sagan's thesis, in brief, is that energy flows have not only powered the evolutionary process but have organized it and defined its overall trajectory. Life's trends, they say, stem from the second law of thermodynamics the so-called entropy law), which refers to an inherent tendency of ordered "free energy" in nature to dissipate and become entropic, or unusable for doing further work. Schneider and Sagan claim that energy flows "generate, perpetuate, elaborate," biological complexity. "Life is organized by energy flows." It was "sired by energy flow." It is "ruled" by energy and its transformations. Indeed, the second law of thermodynamics defines the very "purpose" of life. "Nature abhors a gradient," they claim, and life arose in order to reduce energy gradients – in much the same way that tornadoes serve to dissipate the pent-up energy in the gradient between high- and low-pressure air masses. The emergence of life is "causally connected to the second law," they say. Indeed, the second law is variously characterized by Schneider and Sagan as a force that "governs," "organizes," "selects," "generates," "determines," "mandates," "pushes" and "leads to" biological structure and organization. The second law is the "source" for the overall directionality observed in evolution, they say (Corning, 2015).

Next, we shall analyze the evolution of modern physics since the Enlightenment to examine how energy trends cause changes in our hormones levels, which shape how the human mind's perception of the physical universe and the evolution of modern science.

Energy, predictive mind and modern physics

The rise of Enlightenment science began with the Newtonian view of an orderly universe, focusing on the individual objects of celestial mechanics being held together by the unifying force of gravity, a high-energy view of the Creator of order who unifies absolute space and time, which is also evident in the formation of the law of conservation of energy, which was later established as the first law of thermodynamics by the French scientist Émilie du Châtelet in the 18th century (Arianrhod, 2012).

However, as solar energy declined from its peak in 1776 during the 19th century a new focus emerged in physics on the chaotic flux energy of electromagnetism, with the groundbreaking works of Michael Faraday and Maxwell determining that energy, light, is an electromagnetic wave travelling at the constant speed of light. Around 1859, German physicist Rudolf Clausius stated the second law of thermodynamics determining the order decreases in the universe as heat flows from hot to cold, causing a rise in entropy, a measure of disorder, or chaos. This occurred at the same time Darwin published in 1859 *On the Origins of Species*, suggesting that a chaotic process of

evolution through natural selection drives the creation of species, rather than the God of Order of the Enlightenment worldview. This followed by Ludwig Boltzmann's statistical mechanics which studied the degree of entropy in gasses, as a system composed of atomic particles in motion.

The new paradigm of the NeuroPhilosophy of physics suggested here, proposes that declining solar energy flows are the cause for the change in the human mind's top-down view of nature as biased toward decline in order and increase in chaos, as energy decline in our natural world affecting our social brains.

Although the decline in the paradigm of order, 19th century physics still maintained a classical, Newtonian, mechanical worldview even in electromagnetic theory, as both Faraday and Maxwell believed in luminiferous ether as a medium for the propagation of light. It was invoked to explain the ability of the apparently wave-based light to propagate through empty space (a vacuum), something that waves should not be able to do. However, there emerged a problem with Newtonian view of light as a particle as it was discovered to have a wave behavior, which eventually led to a debate over the wave-particle dual nature of light as a continuous wave or a discrete particle. In 1901, German physicist Max Plank discovered that by quantizing the energy of a light wave he could solve the observed spectrum of light emitted by a glowing object, meaning the light had the characteristics of a discrete particle, in contrast to the 19th century view of light as simply a wave. In 1905, Einstein explained the photoelectric effect of light photons of quantized energy levels emitting electrons from atoms leading the development of quantum mechanics and its particle-wave duality.

As solar activity continued to decline into the 20th century bottoming down into the Great Depression period, caused by declining social mood wave due to low solar energy, it also brought the complete collapse of "orderly universe" of the absolute space-time paradigm, with Einstein's shift toward relativity theory and space-time curvature as the cause of gravity, further disintegrating towards the Copenhagen interpretation of quantum mechanics denying any deterministic causality during the 1920's, upon which Einstein famously stated, "God does not play a dice". During this period, in 1912, the third law of thermodynamics was stated regarding the minimization of entropy in absolute zero temperate, when there is no more energy or motion of heat.

Einstein also disregarded the notion of ether as medium for propagation of light wave, replacing it with a four-dimensional vacuum of space-time which is curved according to mass. This shift represents in physics the Kantian paradigm (Weinert, 2005) of innate mental categories of space and time that contradict the British empiricist view of three-dimensional space that is evident to our sense perception.

