The Emergence of Mind as a Quantum Field Phenomenon

J Shashi Kiran Reddy[1], Contzen Pereira[2*]

ABSTRACT

A 'field' according to quantum pilot-wave theory (Bush 2015) and quantum field theory (QFT) (Griffiths 2009) when applied to the working of the universe is a fluid that is spread across the universe with a value taken in that space which can change in time. New observations in the fields of quantum fluid mechanics, artificial intelligence (AI) and deep learning in machines are providing us novel insights into how quantum processing, memory creation and storage work using the laws that governs the quantum world and quantum field theories. Such an understanding can be extrapolated to the workings of the mind to see if similar processes underlie the functioning of living systems. This paper hypothesizes that the construct of the mind is the resultant of chaotic system of interacting subatomic fields driven by force fields that intersperse with the quantum vacuum; a mechanism which has not yet been fully understood. We propose that this integrated phenomenon also gives rise to the subtle mechanisms that help in the formation of memories and also the structures which store these memories as reservoirs. The future of our evolution is the mind which evolves in these boundless intermingling quantum fields and their force fields within the quantum vacuum. With computers getting intelligent we are instantaneously but naively evolving our minds, and in the future, working together with these intelligent machines will augment it further. In fact, the design and working of these AI systems are resultant of the proof of the intelligence of conscious mind. This way the working of mind is always superior to those of the artificial systems that emerge from it.

Key Words: Quantum Field Theory, Mind, Quantum Vacuum, Fields, Quantum biology, Artificial Intelligence, Machine Learning, Memory, Brain

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Introduction

Over the past century many ground-breaking discoveries have led to scientific paradigm shifts not only in our understanding of the world but also regarding the nature of life and reality. Quantum physics provides us a mathematical description of wave-particle duality and interactions of energy and matter that departs from classical physics primarily at the atomic and subatomic scales. Einstein's theory of relativity revealed how time and space are of the same fabric, while Neil Bohr's research helped us understand the building blocks of matter through quantum physics (Capria, 2005). Louis De Broglie described that all matter and not just the photon or electron has a quantized wave-particle duality, giving us a sneak peek into the spookiness of quantum mechanics (Kadin, 2006). To build the spookiness further, the most widely accepted interpretations of the quantized world are the Copenhagen interpretations and the many worlds interpretation that explains the probabilistic features of the subatomic world (Boughn, 2018).

Though, this is the case, the fundamental questions still remain unanswered. The elementary units that forms the basic building blocks of the universe, are they particles or fields? The field for a subatomic particle is the particle

Corresponding author: Contzen Pereira
Address: [1]Research Scholar, Bangalore-560064, India; [2]Ph.D. Independent Scholar, Mumbai, India
e-mail ✉ contzen@rediffmail.com
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itself, which spreads over the entire pattern as observed in the double slit experiments, and quantum mechanics is about understanding the interactions essentially within microscopic systems and the macroscopic world (Hobson, 2012; Reddy and Pereira, 2016a). However, this particle/field duality could be a creation of our metaphysical perception, but on considering a field the unique phenomena in quantum physics such as quantum entanglement, the photoelectric effect, Compton's scattering and many more can be well understood (Kallio-Tamminen, 2004).

Einstein's model of space-time somehow doesn't hold up on quantum levels and therefore the standard model needs additional force carriers to explain the origin of mass, which was recently discovered in CERN, Geneva as the Higgs field (Wienberg, 1993; Shears, 2012; Nisati and Tonelli 2015). The Higgs field does not fit into the theory of relativity, and hence puts forth that there needs to be something more which lies within the quantum vacuum or the Higgs Quantum Space that is responsible for all that exists (Schaf, 2018). The super string theory can explain the standard model along with the forces towards creation but is applicable only if there are higher dimensions (Castellani 2018). Answers cannot be found that easily because ultimately it is associated with our existence, but understanding how we function can be determined by convincing experimental results from the field of quantum field dynamics.

