THE THIRD STATE – TOWARD A QUANTUM INFORMATION THEORY OF CONSCIOUSNESS

ARTICLE *in* NEUROQUANTOLOGY · DECEMBER 2015

Impact Factor: 0.54 · DOI: 10.14704/nq.2016.14.1.899

1 AUTHOR:

Scot Forshaw
Toridion Project - Visicom Scientific Software

7 PUBLICATIONS **4** CITATIONS

SEE PROFILE

The Third State: Toward a Quantum Information Theory of Consciousness

Scot D. Forshaw

ABSTRACT

The question of how our perceived reality is constructed and subsequently how our mind has evolved such that we are able to both perceive and subsequently alter our own causality or even our own evolution within this reality has been a long running open question. Referred to as "The Hard Problem". There have been many theoretical interpretations on the nature of causal self-observance – hereafter referred to as 'consciousness'. The current paper introduces the reader to the indeterminable operator - "The Third State". The Third State is a term used to describe space itself in relation to the position of all things. As the paper shall show, The Third State is a required omnipresent and universal operator in the otherwise binary realm of data → information. The Third State augments the accepted binary operators to produce the required 'tristate' condition that facilitates the required probabilistic nature of the conscious manifestation. Secondly the Unity Magnitude [Um] scale, which facilitates the bounding of quantum probabilistic memory in a finite model. The paper further introduces the reader to a model and experimental theory that suggests all things we perceive as physical reality can be fabricated from primitive components of data, bits – matter / antimatter / something or nothing. That facilitated by the Third State, our immediate present reality as we experience it and theretofore consciousness is a simultaneous product of the current physical configuration of the frequency stable systems of which we are comprised, interpreted past reality, self-predicted future provided by cyclic frequency stable systems and the immediate physical and sensory state including recursive imagination systems generated by the output of these perturbed frequency stable systems in the cyclic feedback process - ultimately perturbed by, but as one unified with the stochastic processes in relation to the quantum cosmological domain.

Key Words: information theory, chaos theory, non-linear systems, quantum consciousness, probability theory, quantum cosmology

DOI Number: 10.14704/nq.2016.14.1.899 **NeuroQuantology 2016; 1: ● ● - ● ●**

"At any arbitrary scale there is a finite number of discrete observables."

Introduction

When in relation to a microcomputer you ask the valid question: "How many electrons are required to make a 1 state?" you quickly realise the scale of the question quantum information theory hopes to address. How a continuously moving and indeterminable quantity of atomic particles can be held – or remain, in a state that can be used to convey universal meaning to the observer. If one ever needed to emphasize the role of frequency stable systems and quantum information theory in the world we find ourselves at one with, one need look no further than the simple binary bit. It is not my intention to school the reader in the basics of elementary electronics and electron flow but as much contention has arisen from the many

Corresponding author: Scot D. Forshaw
Address: HND Electronics Design, Adv. Dip. Software Engineering & Systems Analysis, Thailand.
e-mail ✉ info@visicomscientific.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
Received: 10 December 2015; **Accepted:** 26 January 2016

attempts to introduce the quantum realm into the consciousness debate, it is important to demonstrate with clarity the simple concept. The microcomputer is built for the most part on the principles of Boolean logic. Information is represented as binary truths 1 or 0 in the logic gates manufactured from semiconductor junctions.

Semiconductors are chemically doped sandwiches of selected material elements (often silicon), in one state the electrons simply move around on one side of the junction never making the jump to the other side. In another state – in which more electrons are introduced, enough electrons make the jump from one side to the other in order to let current flow and form a circuit. Whilst the foregoing is rudimentary and clearly is harnessed with great elegance to allow microcomputers to hold a discernible binary truth (1 or 0, flow or no flow) what is also evident is that the whole system whether in the conducting or non-conducting state, is moving. Not a little, but rather moving a lot. That brings about the question of what is a bit? On the one hand a bit can be described as a 1 or a 0, but if one is to try and 'quantify' the bit with some rigorous mathematical method, it becomes quickly apparent that unless one introduces a scale of observation, there is no way to quantify a single bit as 1 or 0.

When the reader now considers information theory below bit scale, one cannot avoid but conclude that the quantum scale is at work in all things. And furthermore that at chosen scales of observation, no stable state (i.e. a binary bit) can be conclusively quantified as truth or not. So to "observance" itself becomes an important factor. If we consider answering the question posed at the beginning of the chapter, one is now faced with the challenge of counting a moving target. A target whose aspect and position (although intrinsically stable as a collection of physical particles in the form of a "touchable" transistor in your hand), is internally moving in complex ways. Add to this the introduction of external noise, heat, magnetic radiation and before long the task of simply trying to say with any conviction "This is a binary 1" seems like an impossible task. This is the world of quantum information theory, the domain of the Qubit. This paper will address the aspects of quantum information theory as they may apply to the wondrous manifestation of causal self-observance. Causal self-observance is the authors preferred name for what otherwise is popularly known as consciousness.

The axiomatical basis of quantum consciousness

Before quantum information theory can successfully be assimilated by the quantum consciousness community, and for that matter quantum consciousness science accepted by the quantum mechanical fields, there has to be an axiomatic acceptance of some rudimentary facts that give rise to the validity of the study. That for me should begin with one of the most important and glaringly obvious conundrums that biology presents to the information theorist, that is the finite nature of the brain itself. There is a simple, unavoidable truth, and that is - "*From a biological perspective the brain is a finite phase space. There are only N molecular or cellular structures in any single brain. In a classical sense it has a theoretically provable finite entropy that can be used usefully*".