Free energy, entropy and cosmology

The free energy principle can also explain the evolution of cosmological theories on the state and eventual fate of the universe as a projection of the human condition and future existence, caused by mental states and social mood trends. As during the Enlightenment, the universe was viewed as orderly and static, filled with divine energy of the Creator and purpose of creation, who maintains its order through the force of gravity and the conservation of energy, the first law of thermodynamics stated in this period. However, this theology gradually changed with the decline in free energy levels.

In cosmology the standard view was of a static universe that led Einstein to add the cosmological constant in 1917 to his field equation in General relativity in order to correct for his universal space-time to remain steady rather than expand. However, in 1929 this constant was abandoned with Hubble's discovery of an expanding universe. In 1998, the discovery that the expansion of the universe is accelerating, implied that the cosmological constant may have a positive value. Later the cosmological constant was reinterpreted as the energy density of space, or vacuum energy that arises in quantum mechanics. It is closely associated with the concept of dark energy, which causes the rate of expansion of the universe to accelerate.

This led to the conception of the universe in a state of rising entropy, leading to heat death of the universe (also known as the Big Chill or Big Freeze), which is a hypothesis on the ultimate fate of the universe, which suggests the universe will evolve to a state of no thermodynamic free energy, and will therefore be unable to sustain processes that increase entropy, meaning life will eventually cease to exist due to end or any energy gradient, and the universe will die out.

Energy, predictive mind and neurotheology of science

The changing energy trends can also be analyzed in term of the theological views of major figures in modern science and how energy shaped their top-down perception of the universe. "Neurotheology", also known as "spiritual neuroscience", refers to the multidisciplinary field of scholarship that seeks to understand the relationship between the human brain and religion (Sayadmansour, 2015).

The Enlightenment period in England led to the rise of the theology of Unitarianism, of which both Newton and Locke were early followers, that views God the Creator as the single unifying force in the universe. This theology can be categorized with the method of integration in epistemology according to Peikoff's DIM Hypothesis, as

it seeks unification as its fundamental paradigm in the understanding of natural processes.

Einstein, in contrast was a follower of the 17th century heretic, pantheist philosopher, Spinoza, stating that "I'm not an atheist, and I don't think I can call myself a pantheist... I believe in Spinoza's God who reveals himself in the orderly harmony of what exists, not in a God who concerns himself with fates and actions of human beings" (Calaprice, 2010). Hence, Einstein's and Spinoza's God is not concerned with individual or individual objects, but with the overall order of existing systems. The book, *Anima Mundi: The Rise of the World Soul Theory in Modern German Philosophy*, (Vassányi, 2013) describes how the Platonic concept of the universe as a pantheistic, holistic being, shape German philosophy and Spinoza in particular. This theology can be categorized with the method of Misntegration in epistemology according to Peikoff's DIM Hypothesis, as it seeks order in systems but disregards individualism, as its fundamental paradigm in the understanding of natural processes. This is a consequence of declining energy trends during the German counter-Enlightenment period culminating in paradigm shifts in physics in the early 20th century.

Towards the bottoming in solar energy during the 1920's leading to the Great Depression in 1933, we observe the rise of Copenhagen interpretation of quantum mechanics denying any deterministic causality and being criticized by Einstein who still maintained some the classical 19th century mindset of an orderly universe. In the 1975 book, *The Tao of Physics: An Exploration of the Parallels Between Modern Physics and Eastern Mysticism*, describes his discussions with Heisenberg on the parallels of indeterminism of energy in quantum mechanics and Buddhism:

> While he was working on quantum theory he went to India to lecture and was a guest of Tagore. He talked a lot with Tagore about Indian philosophy. Heisenberg told me that these talks had helped him a lot with his work in physics, because they showed him that all these new ideas in quantum physics were in fact not all that crazy. He realized there was, in fact, a whole culture that subscribed to very similar ideas. Heisenberg said that this was a great help for him. Niels Bohr had a similar experience when he went to China (Weber, 1982).