Particles and anti-particles in actuality are fields that are present in the universe where high energy field collision takes place. This has been artificially simulated in particle accelerators from which matter and anti-matter is created simultaneously, hence why the lack of anti-matter in the universe is the biggest unanswered question in physics to date. But when anti-particle fields are trapped through electromagnetic force fields one can study their properties. The quantum state of the field and anti-fields can be interchanged by applying the charge conjugation, parity and time reversal operators (Zhang *et al.,* 2015). The Fermi lab recently discovered that mesons are switching between matter to anti-matter at a rate of three million times per second. This indicates how matter and anti-matter are created simultaneously in particle accelerators and how they switch from one form to another (Abazov *et al.,* 2010).

We traditionally associate the notion of an arrow of time with the sequence of events that we experience through the arrangement of sensory, short-term and long-term memories. We can only have memories of the past and not about the future, and we have always assumed that this reflects the flow of time (Ellis, 2013). Scientists only began to question this logic when discoveries in quantum mechanics demonstrated that some phenomena are not bound by our notion of time and that our concept of it is nothing more than our perception of change in observable values (Mukhopadhyay, 2018). This is also reflected in time dilation and length contraction which are part of the reason why Einstein established time and space are the same fabric. In an absolute sense, the notion of time does not differ from the notion of distance, seconds are equal to light seconds but cancel each other out. To clarify, with distance and time being each other's opposites, the passing of time can be interpreted as the distance that the hands of the clock travel as they move in a direction that is opposite to time. As they move forward in distance they affectively travel backwards in what we would call time. This is also why every single unit of experience is always instantly annihilated within a timeless now (Walstad, 2017). This understanding sets the record straight between wave function collapse and quantum decoherence (Zeh, 2015).

This paper considers the subatomic world to be made up of vibrating subatomic fields which have clusters of different amounts of energy that generally vary because of their vibrational frequencies as proposed under the quantum field theory (QFT). Memories created whether sensory, short or long-term is stored within the fabric of the universe which is comprised of the subatomic fields supported by the force fields within the quantum vacuum. The fabric of the universe is what created living cells and interim the body. In this paper, we hypothesize that the mind of living organisms is a construct of this fabric within the cells, which is where all memories get imprinted. The frequencies and interferences of these fields of waves are of importance, because this is how the mind operates to give rise to the various processes that we perceive within our limited senses. The mind is evolving as we evolve in our perception to that which is unperceived, and as the mind evolves, intelligence will also evolve and this is part of our evolution where survival is key.

Quantum Fields: Understanding the Building blocks

An attempt to understand the fundamental physical laws governing elementary particles has to first cope with the fundamental properties of QFT. QFT provides a better understanding of the complicated interacting systems encountered in the many-body problem and in condensed matter physics. QFT is the best theory currently available to describe the world around us in the form of quantum electrodynamics (QED), and is the most accurately tested physical theory (Firouzjaee *et al.,* 2018; Witten 2018; Umezawa, 1984; Klein and Zemach 1957; Flick *et al.,* 2018). We have come a long way and what we knew from before was the periodic table which is made of 120 elements where it was considered that everything in the universe was made up of one of these 120 elements (Scerri, 2013). J. J. Thompson was the first to discover that the periodic table of elements was not fundamental and there was a particle smaller than an atom which we call the electron. Rutherford figured out what atoms are made of by splitting it in a particle accelerator (Baily 2012). By 1970's, the existence of two quarks, the up (u) quark and the down (d) quark in the proton, and the two down (d) quarks and one up (u) quark in the neutron were discovered, and were therefore considered as the fundamental building blocks of nature (Baily 2012). But even with the best theories of physics, we cannot confirm that these are particles. To explain this, there are theories that tell us the fundamental building blocks of nature are not particles (Pecanha 2015) but fluid like substances called 'fields'. These are considered to spread throughout the universe, and ripple in strange and interesting ways, with a value taken in that local space which can change in time (Hobson, 2012).