The finite brain

"Quantum Consciousness science will remain in scornful isolation until we accept the fact that the brain is classically finite and move on to the important question of why it is so."

The physically finite capacity of the brain introduces a difficult problem for the information theorist and the student of consciousness alike. How can something with N configurations memorise and retrieve accurately what appears to be an almost limitless amount of information?

As with any other classical data storage medium one would imagine that in order to separate data so as to be able to retrieve it in any reliable fashion as meaningful information, then the laws of information theory (Shannon, 1948) would dictate that some redundancy and separation scheme is required. However, adding redundancy to an already finite capacity system would certainly seem illogical in a purely classical sense. If indeed we are expected to accept (the author strictly does not) the Darwinian theory of evolution (Darwin, 1859), that survival of the fittest gets rid of waste leaving only the most economic systems, we would really have a problem. If we for a moment disregard the illogical and just accept the simplest truth, we can better consider the pivotal questions that give birth to the entire field of quantum consciousness.

"Why then is the brain finite? And furthermore -being finite in physical terms, how then is it seeming capable of near limitless

memory recall, concept generation and that most wonderful of nature's creations – imagination?

Postulate: In classical terms the brain is and must be for obvious reasons an informationally finite storage space. And therefore in order to exceed the physical limits of its storage capacity, a scheme of compression must be used. There is no classical compression scheme that can escape the laws of information theory and so the author puts forward the assertion that a form of quantum probabilistic compression is used.

The quantum brain

"To deny that the brain is affected by quantum processes is as it is to deny that the Earth orbits the Sun."

There have been many clashes of opinion on the use of the phrase "Quantum Consciousness". Physicist often keen to dismiss anyone who uses the term as "pseudo-scientific heretics". Conversely the quantum consciousness community is equally to blame through its often liberal use of neologisms or hi-jacking of accepted terminology that without agreement or contextual narratives invite attack, speculation and skepticism. So the second axiom that requires agreement is whether the brain is a system that is affected by the quantum domain or not. What do we mean by a "system affected by the quantum domain"? I would break this down two ways. Firstly, are there any aspects of the brains function that use the principles of currently understood and studied quantum mechanical theory? Answer: Yes. The brain demonstrably operates using electrical signals. Electric signals are comprised of electron flow. Electron flow is well established as a quantum mechanical affect. Secondly, is there any proof that the brain is affected by external non physically attached quantum processes. Answer: Yes, put your head in the path of a high energy X-Ray machine and the effects will become quickly clear. Conclusion: The brain is both a system that uses quantum mechanics in its day to day business and secondly is able to be perturbed or even damaged by external processes that without quantum mechanics would be otherwise invisible to the observer.

These claims *do not* however amount to the rather different proposition that the brain is "a quantum computer" which implies that the brain uses the phenomenon of quantum entanglement in order to accelerate computation.

The quantum cosmos

"If you were in any doubt as to the role of the cosmos with respect to life on Earth, ask a dinosaur."

Having shown in certain terms both quantum mechanics and quantum consciousness fundamentals do indeed share at least some axiomatic lineage, the final field of study that comes into frequent question is quantum cosmology. Quantum Cosmology is the high priesthood of theoretical physics that traditionally looks to unify Einstein's General Theory of Relativity with Quantum Mechanics. It is also a fertile area for pseudo-scientific speculation and misinterpretations. The simple question I want to answer is this - "Is the cosmos quantum"? The importance of the answer cannot be downplayed. For as much as quantum consciousness is a part of quantum mechanics, quantum cosmology sits above these as the method to fundamentally tie the domains together with a coherent mathematical, rigorous and therefore scientifically acceptable theory. I am not going to provide example of how the cosmological realm is quantum, rather I shall let the hundreds of millions of dollars spent annually in astrophysics, particle accelerators and plasma research answer the question for us.

Toward a Quantum Information Theory of Consciousness

The brain is quantum mechanical, and quantum mechanics is present across the cosmos therefore the underpinnings of quantum cosmology hold the key to the information theory of everything. More specifically the focus of this paper is how a unified theory of quantum information (the theory of the laws of how data becomes information and how it is preserved in a low entropy stable state or reverts back to high entropic states) might shed light on the consciousness we experience whilst simultaneously assisting the interdisciplinary research that currently has no common axiom – at least none they are willing to share. The justification for thermodynamic references in relation to quantum information theory is centered around the belief that if the brain is in part quantum mechanical in nature, then there is a symbiotic relationship between the physical configuration of mind and the field of energy in which it resides. If the foregoing is true, then it follows that any universally holding rules of

quantum information theory will be manifest in all macro systems that are derived from them. Therefore, quantum information theory should in the authors opinion not give rise to observed states that violate thermodynamic law – this is quite separate to classical information theory which I believe describes only the information theory of post quantum scale complex systems.

Typically, when we approach any mystery, the first thing one may attempt to find are commonalities between the various pieces of information you have at your disposal. Mathematicians may seek to equalize and cancel like terms of two sides of an equation. A criminal investigator may look to establish links between places, people and times to uncover motive. No matter what the problem, the discovery of a common theme, value or particular outcome is a primary goal.

The paper is concerned with information theory so it is pertinent to define some global:

Data: The smallest discernible element(s) at the current scale of observation.

Information: A collection of Data that together form a pattern to convey something more than is possible with a single piece of Data.

An example of data is the binary value 1.

An example of information is 10101o.

From the former example one instantly recognises the string of 1's and 0's as the digits in a binary number. Taking this a step further we might take 2 of these binary strings and place them together like so: 1010110101.