Neils Bohr adopted the yin-yang symbol, which in Chinese philosophy magnifies the female-male sexual energy contrast as part of cosmic moon-sun, darkness-light dichotomy, as part of his coat of arms when he was knighted in 1947, it is claimed in the book that it was a result of orientalist influences (Aaeserud, 2015). Buddhist Eastern philosophy is the extreme in low energy culture, preaching asceticism, low energy vegetarian diet, and calls of stillness in meditation, inaction, passivity and surrender in acceptance of wheel of fate, and is concerned with holistic nature of the universe as cycles of energy, in contrast to reductionist western science seeking progress

and accomplishment. Hence, this phase can be categorized with the method of Disintegration in epistemology according to Peikoff's DIM Hypothesis.

Also, the term holism, the interdisciplinary idea that systems possess properties as wholes apart from the properties of their component parts, was coined in the 1926 book, Holism and Evolution (Hancock, 1962). In 1962, a period of Cultural Revolution towards socialism due declining solar energy (similar to the 1920's) after its peak in the 1950's, philosopher of science, Thomas Kuhn, published his landmark book, The Structure of Scientific Revolutions, stating the Kantian view that significant paradigm shifts in science are more similar to social experiences of religious revolutions than based on empirical scientific considerations. Kuhn's Kantian concept of incommensurability states that new paradigm is completely incommensurable with the old one, and is based on a different perception of reality that cannot be determined within the old worldview inherent in the previous paradigm. In 1973, Hartry Field published an article that also sharply criticized Kuhn's idea of incommensurability. In particular, he took issue with this passage from Kuhn, "Newtonian mass is immutably conserved; that of Einstein is convertible into energy. Only at very low relative velocities can the two masses be measured in the same way, and even then they must not be conceived as if they were the same thing." (Field, 1973)

Cultural neuroscience and perception

Studies in cultural neuroscience have demonstrated that different neurological activity in different cultures shapes their perception of reality. The article, *Cultural differences in neural function associated with object processing*, proposes that East Asians have a more holistic view than Western reductionism:

> Behavioral research suggests that Westerners focus more on objects, whereas East Asians attend more to relationships and contexts. We evaluated the neural basis for these cultural differences in an event-related fMRI study. East Asian and American participants incidentally encoded pictures of (1) a target object alone, (2) a background scene with no discernable target object, and (3) a distinct target object against a meaningful background. Americans, relative to East Asians, activated more regions implicated in object processing, including bilateral middle temporal gyrus, left superior parietal/angular gyrus, and right superior temporal/supramarginal gyrus (Gutchess, 2006).

These differences are explained with the evolution of social networks and their dependence on agriculture and food production in the article, *Ecocultural basis of cognition: Farmers and fishermen are more holistic than herders*:

> It has been proposed that social interdependence fosters holistic cognition, that is, a tendency to attend to the broad perceptual and

> cognitive field, rather than to a focal object and its properties, and a tendency to reason in terms of relationships and similarities, rather than rules and categories. This hypothesis has been supported mostly by demonstrations showing that East Asians, who are relatively interdependent, reason and perceive in a more holistic fashion than do Westerners. We examined holistic cognitive tendencies in attention, categorization, and reasoning in three types of communities that belong to the same national, geographic, ethnic, and linguistic regions and yet vary in their degree of social interdependence: farming, fishing, and herding communities in Turkey's eastern Black Sea region. As predicted, members of farming and fishing communities, which emphasize harmonious social interdependence, exhibited greater holistic tendencies than members of herding communities, which emphasize individual decision making and foster social independence. Our findings have implications for how ecocultural factors may have lasting consequences on important aspects of cognition (Uskul, 2008).

Temporo-spatial Theory of Consciousness

Georg Northoff, one of the leading figures in linking philosophy, psychiatry, and neuroscience, having developed non-reductive NeuroPhilosophy, proposes a *Temporo-spatial Theory of Consciousness,* asserting that that the brain's constitutes its own inner time and space which, if properly aligned to and synchronized with the world's outer time and space, will yield mental features like self and consciousness. In the article for the Special Issue "Temporo-Spatial Theory of Consciousness (TTC)", Northoff elaborates:

> Consciousness is a key feature of our mental life. Various theories of consciousness have been suggested in both philosophy and neuroscience. On the neuroscientific side, we are confronted with a diverse landscape of different theories such as IIT, GNWT, predictive coding, HOT, and RPT, just to name a few. This leaves open the quest for a unifying framework within which a theory and a model of consciousness can be developed. One such unifying framework is suggested by the temporo-spatial theory of consciousness (TTC). The TTC proposes that consciousness is a spatio-temporal phenomenon based on the brain's construction of its own inner time and space relative to the outer time–space of the body and the environment. This is supported empirically by a wide range of evidence for four key temporo-spatial mechanisms: temporo-spatial nestedness, alignment, expansion, and globalization. Theoretically, this is supported by the development of spatiotemporal ontology, which emphasizes spatiotemporal relation as the basic unit of existence and reality (Northoff, 2023).

