



The Quantum Universe Wm L. Duncan

An Information Systems Perspective

The purpose of this paper is to present a model of the nature of reality and our perception of the universe, applying a few principles of quantum physics. This model represents a new view of reality, utilizing principles of quantum mechanics to explain the construct of existence, as humans perceive it. It is intended to provide a mental platform from which new insights about time, space, and human perception can be obtained. Finally, the author utilizes this model to speculate about various subjects, including the nature of "reality", the passage of time, and an opportunity to detect the presence of advanced life forms in our universe.

I. What is the Fundamental Element of Our "Reality"?

Speculation and investigation about the nature of our universe is at least as old as recorded history. Early philosophers theorized that the most fundamental element in the universe was water. Later, as scientific knowledge began to mature, our view of the universe became more complex, and for many years there was a widely accepted belief that the four primary elements in our universe were earth, air, water, and fire. Later investigations have centered around chemical elements, then molecular structure, atomic elements, electrons, quarks, and so on.

More recently, the advent of quantum physics and the concepts comprising quantum mechanics have resulted in speculation by some of the world's foremost thinkers that the most fundamental building block of the perceivable universe is none of these. It is in fact information.

A relevant conversation held between two world-renowned scientists, Jean-Pierre Changeux, Director of Neural Biology at the Institut Pasteur in Paris, and Alain Connes, Chairman, Analysis and Geometry at College de France was captured and published by Princeton University Press in 1995, entitled Random Thoughts About Mind, Matter, and Mathematics. Connes stated: *"It is humility, finally, that forces me to admit that the mathematical world exists independently of the manner in which we apprehend it, that it isn't localized in time and space. But the manner in which we apprehend it is subject to rules very similar to those of biology. The evaluation of our perception of mathematical reality causes a new sense to develop, which gives us access to a reality that is neither visual nor auditory, but something else altogether."*

Connes' assertion is that the principles of mathematics exist independent of humanity. Unlike human language (reading, writing, etc.) the fundamental relationships that people refer to as mathematical are an innate part of the universe. Without people they would still exist. They are a divine set of rules which order the universe.

A more recent work entitled Explaining Consciousness, the Hard Problem, which is a series of papers by various renowned authors edited by Jonathan Shear and published by MIT Press, contains a treatise entitled Facing Up to the Problem of Consciousness written by Daniel J. Chalmers. Chalmers and a number of other contemporary physicists have concluded that more broadly than mathematics, information in general is the fundamental element comprising reality as we perceive it. In his paper Chalmers states: *"Wheeler (1990) has suggested that information is fundamental to the physics of the universe. According to*

this 'it from bit' doctrine, the laws of physics can be cast in terms of information, postulating different states that gave rise to different issues without actually saying what those states are. It is only their position in an information space that counts."

If this is correct, information is a natural candidate to also play a role in a fundamental theory of Connes'. We are led to a concept of the world in which information is truly fundamental, and in which it has two basic aspects, corresponding to the physical and phenomenal features of the world. The assertions made by Chalmers, Wheeler, and others indicate that they believe the most fundamental building block of the universe is not atoms or even quarks, but rather information itself. At first glance this hardly seems possible. How could information, something that seems completely insubstantial, be the material from which all perceivable physical, and phenomenal aspects of our universe arise? Exploring that question, it is useful to consider the quantum wave function, and particularly the principle of duality.

In the last stages of his investigation into the world of physics, Albert Einstein became particularly enamored with the study of light. He was especially fascinated with the dual aspect of light's existence, both as a particle and as a wave. In 1905 Einstein proposed that light could exist in the form of a particle, a small piece of something known as a photon. This stood in stark contrast to 200 years of experimentation that demonstrated existence of light as a wave. Einstein's proposal showed that light had two distinct and seemingly opposing natures: a wave-like aspect and a particle-like aspect. Niels Bohr, continuing in this field of study, synthesized these opposing aspects of light in his theory of complementarity in 1926, showing that light was neither a wave nor a particle, but was both a wave and a particle. A description of light as either one without the other was scientifically inaccurate.