Now we clearly have a new piece of information, but it's true meaning becomes less clear. There is a problem introduced that makes the understanding of the information difficult. Simply concatenating the information, whilst preserving the Data, has actually lost the information. What is missing is something that makes up the larger percentage of both our own bodies, the Earth on which we live and the universe that we call home – that missing element is quite simply "space". Not zero, not the '0' bit but utter and complete space.

The Third State (Omni present understanding and limitless creativity)

Between data and information lies "The Third State". A universal value that is the only common symbol across all domains of information, the symbol that brings order to chaos and meaning to the meaningless. This third state is both Alpha and Omega, superposed and interchangeable through any scale of observance. It exists only because it separates data packets, means something only because of the meaning it brings in relation to the data it separates. The third state is the universal building blocks of "semantics and understanding". A metaphorical "Joker in the pack", The Third State assumes multiple identity, is omnipresent, one of the same but each individual. The Third Space completes a trinity of elementary data quantities that breathes life and understanding into the universe.

In the example earlier the binary value 10101 was concatenated with 10101o form the value 1010110101 A new compound value that has lost any sense of the 2 values of which it is comprised. If however we add space [..] like so:- 10101 [..] 10101, we now have 2 discernible values. This space is found across the domain of all things. From galactic and planetary scale structures down to continents and geographic constructs, to language, writing, speech, biology, nano technology, DNA, quantum and dare we speculate "sub-quantum". Space is the only truly universal numerical operator that exists in all realms and all scales of information, matter and life. In the very words of this paper space brings meaning to nonsense:

forwithoutspacethiswouldbeaveryhardthingtocomprehend

"The past has non to low probability of exerting influence on the future nor can we recover it with any deterministic high probability. For all mathematical and practical purpose – it does not exist."

Considering the Past

We often hear the phrase "to know who you are you must first know who you have been". As will be explored, this concept is highly flawed, however despite this has a particular habit of appearing to be true because of the bias we apply to it. The classical view is that the past predicts the future, also neither can it be changed. This view may have some truth after our classical human bias is applied, but in quantum terms nothing could be further from the truth. In order to

demonstrate the futility of reliance on the past to predict the future the author presents a simple thought experiment:

EXPERIMENT: Step 1 - Predict the state of the weather 1 week ago based only on the data you can recover that describes the weather in the last 1 second. Step 2 - Then using the results obtained in step 1, predict the weather today using the predicted weather 1 week previous.

RESULT: At best accuracy of your prediction will fall proportionately with time. Or put another way - the further you go back into the past to predict the future the entropy of the prediction will increase.

CONCLUSION: The author concedes that the experiment may raise more questions than answers, however there are some interesting possibilities. According to the 1st law of thermodynamics the energy in a closed system (in this context the cosmos is implied) remains constant. If the past has any effect on the future surely it must first exist. If every version of past exists this would either bring about a violation of the first law, or imply that the cosmos is not a closed system. If every version of our individual past exists, then a large proportion of the available entropy in the universe would be held in increasingly low entropic stable state (as memory) (however this is in violation of the 2nd law of thermodynamics). If therefore the past does indeed not exist, then what in fact do we base our immediate short term predictions upon and what do we actually see when we apparently remember our past?

The author postulates that the past is merely held as a set of quantum probabilities compressed within the finite physical configuration of the minds apparatus. That through the process of wave function collapse against the generally cyclic and stable local system, one can recover with high probability accurate measurements of memory. The concept of how memory can be stored in finite states and recovered by a remote quantum field was demonstrated experimentally in 2015 by Willard Van De Bogart and Scot D. Forshaw (Van DeBogart and Forshaw, 2015).

Fixed Unity Magnitude, scale and redundancy

The preceding chapter makes reference to compression of memory into a probabilistic or unobserved quantum state. Classical physics often uses the word scale in relation to observations of systems. A problem with this word when used in the quantum mechanical realm is the bias we already have to its meaning. Specifically – with respect to quantum information theory, scale is not sufficient a term to describe the observational conditions of a quantum state, why? - simply because it offers no information as to the resolute entropic capability of the observer in relation to the observed system. Trivially, in order to observe quantum states, they must be collapsed, at which point they become real or fixed. If one, simply uses scale to describe the conditions of observation there is a real possibility that one runs into infinities. To overcome this one needs to extend the definition of scale to incorporate the simultaneous reframing of the phase space resolution so that no matter what scale is employed, the resulting collapsed state returns the desired probability with respect to a universal time reference. In an effort to resolve this we shall introduce the concept of a new term - "Unity Magnitude" [Um]. Um is the quantum information equivalent of scale.

To understand its role, it is helpful to describe a real world example, here we use the non-quantum medium of the Latin alphabet. Taking a simple sentence of two words "for any" we might say that it contains 6 letters and 1 space. At an Um of 7 the entire sentence is visible [for any]. At a Um of 1 only a single letter is observable [f] (or any other we might observe). For a model of quantum consciousness working in a finite mechanism such as the brain, this has serious implications for the containment of infinities. As the Um increases the maximum entropy. This takes precious available space from our limited storage capacity. The author postulates that any storage scheme capable of the seemingly endless storage that is demonstrated by the brain, must 1. employ a compression scheme, 2. that the compression scheme used must be probabilistic and therefore quantum in nature, and furthermore that compression scheme will operate with a fixed Um. That means that regardless of the input size, a fixed output size will be stored. Even if the input is smaller than the fixed Um storage space. By this method, additional "information independent" redundancy in the form of "space" is added and compressed along with the information. If for example, we look at the input string at a fixed Um of 16 we shall see [for any].