In his article on manic-depressive disorder, or bipolar disorder, named "*Too Fast or Too Slow? Time and Neuronal Variability in Bipolar Disorder—A Combined Theoretical and Empirical Investigation*", Northoff explains how bipolar disorder effects our perception of time:

> Time is an essential feature in bipolar disorder (BP). Manic and depressed BP patients perceive the speed of time as either too fast or

> too slow. The present article combines theoretical and empirical approaches to integrate phenomenological, psychological, and neuroscientific accounts of abnormal time perception in BP. Phenomenology distinguishes between perception of inner time, ie, self-time, and outer time, ie, world-time, that desynchronize or dissociate from each other in BP: inner time speed is abnormally slow (as in depression) or fast (as in mania) and, by taking on the role as default-mode function, impacts and modulates the perception of outer time speed in an opposite way, ie, as too fast in depression and too slow in mania. Complementing, psychological investigation show opposite results in time perception, ie, time estimation and reproduction, in manic and depressed BP. Neuronally, time speed can be indexed by neuronal variability, ie, SD. Our own empirical data show opposite changes in manic and depressed BP (and major depressive disorder [MDD]) with abnormal SD balance, ie, SD ratio, between somatomotor and sensory networks that can be associated with inner and outer time. Taken together, our combined theoretical-empirical approach demonstrates that desynchronization or dissociation between inner and outer time in BP can be traced to opposite neuronal variability patterns in somatomotor and sensory networks (Northoff, 2018).

The article, *Is seasonal affective disorder a bipolar variant?* also suggests that manic-depressive disorder is also caused by changing seasonal patterns, as more people suffer from depression in the winter, during low solar activity, and mania in the summertime with high energy:

> This article compares BD SP with major depressive disorder with seasonal pattern (MDD SP), in which depressive episodes usually occur in fall or winter and fully remit in spring or summer. Rather than being categorically distinct from each other, BD SP and MDD SP may represent extreme variants on a seasonal depression continuum from unipolar to bipolar (Roecklein, 2010).

This view of Temporo-spatial Theory of Consciousness can explain the evolution of modern physics from Newton to Einstein and quantum mechanics and cosmology, if we view it from the perspective of the life-cycle of civilization driven by incoming solar energy flows. Hence, energy levels are driving our collective mental states of human society from a high-energy manic phase during the Enlightenment peaking in 1776, to a fall into low-energy depressed state into the 1930's, leading to a complete transformation of our view of the universe during the Great Depression. The high-energy state produced Newtonian mechanical view of the orderly universe created by an omnipotent Creator who maintains its order through the force of gravity.

With the decline in energy into the more depressive phase we observe the rise of the theory of relativity that questions the objectivity of space and time, stating that they are not absolute, but depend on the state of the observer in relation to speed of light. Einstein's theory

of general relativity predicts that where gravity is stronger, time passes more slowly. That's called time dilation. Gravity is stronger closer to the center of the Earth. So, according to Einstein, time should pass more slowly closer to the ground.

A Grand Unified theory: The NeuroPhilosophy of Physics

As stated in the introduction, the goal of this article is to suggest new paradigm in physics and neuroscience based on energy flows in complex systems in order to utilize our newly acquired knowledge of cognitive neuroscience and neuroendocrinology, to study and correct the past cognitive biases that shaped evolution of modern science and philosophy. As Kant's skepticism of the potency of human reason, with his assertion in the *Critique of Pure Reason* that we can perceive only the phenomena in our mind rather than the noumena, things as they truly exist outside of our perception, may be overcome by the understanding the inner workings of our brain as the Temporo-spatial Theory of Consciousness in neuroscience suggests.

During the Enlightenment, new instruments such as the telescope were developed by great scientists, such as Galileo and Newton, which enabled the human mind to perceive objects that are not visible to the naked human eye, and contributed the rise of modern science. Similarly, today, we can utilize our knowledge gained from neuroscience to better comprehend how our brain as an instrument of perception of reality and make the proper adjustments to our theories of the universe, thus transcending the limitations of our unguided perception.