Light was only a precursor to the broad understanding of quantum mechanics as it stands today. The central dogmas of realistic quantum field theory hold that:

1. The essence of material reality is a set of fields,
2. These fields obey the principles of special relativity and quantum theory,
3. The intensity of a field at a point gives the probability for finding its associated quanta – the fundamental particles that are observed by experimentalists,
4. These fields interact, and imply interactions of their associated quanta. These interactions are mediated by the quanta themselves,
5. There isn't anything else.

In a book called *The Cosmic Code: Quantum Physics as the Language of Nature* (1982), Heinz Pagels stated *"Physicists have discovered that there are only four fundamental quantum interactions. In order of their increasing strength, they are: The gravitational interaction; the weak interaction responsible for relativity; the electromagnetic interaction; and the strong quark-building interaction. Each of these four interactions has an associated gluon, and the 'stickiness' of the gluon is a measure of the strength of the interaction. The four interactions might really be the manifestation of but one universal interaction! This possibility is the basis for a unified field theory which has long been the dream of physicists."*

Without reviewing the details of "even" and "odd" wave shapes, it is worth mentioning that in the world of quantum physics, even waves represent the condition where two particles coincide in space/time and odd waves represent the probability of the two particles coinciding being zero. The author proposes that "even wave" conditions present in a large number of discrete information elements, coinciding within a specific plane along a temporal continuum, represent the sum and substance of "here and now" as we perceive reality.

II. The Dual Cone Shape As a Recurring Theme in Physics

Dual Cone Shape (Example 1)

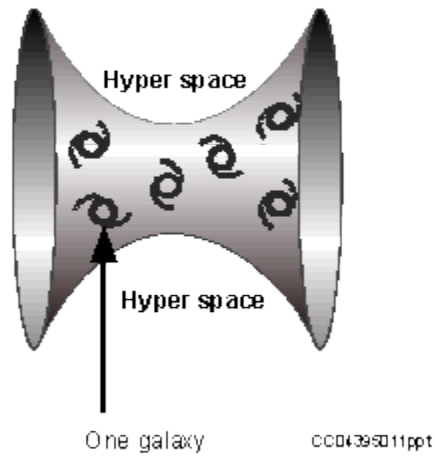


Figure 1A. The Saddle-Shaped Universes Described by MacVey

Throughout the study of modern physics, constructs pertaining to the nature of the universe have repeatedly manifested themselves in models represented by a dual cone shape. See Figures (1) and (2).

Dual Cone Shape (Example 2)

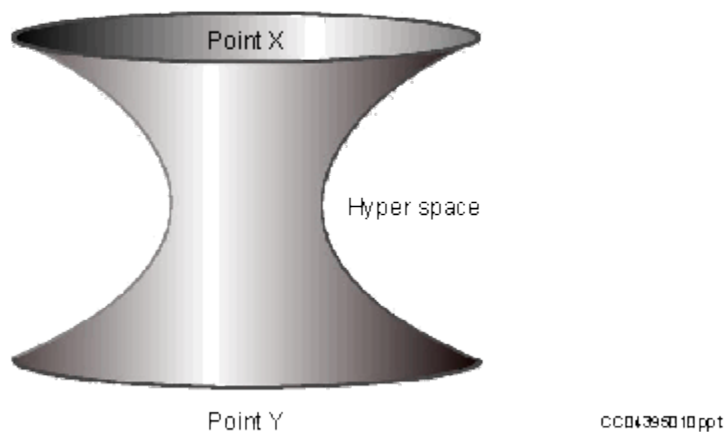
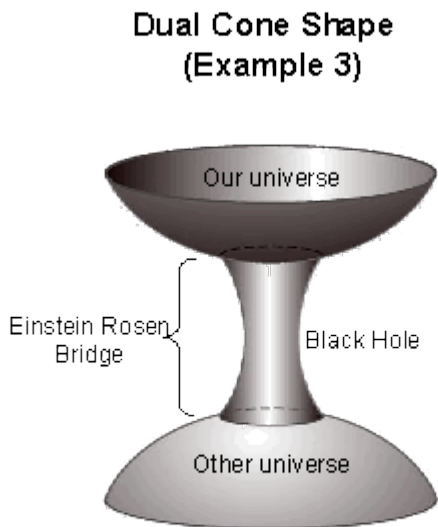