By the employment of fixed Unity Magnitude in the sampling of sensory data for example, one is able to 1. phase lock information to a steady clock that is independent of space time and 2. introduce a means by which the quantum probabilistic state can be bound to finite limits thereby avoiding infinities related to scalar values rising in sympathy to entropy. Another way to look at Um is to think of it as a resolution independent vector that describes the magnitude of a phase space in which the entropic ceiling is the maximum number of discreet observables possible. In human terms, we use the Um constantly in our daily lives. If we cannot make out a distant object, we simply adjust the Um by moving closer to it until it makes sense. But the most important concept to understand is that as the Um scales, so to the entropy is bounded accordingly. The concept of the Um scale is not new. Having been studied at length in the field of genetics. The genes found within all living things have their own Um scale provided by the Ribosome. The Ribosome traverses the RNA strand to decode DNA and ultimately rebuild proteins according to an otherwise indecipherable stream of data. Within a species such as humans, Ribosomes decode this knowledge in 3 base pair steps Khorana, 1965) – redundancy in DNA is used to great effect to ensure the propagation of accurate information.

The scale of observance

The importance of scale can be demonstrated with what might be referred to as - "The not so thin blue line". It is a play on words, relating to the famous photographs of the Earth atmosphere that depicts it as a thin blue line separating space and Earth like some protective shield. It conjures a picture of a sharp edged cover, a semi-permeable barrier allowing the good stuff in and keeping the bad stuff out.

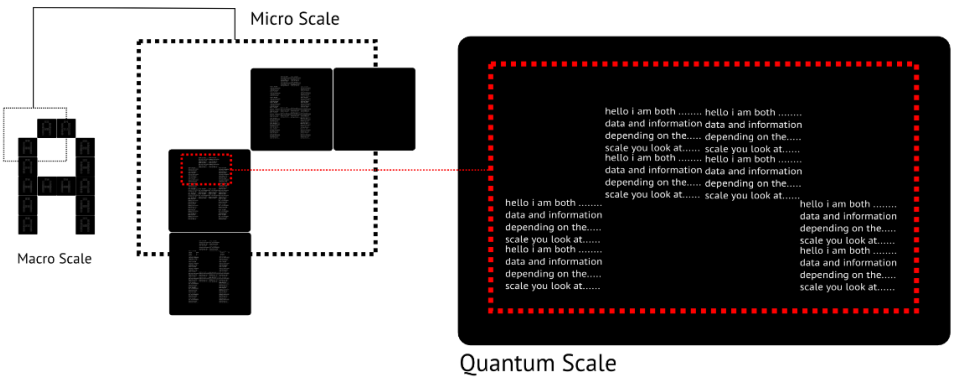

Figure 1. As scale changes so to do the number of discrete observables.

Many chaos theory pioneers observed the frailty of absolute measurements. Helge von Koch. demonstrated how scale allows a theoretically finite space to hold infinite expansions (Addison, 1997). Scale is a deciding factor of understanding the context in any system. In relation to "The thin Blue line" one can see that the closer one gets the line loses identity as it reveals its multitudes of layers and micro/macro structures. By Koch standards, the atmosphere has infinite thickness as it is viewed from increasingly closer scales. Figure 1 demonstrates this as a single character viewed at the macro, micro and quantum scale.

Can a finite data state space generate all information that may exist?

ANSWER: Yes. This is a trivial but important fact. One need not expand to all permutations to make rigorous proof, but to clarify the claim consider this. In the context of a computer system, all information that can exist can be represented by just 2 bits – 1 & 0. Given an arbitrary state space, let us say 1024 bits, anything that can be represented in 1024 bits can be quite obviously represented. As the scale of a state space changes it is a simple step to understand that all that can be represented, indeed can be represented. It is

however important to understand that it is equally not possible for every configuration of a compressed phase space to exist distinctly as an uncollapsed wave function. Quantum information theory shows that some quantized states will carry the same probability of representing multiple final observations (in information terms the wave function before collapse is superposed). It therefore follows that in an uncollapsed state, the compressive effect may give rise to theoretically identical states that represent different final observed outcomes.

The preceding observation is in line with the rules of Shannon's information theory. One may consider this a distinct disadvantage when the considered aim of memory is accuracy. However according to the results of the Neuroplasticity Demonstrated in Quantum Neural Networks (Forshaw, 2015), these potential errors are actually fundamentally helpful to a quantum consciousness model, allowing a probabilistic system to form intrinsic semantic relationships in sparse neural networks by allowing the formation of redundancy in the cyclic feedback of a system. Forshaw states that "errors in the recovery of probabilistically stored information creates new collapsed states, these states when cyclicly recompressed and stored, facilitate the recovery of new previously unknown information or permutations of sensory information, and at such time as a systems configuration is completely mapped – at this point all imagination and creativity ceases to be". The process of compression into a quantised probabilistic state using fixed Um scaling will after a sufficient number of cycles produce a probabilistic memory map that is capable of understanding and even interpreting itself when collapsed against a suitably loaded register of sensory data.

When data becomes information all by itself

A simple thought experiment helps one to see how stochastic and sometimes chaotic data may form self-replicating systems.

Imagine a simple computer program such as the Mandelbrot set. The loop is designed to take input from its last output. Each iteration creates more data that is stored in some medium. When executed the program begins to generate information.

Now let's look at the creation of the program itself. The Mandelbrot set generator is a very small program, typically it can be written in less than 100 characters. Imagine now a square phase space of say 200x100 bits.