We shall apply this view here to figure out the nature of reality by analyzing the evolution of modern science from the perspective of energy flows. The Newtonian view of an orderly universe composed of objects attracted by the universal low of gravity is a high-energy view of the cosmos in the period that stated the law of the conservation of energy. The theory of entropy developed during the 19th century stating that order is decreasing in the cosmos as energy flow from hot centers, such as the sun to cold, such as empty space, presents a degeneration of our view of the universe, seeing the glass as half empty rather than half full. A more complete picture requires that we examine this from the perspective of the life-cycles of stars and solar systems, and how our cyclic energy of our sun shapes the life-cycle of our civilization on earth.

We know that it is the force of gravity that attracts particles together to form stars, and this force causes the center of stars to fuse together hydrogen to form helium and release energy waves in the form of light that powers our biological evolution of earth. Hence, the force of gravity is opposite to entropy by increasing order in the system and leading to energy release in the form of heat, that eventually increases entropy, until the energy fuel of the stars is exhausted and it collapses

into a black hole, or a white dwarf according to its mass, and then it explodes in a supernova explosion that leads to its heavy elements spreading throughout the universe, only to be assembled again by their mass attracting each other due to the universal force of gravity, and hence begin the life-cycles of a new sun powering birthing a new solar system in the universe. The rise of the law of entropy in the 19th century was due to the study of gasses burning as fuel to power steam engines during the industrial revolution. This is true for gasses on earth; however, in the larger scale of solar systems we know that the force of gravity pulls the gas clouds together to form a sun that creates a new energy source of heat, which suggests that the universal law of entropy is an invalid, pessimistic view of the universe.

Hence, our pessimistic view of universal entropy may originate in depressed phase of social mood caused by declining solar energy trend into the 21st century. This is in contrast to the optimistic Enlightenment paradigm of linear progress forward. We can observe this gloomy cyclic paradigm in Robert Penrose's 2010 book, *Cycles of Time: An Extraordinary New View of the Universe*, suggesting a controversial new theory of Conformal cyclic cosmology (CCC) is a cosmological model in the framework of general relativity, claiming the universe iterates through infinite cycles, with the future time like infinity of inflation followed by deflation and collapse due to entropy.

Grand Unified field theory of quantum gravity

Einstein coined the term unified field theory (UFT), in his attempt to unify his general theory of relativity with electromagnetism. However, his efforts proved ineffective, due his disregard of the ether, Maxwell's classical mechanical model of electromagnetism as the cause of particle flux, in favor of a curved four-dimensional space-time to unify gravity with the constant speed of light, as derived in Maxwell's equations. Hence, Einstein began the trend towards departure from the logical and causal view of classical mechanics, even though he made great progress in our understating of the universe in his unification of mass and energy in his most famous mass-energy equivalence equation.

However, this created a problem of unification of quantum mechanics, which is concerned with the smallest particles moved by electric fields, and gravity, which is concerned with motion of large bodies.

The emerging view that a different set of laws are determined by nature to different scales from the small to the large represents a degeneration of logical reasoning from the grand unified view of Newtonian cosmology. The question of wave-particle duality, in which wave identifies with energy, and particle with matter, has still remained an unsolved mystery debated in science today with not much progress in sight.

According to the theory of NeuroPhilosophy of physics, the failure of mainstream science to create a logically consistent theory of the universe, unifying all its forces in classical manner, as with the classical theories of Newtonian gravity and Maxwell's electromagnetism is due to the Kantian categories that shape how our mind perceives reality. However, if we apply our new formed understanding of human cognition to the study of physics we can solve this dichotomy of mind-body dualism, which has shaped western philosophy since Plato.

We may seek the answer in the theory of the fractal nature of the universe developed in the 1970's, stating that universe is composed of self-similar patterns repeating in different scales from small to the very large. If we unify this view with the classical vision of Maxwell's ether as the medium for the propagation of light in three dimensional Newtonian spaces, this would require rebuilding the foundations of modern physics. However, this has already been done by ether physicists who have been ignored by the mainstream for the last century, in favor of non-empirical assertions, such as string theory, that have no evidence or basis in reality.