Michael Faraday was the first to demonstrate the existence of a field based on the experiments he did with electricity and magnetism, wherein he determined the electric and magnetic field that is spread across the universe. Faraday believed that there is something physical in this fluid that builds up to demonstrate force which he called the lines of force. Now we call them as magnetic and electric fields, and it is the ripples in these fields that give us light (Israelsen, 2014). With the advent of quantum mechanics, we now realize that the world is a very different place in comparison to the world we have known from a Newtonian and Galilean (Jennings, 2008) framework. According to quantum mechanics, energy is not continuous in the world and exists as discrete lumps we know as quanta (OpenStax, 2012). Combining Faraday's idea of a field and the current quantum mechanics, we can observe quantum fields in electromagnetic waves as discrete particles called 'photons', which in fact applies to all particles; be it the electron, quarks or neutrinos, where each are created within a field of their own. Fields are limitless, and in nature, the quantum world is made up of more fields than we can ever imagine. We have the muon and tau which behave exactly the same as the electron, but are much heavier than the electron, which is similar to the neutrino, up (u) quark and (d) down quark. Why these subatomic fields exist is a mystery but has been found in particle accelerator collisions.

The twelve fields known until now in the standard model of physics are constantly interacting with each other along with the four forces and the field associated to gravity is space and time, that was discovered by Einstein as part of the 'General Relativity' (Arbuzov 2018). As of today, we know that the universe is made up of these twelve fields that give rise to matter, and the four fields that make up the forces. The world we live in is a combination of these sixteen fields all interacting with each other in interesting ways (Maldacena 2014). For example, when the electron field starts fluctuating, it kicks of the electromagnetic field that gives us light, which then will interact with the quark field causing oscillations and ripples, and finally end up in a harmonious dance between these fields. The universe as we know is 13.8 billion years old, and around the first 380 thousand years after it began it was filled with a fire ball known as the cosmic microwave background radiation which is still observed in the universe (Koterwas, 2016). The cosmic microwave background radiation actually was a result of the activity in the quantum vacuum that gave rise to the subatomic quantum fields because of the quick expansion giving rise to quantum fluctuations that were stretched (Davies, 2001).

When the quantum vacuum is simulated by removing all the subatomic fields and the respective force fields, what is left is a vacuum which in reality is absolutely nothing (Paraoanu 2014). According to Heisenberg's uncertainty principles in quantum mechanics, this field cannot be still and is continuously bubbling and fluctuating in a very complicated way considered as quantum vacuum fluctuations (Shalyt-Margolin, 2016). Computer simulations are being

used to understand these forces which can be measured using theorems such as the Casimir effect which in actuality demonstrates nothingness (Nguyen 2003; Lambrecht 2002). Though quantum vacuum is the simplest and fundamental thing in the universe, studying this involves inherent complications. The moment particle fields are introduced into this simulation it becomes much more complicated e.g. the magnetic spin of an electron is perfect when the vacuum is calm but when it gets rougher it goes haywire (Majlesi, 2015). Experimental studies are being conducted to determine the properties of the quantum vacuum in a calm state in correlation with the several hypotheses proposed by theoretical physicists (Tattersall and Sidebottom 2014).

The total vacuum energy density comprises of fluctuations characterizing the zero-point field (ZPF), the fluctuations characterizing the quantum chromo-dynamic (QCD) level of sub-nuclear physics and the fluctuations linked with the Higgs field (Caligiuri and Sorli, 2014). The Higgs field is a condensate of weak charge; where a condensate has a property wherein adding to it or subtracting to it leaves it the same, and hence lies in empty space. It is now mathematically proven that it is this field that results in the formation of mass. The subatomic fields carrying weak charge interact with this field to create mass, which is based on the coupling strength. It is because of this that the fields have different oscillating frequencies; which make them unique with different masses, in comparison to that of a photon which is massless and does not have weak charge (Allen, 2013). The Higgs field does not actually fit into the theory of relativity, and hence puts forth the idea that there needs to be something more which lies within the quantum vacuum that is responsible for all the matter that exists. Apparently, the super string theory has an answer and can explain the standard model along with the forces towards creation, but it is possible only if there are other higher dimensions (Castellani, 2018).