Figure 1B. A Representation From MacVey of the Connection of Two Remote Regions of the Galaxy via an Einstein-Rosen Bridge

Sometimes referred to as a saddle-shaped universe (Is Time Travel Really Possible, John W. Macvey, 1990), this shape is perhaps most popularly presented in the form of the Einstein-Rosen bridge depicting a gravitational tunnel connecting two remote regions of the galaxy. This appears to most succinctly depict man's perception of the fundamental workings of extremely complex universal phenomena such as "black holes."

The model is pervasive as MacVey points out: *"It has been suggested by a few imminent and reputable scientists that every region of the universe is interconnected with every other by fixed 'hyper space' currents that flow between every possible departure and arrival point in space. Noted aerospace scientist Alan Hold has even postulated that almost instantaneous interstellar transit might be achieved by 'riding' the*

hyperspace currents that flow from star to star. This, he believes, could be accomplished by generating cone patterns of electromagnetic energy that interact with these hyper space energy currents, thereby reducing or augmenting the gravity field around the ship. In referring to how these voyages via black holes could be navigated, the Einstein-Rosen bridge is presented as a model (see Figure 2).



Returning to MacVey: *"In 1935 Albert Einstein and his colleague, Nathan Rosen, published a paper predicting the interconnection of the universe by timeless tunnels, 'shortcuts to infinity' as a skeptical contemporary remarked. More than half a century ago, such a concept was hard to accept and even harder to visualize. Nevertheless, it endured and is now looked upon with considerable, if not universal, favor."*

Figure 2. An Illustration From MacVey of the Manner in Which an Einstein-Rosen Bridge Might Act as a Passageway Between Our Perceivable Universe and a Parallel One

III. Quantum Wave Collapse, and the Creation of a New Dual Cone Model of the Universe

A similar dual-cone pattern emerges with an examination of the quantum model of the mind-brain, as presented by H. P. Stapp in 1993 (from Explaining Consciousness, the Hard Problem by J. Shear). Stapp outlines 13 principles pertaining to his model:

1. *Facilitation. The pattern of neurological activity associated with any occurring conscious thought is facilitated in the sense that the activation of this pattern considers certain physical changes in the brain structure, and these changes facilitate subsequent activations of this pattern.*
2. *Associative Recall. The excitation of a part of a facilitated pattern has a tendency to excite the whole.*
3. *Body – World Schema. The physical body of the person in its environment is represented within the brain by certain patterns of neural and other brain activity.*
4. *Executive Level Template for Action. A main task of the alert brain at each moment is to construct a template for the impending action of the organism. The representation is imprinted in the brain by means of an automatic causal spreading of the neural excitations of the executive level to the rear of the nervous system.*
5. *Beliefs and Other Generalizations. Beliefs can be added to the landscape of the simple body-world schema.*
6. *Quantum Theories. The classically describable aspects of nature that we seem to experience, arise in a rational way from the quantum underpinning.*

7. *Superposition of Templates.* Without quantum collapses the body/brain would evolve into a superposition of macroscopically distinguishable possibilities, as a measuring device normally does.

8. *The Reduction Postulate.* The Quantum collapse of the brain state occurs at the high level of the template for action. The (Heisenberg-picture) state (of the universe) undergoes the collapse:

$$\Psi_i \rightarrow \Psi_{i+1} = P_i \Psi_i$$

where P_i is a projection of the operator or that acts on appropriate macroscopic variables associated with the brain. It picks out and saves, or 'actualizes' one of the alternative possible templates for action, and eradicates all others.