In 1973, Menahem Simhony, a professor of physics, developed an epola (electron-positron lattice) structure model of space as composed of a lattice of charged particles, electron (negative) and positron (positive), similar to a salt crystal composed of two different elements of opposite polarity. In 1994, he published his books, *Invitation to the Natural Physics of Matter, Space, and Radiation*, (Simhony, 1994), among other articles and publication, to further his naturalistic field theory, unifying gravitation and electromagnetism in a logically consistent three-dimensional space. However, contradictions to Einstein's paradigm were not accepted by mainstream science, as Simhony suggests a return to a Newtonian view of a static universe that is made of electric particles that explain the electromagnetic nature of light as energy wave passing through this electric lattice in space, and also provide for an explanation for the force of gravity caused by the resistance of this lattice to motion inside it.

Moreover, the epola model explains absurd notion that an electron-positron pair can emerge from nothing in empty space if a high-energy radiation in introduced and then annihilate each other back into nothing, by suggesting that space is not empty but made a physical medium that directs the movement of light, energy waves through it. Furthermore, it explains the absurd idea of vacuum energy, as quantum energy has been observed in so-called empty space.

The fundamental issue of counter-Enlightenment has been the collapse of the universe into entropy and darkness, as demonstrated by the religious worship of the second law of thermodynamics and the collapse of stars into black holes of non-existent space-time, as derived from Einstein's equations of general relativity. However,

Enlightenment paradigm believes that the universe is made of light, energy and order. Simhony's epola model suggests the cosmos is made of vibrating electric particles that are perceived as light by our visual sense, but as we know of light its frequency and energy can change through time and hence shape our perception of light versus darkness. The decline in incoming solar energy, as light reaching earth, does not mean that space is in a state of entropy or empty but that our perception of light is changing's our state of mind regarding the nature of universe, similar to an optimist perceiving a glass half full versus the pessimist perceiving it as half empty. The article, *the glass is half full and half empty: A population-representative twin study testing if optimism and pessimism are distinct systems,* (Bates, 2015) discovered that a general positive genetics factor exerted significant links among both personality and life-orientation traits. Both optimism bias and pessimism also showed genetic variance distinct from all effects of personality and from each other.

Furthermore, abolishing the ether has caused enormous discrepancies as vacuum energy has been discovered in space, and most of the dark matter and dark energy that supposedly make up the universe remain a mystery to science. This manic-depressive cosmology has created the problem of logically explaining the universe, as articulated in the article, *The Cosmological Constant Is Physics' Most Embarrassing Problem*: Physicists have new ideas about why the energy of empty space is so much weaker than it is predicted to be (Moskowitz, 2021).

In addition, indeterminism interpretation of reality in quantum mechanics has been challenged by De-Broglie, founder of the matter-wave idea in physics, in 1927, and rediscovered by David Bohm in 1952. This pilot wave theory, also called the Broglie-Bohn theory, proposes that the quantum particle follows a deterministic wave pattern rather than the illogical interpretation of a superposition of a particle in infinite states simultaneously in space. However, this logical view was also attacked by the mainstream, although that in the high-energy period of the 1950's, even Schrodinger challenged superposition with his famous Schrodinger cat problem, asserting that according to the absurd notion of superposition the cat would be being both alive and dead at the same time while not observed.

The pilot wave theory suggests that energy wave guiding the particle according to the wave equation is non-local, spreading throughout the universe. This inspired physics John Bell in the 1960's to devise a theory of how to prove the quantum entanglement phenomena, which was proven since with many experiments, suggesting that the universe is synchronized in cosmic energy wave patterns. This cosmic synchronization according to observed non-locality of quantum entanglement, further suggests the ether epola model which connects space together, rather than Einstein's assertion of empty space that led to his famous EPR paradox, calling "spooky

action at a distance" inexplicable. Furthermore, in space were really empty then one cannot explain why the speed of light is constant.

Also, a new ether theory to better explain quantum mechanics and particle physics was developed by Jeff Yee in his 2012 book, *The Particles of the Universe* (Yee, 2012), arguing that The strange quantum world can be explained and unified with classical physics under a new theory based on space-time oscillations creating wave patterns. This new mathematical model describes the simplicity of nature. One fundamental particle can create all particles, one principle cause to all forces, with three spatial dimensions, and simple physics.

Conclusion

To conclude, we have proposed here how the free energy principle provides a grand unifying paradigm to uncover the mystery of how our mind perceives reality or possible solution to mind-body dualism. The emerging paradigm of complex system, synchronization and understanding the yin-yang, holistic-reductionist opposing characteristics of human cognition can help provide better framework for understanding of the cognitive and natural forces that will shape the future of science and philosophy.

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