Next take a random function and begin to populate the phase space. When the space is populated, present the result to the computer and ask it to run it. There is a probability (howsoever small) that one permutation of the phase space will in fact be the executable program described earlier. At which point the computer will begin to execute the instructions in a perpetual iterative loop, creating information.

The example above of course takes no account that there is in existence a computer in the first place and so one may conclude to ask the question "where did the computer come from". Fortunately, this is a semantic issue and one that is easily resolved.

A computer is simply a mechanism that moves data. One could replace the computer with anything capable of moving data. Data in this context is taken to mean at the most rudimentary level, matter and antimatter, followed by particles, molecules and ultimately elements. In this way one can classify: The Wind, Sun, Ocean, Plasma and Universe as computer systems. They move data and sometimes information continuously. The interactions of data and information has a probability of creating new results at some scale of observance. Some of those results will form new stable systems.

Frequency is the most primordial form of data manipulation and the foundation of reality as we understand it

Everything runs to time. From the earliest movement of the universe, frequencies were the first information to manifest. Initially manifest in the stochastic but discreet collisions of matter and the first elementary particles to form. If one were to be able to find a recording of this, one might hear a seemingly random white noise as countless collisions took place. Amplitudes changing as particles grew in size and complexity. These cosmic scale interactions are discussed by Mae Wan Ho in her paper How the electric plasma universe creates galaxies and stars (Ho, 2015).

If we replace the computer in the preceding example with the motion of the universe and bits with elementary data, the 'stuff of the universe', the same rules of information theory apply. Eventually, stuff will coalesce into things, things

that reject (filter) or compliment other incoming data – data in the form of particles, elements and ultimately magnetic and energetic waves of many kinds. Eventually and with a low yet certain probability these things will form symbiotic systems that become themselves 'information producing' in their own right. Over eons, data will form into particles, matter and objects. By the laws of non-linear systems, chaos theory and driven later by thermodynamic processes fuelled by heat and energy that are spontaneously created by the process, eventually the frequencies of some systems become stable.

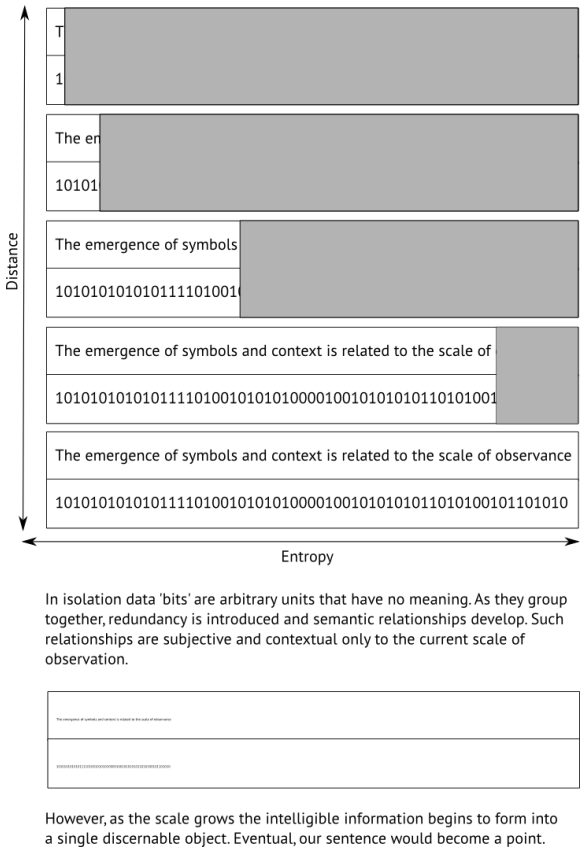

Figure 2. All information has a 'sweet spot'- a scale at which it makes sense.

The beginning of intelligence begins with the first stabilisation of frequencies as a result of particle evolution into self-similar structures. By the same process, the birth and rotation of stars such as our own Sun, created accurate clocks by which systems could evolve in a more repeatable way. There is of course however a point at which a system might become self-regulating and no longer reliant on external frequency influences entirely. This is due thankfully to the preceding fact that at some scale, finite phase spaces may indeed form anything that can exist within the provided entropic bounds and so will with some probability be capable of forming equally competent data and information generative systems.

In Figure 2 it can be seen that the farther away the subject is, the more intelligible it seems to become. However most critically, at some point the information that was once contained in the sentence is lost as it once again becomes a single point. In essence, the information is reborn as data that once more can enter the cyclic system of information creation.

Cyclic Frequency Stable Systems

The author introduces the term "Cyclic Frequency Stable Systems" which contribute to the creation of pseudo-cooperative self-organising and self-similar structures. One can define a Cyclic Frequency Stable System as a collection of complex units with one or more inputs and one or more outputs that by happenstance actions one upon the other to form a stable system that is resistant to external influence. For example: If one is to take a sample of simple molecules, (molecules whose size is increased by light falling upon it, and furthermore such a molecule also emits light as a diminishing proportional function of its size) and then place the molecules together in a protected enclosed space, it is simple to predict that with little difficulty the molecules will by a process of feedback summarily arrange themselves into some form of order or 'equilibrium'. As a molecule receives light it grows in size, pushing its neighbours away, simultaneously its own emitted light diminishes and so its effect on its neighbours reduces as the received light falls. This is one of many simple ways to demonstrate how stability can be created. As the number of inputs or outputs grows, or as two systems with compatible but different input/output come together, the number of ways to develop stability grows. The system described is also resistant to some perturbation. Consider if there is introduced for a short period an external light source acting on the entire system. Here the collective sample grows together. However, when the light is removed the system will recover quickly to equilibrium. These principles are indeed used with great effect in everyday technology such as semiconductors, in which free electrons move from free hole to free hole in the covalent bonds of silicon atoms.