9. *The Psycho-Physical Postulate physical postulate.* The collapse of the wave function to the branch that specifies one particular template for action is the brain correlate of a corresponding psychological or experiential event.

10. *Efficacy of Consciousness.* Pieces associated with conscious events are dynamically efficacious. Each such event effects a decision between different templates for action, and these different templates for action lead on to different distinguishable responses of the organism.

11. *Consciousness and Survival.* Consciousness emerges because it aids survival. For this to be so, consciousness must be efficacious.

12. *Conscious Events and Unconscious Processing.* The general temporal development of the brain profits by periods of unconscious processing punctuated by conscious events. Conscious events actualize a template for action that, by automatic spreading of the top-level neural activity to the rest of the nervous system, controls: a) motor action, b) the collection of information, c) the formation of the next template for action.

13. *Overall Picture.* Graphically only a single "next template" would be formed. This could be achieved either by the formation of a resonant state that sucks energy from competing possibilities, or by inhibitory signals, or by dropping into the well of an attractor. Each of the distinct events chooses from among the alternative possible allowed templates for action of the local deterministic loss of quantum mechanics, and hence between the different associated macroscopic responses from the organism.

Principles 5 through 10 are especially relevant to this subject, as we shall discuss.

In conjunction with this overall dual cone model, a related recurring pattern is a branching effect where movement from one universe to another is represented. This branching effect supports an idea which has been postulated for many years, that parallel universes exist, drawing their elemental properties from one another (see Figure 3). In Figure 3 a hypothetical representation of a black hole system is presented, which has been theorized by MacVey to be capable of leading into the past or future of our own universe. The branch effect represents events stemming from a singularity that spins off to white holes leading to present-but-parallel universes.

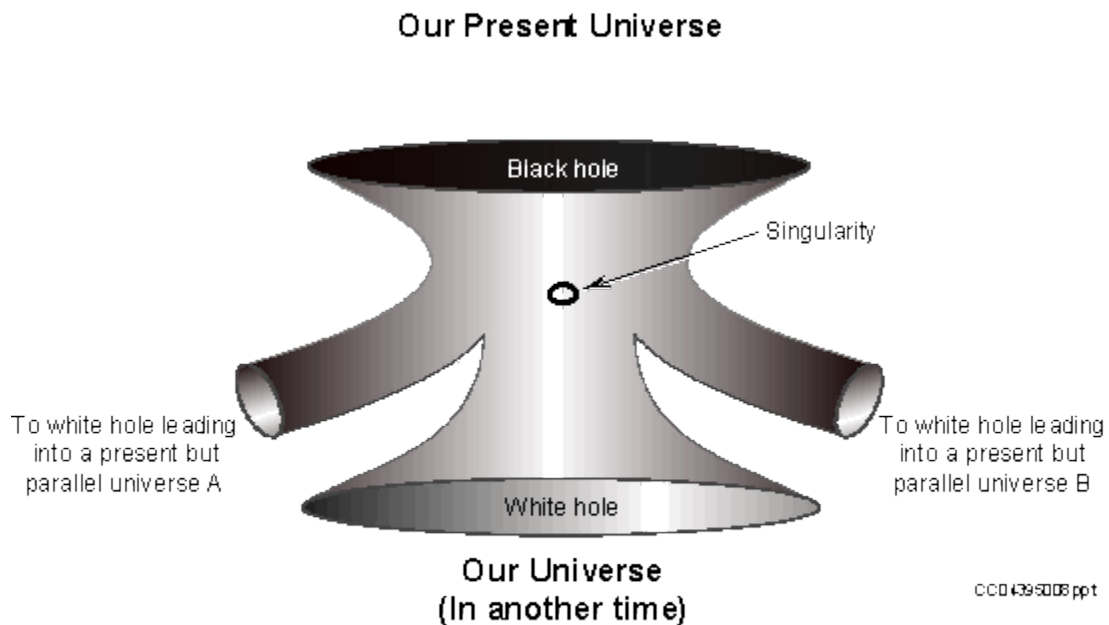


Figure 3. MacVey's Hypothetical Representation of a Black Hole System Capable of Leading Into the Past or Future of Our Own Universe as Well as Into Parallel Universes in the Present