Quantum events within living systems are being studied under the discipline of quantum biology (Arndt *et al.,* 2009; Reddy and Pereira 2016a, 2017). There are physical structures within living systems which are known to be in a state of superposition (Hameroff and Tuszynski, 2015) similar to how a quantum computer works and stores information (Forcer *et al.,* 2002). Following such observations, here we hypothesize that such processes may also underlie the phenomenal working of the mind in living beings. The mind, its origin and its working, has always been a mystery, and the answer may lie in a thorough understanding of the quantum fields and forces that makeup living cells. Over millions of years of evolution, cell signaling pathways have evolved into complex networks of interactions (Pereira 2015a, 2015b; Reddy and Pereira 2016a), but surprisingly, genetic and biochemical studies reveal that only a few classes of signaling pathways are sufficient to pattern a wide variety of cells, tissues and morphologies (Pires-daSilva and Sommer, 2003). Cell-cell signaling be it a plant cell or animal cell is a combination of chemical and electrical signals and has greater information processing efficiencies than programmable computers (Uschner, 2016). Intracellular redox homeostasis supports energy transmission by means of electron transfers across membranes; a quantum process called quantum tunneling which resembles biological superconductors operating in a warm, wet and noisy environment of a living cell (Haas 2011; Reddy and Pereira, 2016a).

Constantly interacting quantum fields and force fields within the quantum vacuum is where the mind-like system originates and operates managing every bit of electrochemical functioning within a cell to give rise to an array of chemical reactions that support the body. The idea that living organisms may already be carrying out such superfast quantum operations should not be a surprise, as cells are made up of atoms and at a basic level, all atoms should obey the laws of quantum mechanics. Experiments are currently being conducted by both quantum computer researchers (Dragoman and Dragoman, 2014; Steffen *et al.,* 2011; Dragoman *et al.,* 2018) and quantum biologists (Rieper, 2011; Salari *et al.,* 2014; Lloyd 2011) to determine how quantum computing occurs at room temperature in relation to quantum computing mechanics that is usually understood at very low temperatures, to overcome the issues of decoherence which deals with destruction of quantum mechanics in warm and wet environment. The search for molecules that can support quantum superconductors at room temperatures is the future of quantum computing (Accenture, 2016) and interim will also help us understand quantum biology from this standpoint. There definitely is a link between quantum mechanics and the functioning of mind-like centralization system in this warm and wet environment of living structures (which uses electrochemical signaling or redox homeostasis

in biochemical processes at a cellular level), but is yet to be explored from a quantum perspective.

Raising the Mind in Quantum Fields

According to neuroscience, the human brain is considered the seat of the mind (Kanwisher 2010). The brain is a collection of highly evolved specialized cells which are known to perform complex computations. It is a network of approximately 100 billion neurons with all possible ways of interaction. The number of connections an individual neuron can form adds up to this complexity, and this makes it more difficult to study. Each neuron generates a voltage which can change when ions flow in and out of the cell via the redox potential; the process that regulates cellular signal transmissions (Van Dongen and Serdijn, 2016). Once the voltage of these neurons reaches a certain threshold, it will fire an electrical signal to other cells, and thereon the process repeats. When many neurons fire at the same time we can measure these changes in the form of a wave. As they oscillate at different frequencies, they get classified in bands such as alpha, theta and gamma, etc., and each of these waves in turn are associated with different tasks and can be viewed in an EEG (Basar *et al.,* 2001). The different neural connections and patterns result in unique subjective experiences with distinct emotions and feelings of varying intensity (Tosi and Beggs, 2018). Thus, each emotion or feeling will have its respective neural correlate specific to its experience.