From self-similarity at scale is born the notion of classification and symbols

Referring to Figure 2 again, we can see that at some scale of observance the sentence would quite literally become a dot, a point – 'a bit'. At that scale we would be able to classify it. With hindsight and understanding that the 'bit' in our example is in fact a sentence, we can make some observations about the nature of data and information. The observation is simple: *"Sometimes the same unit of data can represent multiple versions of information. Another way of saying this is that the scale of observance may at times have a compressive effect".*

The author believes this is intrinsic to the nature of the conscious apparatus. This is based on the previously determined fact that the brain is finite, yet has a seemingly infinite capacity to recall information upon demand in response to sensory experiences – whether external or internal by way of the cyclic mental workspace of the imagination.

Communications and non-purposeful signals

Communicating is defined as purposeful information exchange between 2 or more parties. At its current state of evolution, it is one of the richest cosmic creations most of us take for granted. A large amount of fruitful research is conducted in the theory and understanding of the written and spoken word, but language at our current stage of evolution is a highly convoluted and diverse system comprising many layers of already complex data relationships, so what comes before it?

"Xenolinguistics does not begin with the search for a new language, but rather the rediscovery of the language of creation that resides in us all. For here, in the simplicity of the before and hereafter is the binding code that runs through all of the cosmos."

The language we use today whilst seemingly far removed from the simplicity of rudimentary and stochastic binary operations in space time still bears the hallmark of an information based evolution. Stories reduce to paragraph, paragraph to sentence, sentence to word, word to letter, letter to phoneme, phoneme to sound wave, sound wave to verbal motion, verbal motion to electro biological process, electro biological process to quantum mechanics, quantum mechanics to quantum thermodynamics, quantum thermodynamics to quantum information theory... finally theory to cosmology. It is the authors opinion that no complete science of consciousness is complete without adequate room for the science of Xenolinguistics. Language like all things is interwoven in to the fabric of evolution by the Third State. Space is present in all languages, sound, music and written word. Space brings meaning to otherwise meaningless symbology.

The primordial nature of sound and music to move the emotions and affect the mind need little explanation. The wondrous way that a major chord can give you Goosebumps whilst a minor chord invoke melancholy, or the way a scream of fear is understood no matter what language the speaker bears testimony to the deep rooted nature of frequency in the role of perception and consciousness. When we are touched by these most basic of nature's communications – seldom is translation necessary.

Highly evolved communications may take the form of speech and symbols, but the most primordial information exchanges develop early on in the feedback cycles of discreet stable systems as they come together. However else you want to classify it, the repelling force of opposing magnetic poles, the expansion of a gas or the annihilation of a proton and electron to give birth to light are all forms of signal. Signals differ from communications by their lack of reliance on a response. They can be unidirectional, they can be unintentional, they can be uninformative. One might conclude that a signal is of no use unless it is observed, however most certainly its power as a communications tool is limited until the recipient of the signal might respond. Simple mathematical formulas such as a logistical formula shown in equation (1) and used frequently in population modelling are an easy way to understand the feedback process involved as 2 or more systems capable of signal generation and or reception come together.

$$\frac{dn}{dr} = n(1-n) \tag{1}$$

The continual feedback of n will model the output curve of "boom and bustiness" of a system. The output is fed back to the input and a new value is produced. The process can be modulated by variance of the variable r and for some cases a steady state can be achieved. If the output n is translated to a physical output and r the input received from another system, then causal

communication is created between the two systems. The output n, might be anything from a sound, increase in heat or size. The input r may be a systems response to heat, light, sound or electromagnetic radiation. In isolation two discreet systems would normally reach equilibrium. Only when a third system is introduced (this may be a system with a monopole or unidirectional output signal) is this equilibrium disturbed. A pulsar of light falling upon the system, may cause the two systems to escape equilibrium and begin to increase and decrease in size in a oscillatory fashion for example.

Embodied memory: The fallacy of Darwinian survival of the fittest

The Darwinian notion of survival of the fittest implies that long term evolutionary success is attributable to some measure of intentional self-preservation. By contrast the notion put forward in this paper is that there is no intention required for evolution to take place. Consider: There are traditionally only two states of life: Alive or Dead. Success is life, Death is failure. The choice is binary. If therefore the choice is binary, it shall be governed by the laws of information theory set down by Shannon. The only addition to this binary model is what the author calls "The Third State". The Third State is simply "space" or more understandably "redundancy". In this sense Life might be seen as a point between "space (nothingness) and Death (a state not of nothingness but simply a change of state into energy that is reused by new systems)". As a system (a life or any stable structure) evolves to become stable, countless predecessors did not. It is not so much that the successful system was "fitter" or somehow "knew better". It is rather that there were just many failures. The successful system has no "memory" of its past success or the failure of its predecessors. It simply is the current state space of a systems evolution which has reached a point of stability. There may be much to learn from the systems that did not make the finish line (Genetics, Biological engineering and chemistry are now the fields of study that are able to resurrect these failures, modify them and produce new synthesized stable systems). One could say that the memory of survival is embodied in the system itself, whilst the memory of all the wrong ways to do it are stored in the nothingness of failure (there is no past). Whilst the end result is the same as the Darwinian idea, the process is simply a matter of stochastic process governed by cosmological information change. There may be those who question this view and argue that there are some systems that have an aggressive quality. Whilst this may be true, one cannot escape the certainty of mathematical and information theory that provides the apparatus for a finite state space that allows indeterminable entropy to appear, live and die. Therefore, it is perfectly reasonable to deduce that sometimes, some systems may have aggressive or communicable ability. It is not however reasonable to assume that the evolution of all systems "depends upon it – nor even have knowledge of it".