We can observe then, that modern physicists appear to be coalescing around a model of the universe that may be visualized as a dual cone with branching portals to similar, present-but-parallel universes. These universes all operate in accordance with principles of quantum mechanics characterized by quantum waves and quantum wave collapses, evolving into super-positions of macroscopically distinguishable possibilities.

The cause-and-effect relationship between human consciousness and the environment represented as a universe around that conscious entity are still murky at best. It is unclear whether the human species "creates" our universe by virtue of conscious and unconscious processing, actualizing "templates" as has been theorized by Stapp, or the universe presents itself in a manner independent of conscious activity. Whichever of these is correct, some underlying principles about the operation of information as the fundamental material of the universe may well provide invaluable tools for comprehending the mechanics of the overall system.

IV. Speculation on the Nature of Reality

In the course of speculating about the nature of reality and the most fundamental elements of our universe, it is useful to draw together the various aspects of recent work in the field of quantum mechanics that have been described in earlier sequence of this document. The reader will recall that assertions have been made by Chalmers, Wheeler, and others that the most fundamental building block of our universe is not atoms or atomic elements as we have known them, but rather information itself. Information is theorized to be comprised of dual aspects, similar to the dual aspects of light, namely wave and particle. Recall that Wheeler stated that information is truly fundamental and has two basic aspects: Physical and Phenomenal. The resulting construct would imply that we live in a world where not only mathematics (Connes and Changeux) but all information is independent and fundamental. This gives rise to the question: "What is the relationship between this construct and the quantum wave nature of physical existence?"

Applying the probabilistic aspect of quantum physics to the theory of information fundamentalism illuminates a function between information and existence that not only explains the nature of reality as we perceive it, but also yields the key to altering reality through altering the probabilities of discrete information elements.

For example, there may be a threshold of probability beyond which any information element becomes a part of perceived reality - of human conscious experience. If so, "less probable" information may comprise alternative existences or realities outside (or beneath) our perceivable reality.

In this model it is important to understand the definition of "true." True is a variable condition in the same way that the existence of a quantum level particle is "probably" present at a given position at any point in time. In quantum physics a fundamental element can neither be clearly stated to be at location A or location B, but rather must be described as most probably in one location or the other. (refer to the problem of Schrödinger's cat Who's Afraid of Schrödinger's Cat?, Marshall and Zohar, William Marrow & Co., 1997.)

Figure 4 represents the universe of all information elements. It is a graph which depicts those elements on a scale of probability of "trueness." With some elements of information at the low end of that scale considered by humans to be untrue and with other elements at the high end of that scale considered by humans to be true and of which humans are aware. In the center of the graph, transfixing between the threshold of existence in the subconscious mind and the threshold of existence in the conscious mind are those elements of which humans are aware, but which we consider to be untrue. The threshold of conscious/awareness/truth as depicted in this figure may correspond with the concept of quantum wave collapse (see Stapp's principle #8, "The Reduction Postulate", in section III. of this document).