Neuroplasticity is the ability of the brain to reorganize or reprogram, where new neural connections become stronger and well-defined, which are measured as electrical signals by electroencephalography or EEG (Lord and Opacka-Juffry, 2016). This shows the ability of the brain to flexibly adjust according to the life-style or environmental changes. This is where the mind can play a role through the physical system. Here, mind acts as a centralized operating system of various experiences and memories that can be accessed. Emergence of such a centralized operator has many evolutionary advantages associated with one's survival, foraging and interaction with the environment (Reddy and Pereira, 2016b).

Studies show that the central nervous system (CNS) supports memory, perception and behaviour (Kandel, 2000). But underlying these processes are seven intracellular signalling pathways which have been constant throughout the process of evolution and thus far support functions in physiology, cell proliferation, cell differentiation and behaviour (Pereira, 2015a; 2015b;). At the extreme scales of organization, dynamic self-organizing subcellular components like cytoskeleton and molecular networks, and colonies of organisms perform similar functions in their own contexts (Pires-daSilva and Sommer, 2003; Pereira 2015b; Reddy and Pereira, 2017). Neural signalling is observed as brain waves which tune into the frequency corresponding to their particular task while ignoring irrelevant signals; which is similar to how a radio hones in on different waves to pick up radio stations (Brahmankar *et al.,* 2012). The transfer of information between neurons becomes optimal when their activity is coherent and synchronized because of the external and internal fluctuations taking place with the subatomic fields.

Electrical signals in the brain are force carriers or force fields which support the progression of subatomic fields of the atoms that make up the molecules of the neurons in the brain. The fluctuations in the subatomic fields within the quantum vacuum space of the neurons results in the generation of a signal between the neurons. The interaction of fields within the neural cells is the mind which computes and supports various brain processes which is constantly bubbling and fluctuating according to Heisenberg's uncertainty principles; where as a result, we try to adapt or resonate with our environment with the creation of thoughts within the mind. This process seems to be occurring in every cell of the body, but the intensity of computation differs from one cell to another. It is higher in some cells belonging to specific physical structures such as the heart, brain, etc., while lower in cells that form the skin. In future, we may have a similar device like an EEG which would measure the wave frequencies of the subatomic fields and their interference patterns in order to understand the complex computations occurring within the body.

Memory in neuroscience is an assumed biological phenomenon that begins with perception. It is a set of multiple sensations that travel to the hippocampus region of the brain which combines these perceptions to a single experience (Bird and Burgess, 2008). The hippocampus and frontal cortex are responsible for analyzing these sensory inputs and deciding whether they are worth remembering so that they become part of the long-term memory (Robertson 2001). Memory processing although begins with perception, but is initially encoded as

electrical signals via the action potential across the synapse where chemical interaction brings about a successful transmission of information between nerve cells and the brain. The memory is therefore created within these signals and is embedded as sensory, short-term and long-term memories which becomes part of the mind. Thus, memory is a result of the computation that happens within the underlying electrical and subatomic fields supporting the biochemical processes that generate signals that is ubiquitous among all levels of biological organizations.