Many memories stored in one place: microtubule

It is the nature of the brains formation that it be capable of using sensory information (internal or external) to mathematically reconstruct many varying phase spaces from a single entry of information according to the input phase space and the frequency of the memory stored in the biological apparatus (i.e., microtubules, protein and other structures found in the cellular construction of the brain).

Imagine that a biological structure such as a Microtubule has a nominal degree of accuracy of 512 discreet values. One may imagine that the limits of information storage are bound by that figure. However, whilst the limit of sensory information is finite in nature at the time of observation, the phase space of all possible sensory configurations is indeed infinite when viewed across all scales: for example, an Orange viewed from 100 meters is little more than a dot, at 1 meter it is clearly an Orange, at 1mm it is something altogether different. If for the sake of simplicity, we assign the value 123 to our microtubule and subject it to an iterative function to which the input is both the external sensory information, as well as the mental imagery being constantly produced by the function - then allow the output of the function to populate a finite phase space we can see that even a single discreet value is capable of producing near infinite versions of reality in a finite phase space at any chosen scale of observance.

In 2015 Van De Bogart/Forshaw published the results of an experiment that sought to store the memory of a photograph in a quantum probabilistic state (Van De Bogart and Forshaw,

2015), then using the information captured from an audio composition by the same artist attempt to reconstruct the original memory using the Toridion Algorithm developed by Forshaw -see equation (2). Where *a* is an array distribution of quantised values that were obtained by a proprietary quantum annealing processor. The result was the collapse of the quantum compressed memory into a highly recognisable representation of the original memory (Figure 3).

$$I = r + \left(\sum_{i=} \begin{pmatrix} a_1 \\ a_2 \\ \cdot\cdot \\ a_{nA} \end{pmatrix}^{nA} \sum_{k=22}^{0} 1(128^k) \right) + (p^{pL}). \quad (2)$$

Forshaw's formula used to reconstruct memory recovered from probabilistic storage by simulated quantum tunnelling. Where *a* is an array distribution of quantised values that were obtained by a proprietary quantum annealing processor.

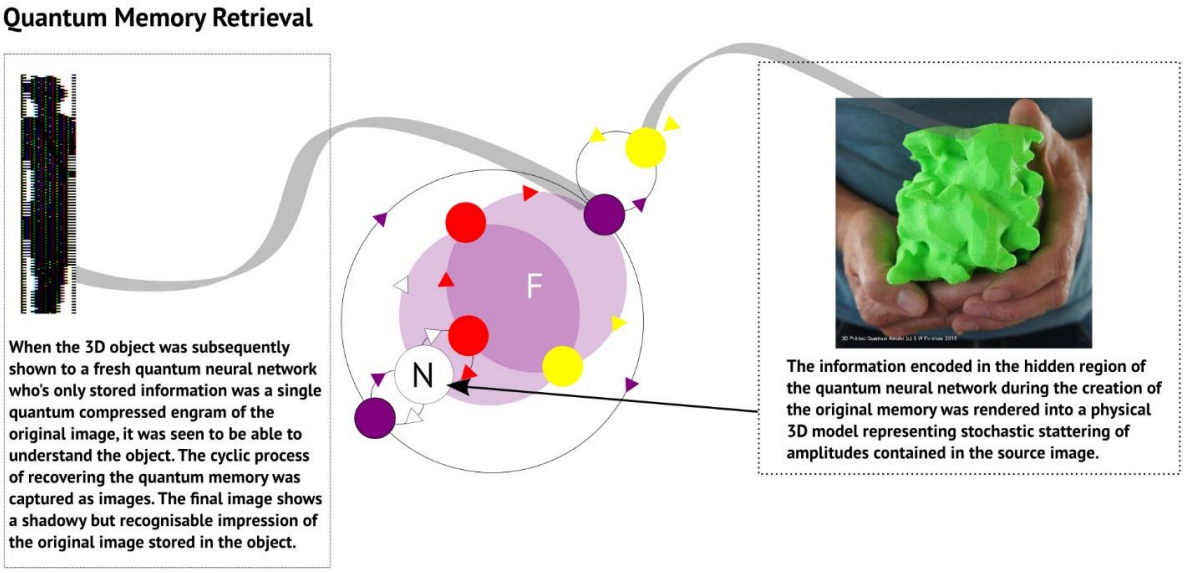

Figure 3. Probabilistically stored memory data printed in a 3D format was used to visually stimulate a quantum tunnelling algorithm to recover a complex memory engram of an image stored in 16 bytes of data.

Quantum Deterministic non-periodic systems

A common argument against determinism is that the classical understanding of it precludes freewill. If the universe is a deterministic system, then that would imply that our fate is fully mapped out. What is certain is that some systems are clearly deterministic whilst other appear to be either random or self-directing, whether or not that self-direction is conscious or intrinsic to the system in question. The ability for apparently deterministic systems to produce unexpected output conditions or 'bifurcations' has been extensively studied. Yorke in his 1975 paper 'Period 3 Implies Chaos' (Yorke, 1975) built heavily on the work of Lorentz and his discovery that some systems demonstrate a high degree of sensitivity to initial input conditions – later fondly referred to as 'The Butterfly Effect' (Lonrenz, 1963).