Creation of thoughts ensues in the mind as a result of the quantum fluctuations caused by the interaction of the quantum fields within the quantum vacuum, while the decision taken after a thought lies within the purview of consciousness. This is the basis of how all living beings function, and this process occurs in every living cell in nature; which calculates a lot faster and much smarter than our computers do. Molecules are made up of atoms and these atoms are held together by a chemical bond which is a result of the sharing of electron fields which essentially are in a state of super position that keeps the atoms bound tightly (Reddy and Pereira, 2016a). The mind and its memories are a product of the interactions taking place in the quantum fields and therefore reside in these fields that constitute everything in the universe. Ricciardi and Umezawa were the first to develop a quantum field theoretical framework of brain functioning called quantum brain dynamics, and that of general biological cell functioning called quantum biodynamics (Ricciardi and Umezawa, 1967). Vitiello applied QFT to memory and was concerned with the storage of data, so that it can be recalled later on and can be associated with other information. In order for the data to stay in memory, it has to be refreshed every once in a while. According to Vitiello, memory could be contained within the mind as a kind of back reaction in the Higgs field based on the formalism of QFT by Umezawa's many body systems; which is a dissipative QFT within the brain and its functions (Vitiello, 2009).

Succession of events that happen in our body be it the brain, heart, stomach, etc. does not happen within the domain of our consciousness. This is because, though the same strings of events repeat itself, these events become conscious only when these organs malfunction and this is when consciousness picks up the task of reprograming the events to stabilize the body (Reddy, 2017). This reprogramming takes place in the mind. We follow a programmed path to our work, we cross the road at customary places, turn into side streets, etc. even though we are occupied with different things. But if say the road is dug up at a place and we need to take a detour, this change makes us conscious to take a decision. This event leads to an altercation or fluctuation in the quantum fields and force fields which results in a gradual change in the neural firings resulting in the reprogramming of the brain. The gradual fading of consciousness is because the mind is wholly based on the process of acquiring practice by repetition, just like a machine memorizing an algorithm and refining it by repetition. During this process, the mind stores memories which can be re-read when the event re-occurs again, but for a new event, consciousness supports the creation of memories in the mind and is therefore the most fundamental unit of all living beings. Quantum fields that make up the mind are where these interactions take place, and where these memories get deposited to be examined for both conscious and unconscious events.

Quantum biology has a potential to support the emergence of the mind by stating applications of quantum mechanics and theoretical chemistry to biological objects alongside their evolutionary traits. Biological processes involve the conversion of energy into forms that are usable for chemical transformations that are quantum mechanical in nature (Sjulstok *et al.,* 2015). Chemical processes such as photosynthesis and cellular respiration involve chemical reactions, light absorption, formation of excited electronic states, transfer of excitation energy, and the transfer of electrons and protons (Levine, 2005). Nature uses properties of quantum mechanics and therefore there is rarely an error in the processing, because like a quantum processor in a state of super-positioning, it can take all the paths at the same time completing the task accurately at a much faster rate. In the photosynthesis reaction, because of quantum computing, the electron field which is in a state of superposition can find the fastest and most accurate way to reach the specific site to release oxygen (Lambert *et al.,* 2012).

Electrical or electromagnetic fields are produced by living cells, tissues or organisms. In bioluminescent bacteria, the cell membrane potential and the electric currents that flow in nerves and muscles are a result of action potentials (Zhou and Uesaka, 2006). These short-lived electrical events occur in several types of

animal cells which are called excitable cells; a category of cells include neurons, muscle cells, and endocrine cells, as well as some plant cells. The action potentials are used to facilitate intercellular communication and activate intracellular processes. The physiological phenomena of action potentials are possible because voltage-gated ion channels allow the resting potential caused by electrochemical gradient on either side of a cell membrane to resolve (Fillafer and Schneider, 2013; Behrens and Latorre 1991; DeCoursey, 2018). What is currently going on in our bodies is still obeying the same laws that are going on in the universe, however they are laws that we not yet fully understand. Studies in bioelectrodynamics thus has a potential to provide us with an insight of the interplay of force fields and subatomic fields interacting with the chemistry in biological systems.

Levin's lab of regenerative medicine in Tufts University has demonstrated electrical gradients which were shown to precede the development of the tadpole's face and body as a relevance to electrical signalling in development (Levin, 2012). Planarians are known to generate their tail end into their second head, while tadpoles can be bioelectrically modified to grow additional eyes, genetically altered so that a particular frequency of blue light would stimulate ion regulators in their cell walls. Electrical gradients can be precisely changed to match the electrical characteristics that cue the body to grow all the tissue required for the eye (Blackiston and Levin, 2013; Morokuma *et al.,* 2017). This provides a valuable insight into how life on earth uses electricity to shape or instruct the tissues of the body; which suggests the presence of force and subatomic fields in these processes. Salamanders and newts are known for regeneration of their whole appendages. Scientists currently working in this space to understand what conditions are needed for natural regeneration have shown how a body's infrastructure of bioelectricity makes executive decisions. Changing the voltage exerted on a cell membrane can modify genetic expression in the cell so that a group of cells can carry out a very different plan of growth (Borgens *et al.,* 1984; Tyler, 2017). Electrical forces are known to induce cell development and support cell injury which has also been observed in photobiomodulation studies as a holistic system of physiological decision making integrated with the body's biochemical and genetic instructions (Kuffler, 2015; Mignon *et al.,* 2017).

The Mind-like Intelligent Systems and Evolving Mind

Artificial intelligence (AI) and deep learning deals with simulating the working or functional aspects of the mind and memories in machines using quantum computation. Such attempts can also be extrapolated to help us study whether the same can be applied to understand the processes involved in the functioning of the biological world. If this is the case, all our AI systems would just be biomimicking systems. Machine learning is an application of AI that provides systems the ability to automatically learn and improve from their functional experience based on the constant feedback system (without being explicitly programmed). In machine learning, an algorithm is a set of rules or instructions given to an AI system to perform a specified task (Domingos, 2012). Well-constructed algorithms are the backbone of AI, by means of which they can accomplish intelligent tasks. Here the main focus is to develop computer programs that can access data and help AI systems to learn for themselves. The process of learning begins with observations or analyzing the data, for example, direct experiences or instructions in order to look for specific patterns in the data help to make better decisions in future, based on the illustrations that we provide (Abe and Yamaguchi 2004; Castaño *et al.,* 2017). The primary aim is to allow the computers learn automatically without human intervention or assistance and make decisions accordingly. Machine learning enables analysis of massive quantities of data. While it generally delivers faster, more accurate results in order to identify profitable opportunities or dangerous risks would require additional time and resources to train it properly (Najafabadi *et al.,* 2015). Combining machine learning with AI and cognitive technologies can make it even more effective in processing large volumes of information (Abdeljaber *et al.,* 2017; Marblestone *et al.,* 2016; Kietzmann *et al.,* 2018).

A process streaming in our mind is like a machine learning an algorithm; as we discussed, which is the result of a quantum interaction between the subatomic and force fields in the vacuum. We feed our minds with certain data, in the form of stories we tell ourselves (self-narratives), the experiences we have based on various interactions with others and the surroundings, beliefs we take-up, things we read

or watch etc. We optimize such data based on interpersonal and intrapersonal evaluation. In feeding our mind this data, we form a belief system, and then we pick the next data point which best matches the belief system we developed, from the information that our mind has received. Much like a machine learning algorithm, we use our minds to make decisions based on the input we give it and our emotional reaction to it. While machine learning algorithms do not have an emotional and feeling component, our psychological makeup within the domains of consciousness is such that we do. This is also stored as different memories in the mind, and can be accessed via the neural-quantum pathways. Our perception of life and the events we gravitate towards is largely defined by the signals our body and its cells receive from us in the form of data; both in terms of concrete events and the emotions we associate with them.