"Determinism does not preclude freewill as far as freewill is intrinsically bound by the limits of itself."

An information theory of quantum consciousness as proposed by this paper suggests that sometimes stable systems develop and sometimes they do not. However, because at the quantum scale the exact state of the quantum information that makes up the classical information is in fact "uncertain" then the interaction of these systems is probabilistic rather than deterministic, but not random – quantum probability allows for stable systems that can demonstrate a high degree of classical resilience to perturbation whilst still producing irregular permutations that are neither deterministic or random. Rather that there is a strong case for systems whose cyclic rhythm is tied to the feeding back of its own output and also the output of other systems that may or may not modify both the outbound and inbound

communication that the system has access to. As a symbiotic systems composition grows into a macro system and eventually an ecosystem, it is probable in statistical terms that some systems may develop that are able to both filter and react to these signals in such a way as they could be classified as 'causally self-observant. A complex ecosystem whose stability is reliant on the complex interactions with many others will grow in capability and entropic possibility whilst at the same time remaining inside the bounds of the matrix that contains it.

"The introduction of causal self-observance in quantum deterministic stable ecosystem is the birth of the consciousness and rational freewill."

Once causal self-observance is attained, freewill is permissible, but not without limitation. Freewill is mistaken to mean that all things are possible. The author strongly postulates this is incorrect. Freewill can only operate within the degrees of freedom that are bounded by the entropic ceiling of the larger ecosystem in which it resides. For example, whilst we might like to think fondly of popular inspiration in the form of "You can achieve anything you set your mind to" - It is clear this is nothing more than folly. Rather you can imagine many things such as growing wings and flying, but clearly the laws of gravity in your parent system say otherwise. The author then seeks to reframe freewill to mean simply: "you have freewill to do anything that the laws of science and the universe will permit at that point in time and space". A quantum information theory of consciousness has more than enough room to accommodate freewill in these terms. To escape determinism one needs probability in the equation.

Those who would argue that we might fly by imagining an aeroplane and subsequently building it in order to take flight, only then to attribute that act to freewill are missing the point. Our ability to extend our entropic possibilities by extending our own system by the manufacture and interaction with another system is not limited by quantum determinism – crucially however, the act of discovering artificial flight is not itself an act that either extends our separate capability to fly as a standalone system without assistance from another.

Conclusion

The conclusion is that the brain is both biologically constructed and operationally dependent on many of the accepted principles of quantum mechanics. That due to its finite biological size and complexity, the maximum classical storage capacity of the brain has a ceiling limited by classical information theory. To exceed this limitation, the molecular structures of the brain use a probabilistic form of memory storage and retrieval and that this method allows not just for more efficient storage, but more importantly avoids low entropy stagnation by constantly pruning and redefining memory units in a probabilistic fashion. Probabilistic memory schemes as discussed and demonstrated by Van De Bogart and Forshaw facilitate the storage of many memories in a small number of locations in such a way that they can be recovered selectively by another field (or stimulus) that approximately created them. In simple terms Van De Bogart and Forshaw demonstrated that a single uncollapsed quantum memory state could be collapsed into many equally valid recognisable constructs (or system outputs) depending on the object or stimulus currently in view (Van DeBogart and Forshaw, 2015). Additionally, the paper proposes that reality is a function of the present configuration of physical mind, feedback created in the mind and the stochastic information that is received in the form of sensory information (whether through the understood sensory channels or otherwise by way of indeterminable forces, for example 'Electromagnetic Radiation'). The author postulates that the self can influence the state of the wider quantum field by its actions and subsequently the implication is that consciousness resides both within and outside the mind. Furthermore, that the present state of mind whilst it is a product of past interactions, it has no relationship to it other than the present. In that sense, every second is a clean slate in terms of self, giving rise to indeterminable possibilities.

References

Addison PS. Fractals and Chaos. An Illustrated Course. Institute of Physics (IoP) Publishing, 1997.

Chalmers D. Facing Up to the Problem of Consciousness. J Consciousness Stud 1995; 2 (3): 200–219.

Darwin C. On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life. J. Murray, Evolution, 1859.

Forshaw S. Neuroplasticity demonstrated in a Zero Logic Quantum Neural Network. 2015. http://www.visicomscientific.com/web/en/rss/wp/neuroplasticity-demonstrated-in-a-zero-logic-database-zlqnn/.

Ho MW. How the electric plasma universe creates galaxies and stars. 2015. http://www.isis.org.uk/How_the_Plasma_Universe_Creates_Galaxies_and_Stars.php

Khorana HG. Polynucleotide synthesis and the genetic code. Fed Proc 1965; 24 (6): 1473–1487. PMID 5322508.

Li TY and Yorke JA. Period Three Implies Chaos. Amer Math Monthly 1975; 82(10): 985–992. http://doi.org/10.2307/2318254

Lorenz EN. Deterministic Nonperiodic Flow. J Atmos Sci 1963; 20:130-141.

Shannon CE. A Mathematical Theory of Communication. Bell Syst Tech J 1948; 27 (3): 379-423. doi:10.1002/j.1538-7305.1948.tb01338.x.

Van De Bogart W and Forshaw S. Re-constructing memory using quantized electronic music and a "Toridion byte" quantum algorithm: Creating images using zero logic quantum probabilistic neural networks (ZLQNN).2015. https://www.researchgate.net/publication/281480809_Reconstructing_memory_using_quantized_electronic_music_and_a_Toridion_byte_quantum_algorithm_Creating_images_using_zero_logic_quantum_probabilistic_neural_networks_ZLQNN.