Just like machines, if we want to make changes, we have to start nursing our mind with different data. If we do not feed it certain data, our mind will not compute, we must first make a choice with our minds. The mind is an efficient and faster processor as compared to the mind-like systems created via AI. This could be because our functional mind emerged as part of the life's evolution propelled by the nature's intelligence which is more than 3 billion years old. We may use the same quantum fields and forces, but the detailing created over evolution is no match to AI that lacks consciousness. Our minds can compute complex situations both mechanical as well as emotional within the scope of our consciousness. Artificial intelligence has penetrated many aspects of contemporary life, from computer games to autonomous vacuum cleaners to digital personal assistants. Though AI programs are built for a specific purpose like play card games, clean houses, provide directions, etc. they are not intended to demonstrate general intelligence (Pennachin and Goertzel, 2007). Some scientists in the AI field subscribe to the idea that, at some point, in the not-so-distant future, AI technology will reach and surpass human intelligence (Ali, 2016; Brynjolfsson and McAfee, 2014; Moravec 2015; Grace, 2018). The complexity of the human mind augments with consciousness, and therefore human intelligence is too nuanced to be imitated or replaced by machines.

Computation in machine learning uses implementation-independence, a core principle wherein an algorithm does what it does regardless of what kind of medium is implementing the steps (Yang *et al.,* 2018). But in case of neurons and their subatomic fields the added feature is the decision-making capability, which is a result of qualia or consciousness. Besides neurons, there are a broad range of systems at various scales from molecular to organismal, which have their own distinct ability to process information, make decisions and achieve specific goal states (Buonomano, 2007). Unconventional cognitive systems studied across biology can expand to the extent that information-centred approaches are shown to be effective in predicting and controlling the behaviour of biological systems (Baluska and Levin, 2016).

Currently AI has beaten humans in poker, but not to forget that a computer can't win at poker if great set of algorithms aren't behind it. The victory of AI proves the ability of a computer program to learn from human to surpass him, but that doesn't mean human intelligence has been left behind by the AI. Though the technological breakthroughs frighten us, we have the certainty that human intelligence will remain dominant as long as it knows the only thing a machine can never transmit is emotion (Jarrahi, 2018; Yudkowsky, 2008). This means that artificial intelligence can only assist us with functions and tasks that do not involve emotions and feelings, because both these aspects arise from qualia or consciousness. The basis of any choice we can make is wholly dependent on our consciousness which is the fundamental unit that drives the mind (Pereira and Reddy, 2017). This notion of conscious choice is again what lacks in AI systems. The cells in our body are perfectly programmed quantum computers which compute every event with the utmost precision; at some levels consciously and others unconsciously in the form of reflex action, and this took thousands of years to evolve to its present state. Quantum fields and forces operating within the quantum vacuum are the crux of every event that happens within a living cell, and these effects together constitute a larger output as demonstrated by our bodies and mind.

Conclusions

Living cells are bio-machineries that work with a combination of electrical and bio-chemical processes supported by the underlying quantum mechanics. The mind being a subtle and non-physical system is known to have evolved as a result of certain organization and a pattern of interaction in the associated physical systems

(Reddy and Pereira, 2016b). This way one cannot limit the happenings of mind to multi-cellular structures like the brain alone. Since the functional mind emerged as part of the natural evolution, the physical processes and mechanisms which confront it should be universal and ubiquitous in nature. In looking for such mechanisms which are happening everywhere and those which span the entire cosmos constituting both animate and inanimate worlds, takes us to the domain of quantum field theory (QFT). The mind from a quantum field theory perspective provides a robust understanding of its construct and workings, and with the upcoming theories of super symmetry and string theory this understanding can be improved. The basis of a conscious choice is wholly dependent on existence of consciousness; which is the fundamental unit that drives the quantum mind. The future of our evolution is the mind which evolves in these limitless quantum fields along with the supporting force fields within the quantum vacuum of nothingness. The quantum world is vast in comparison to the classical world that we live in but there definitely is a correlation between the two which is currently revealed in newer sciences such as quantum biology, artificial intelligence and deep learning. AI can only assist us with functions and tasks that do not involve emotions and feelings that arise from qualia or consciousness. With computers getting intelligent we are instantaneously but naively evolving ourselves, and in the future working together with these intelligent machines will augment it further.

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