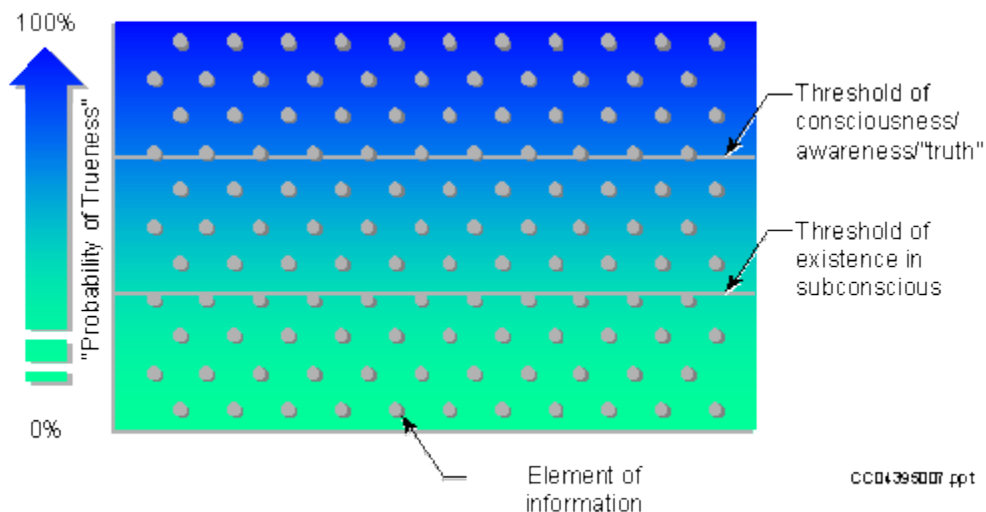


Figure 4. A Cross-Section of the Perceived Universe at Its Most Fundamental Level

In this model an element at the lower end of the scale below the last threshold (threshold of existence in subconscious) might be $X=P^2M$. Since no one knows what X, P, or M are in this equation, it represents information unknown to humans and therefore below the existence of even the subconscious mind. An example of an information element that is transfixing between the two thresholds represented in this figure might be "I perform better in my job on Mondays." In this example a person is aware only subconsciously that historically their job performance has been better at the beginning of the week than it has toward the end of the week. The reason for that performance difference (for example, a greater quantity of sleep on weekends which corresponds with better job performance after returning to work on Monday) is only recognized subconsciously. The individual involved has never thought through that relationship and is not consciously aware that they perform better at the beginning of the week, but recognizes that condition only on a subconscious level. Finally, one example of an information element above the threshold of conscious/

awareness/truth might be "Today is July 29, 2001." This is information that the individual is conscious of, and considers to be accurate beyond question.

Therefore, for any individual in the universe, reality is represented by those elements of information which have a probability of trueness that exceeds the threshold of conscious/awareness for them. To some degree it can be argued that reality also includes those elements of information that have reached the center portion of this model, having crossed the threshold of existence in the subconscious mind, but having not reached the threshold of conscious awareness.

Accepting this model as a basis for additional speculation about how a "universe" of reality comes into existence that is shared by more than one person, it is useful to consider the model described in Figure 5. Figure 5 represents an overlap of multiple consciousnesses where a substantial number of the information elements above the first threshold, and the lion's share of information elements above the second threshold are shared by more than one individual at the same time.

If information elements operate in a manner similar to what we perceive as the physical universe at a macro level, the shared group of elements considered to be true would produce a form of "gravity." This "gravity" would increase with the number of individuals sharing those information elements in their perceived-to-be-true reality, such that an adequate number of humans sharing an adequate quantity of "true" information elements generates adequate informational "mass" to bring a universe into existence. This model gives rise to a number of questions about specific mechanical operations that cry out for further investigation. Among those are:

- What level of information is "fundamental" in this context? (Entire constructs, facts, perceptions, binary conditions, etc.).
- What number of people sharing what number of data elements constitutes adequate mass to produce "reality," or a universe?
- What is the relationship between the information elements considered to be true by more than one individual that generates this "gravity", produces "mass", and results in a universe?
- Does the universe spring into existence at a discrete threshold of individuals sharing a specific number of elements or are the causal factors related not only to the number of elements, but also to the strength of the relationships between the individuals sharing those elements or the number of individuals involved?

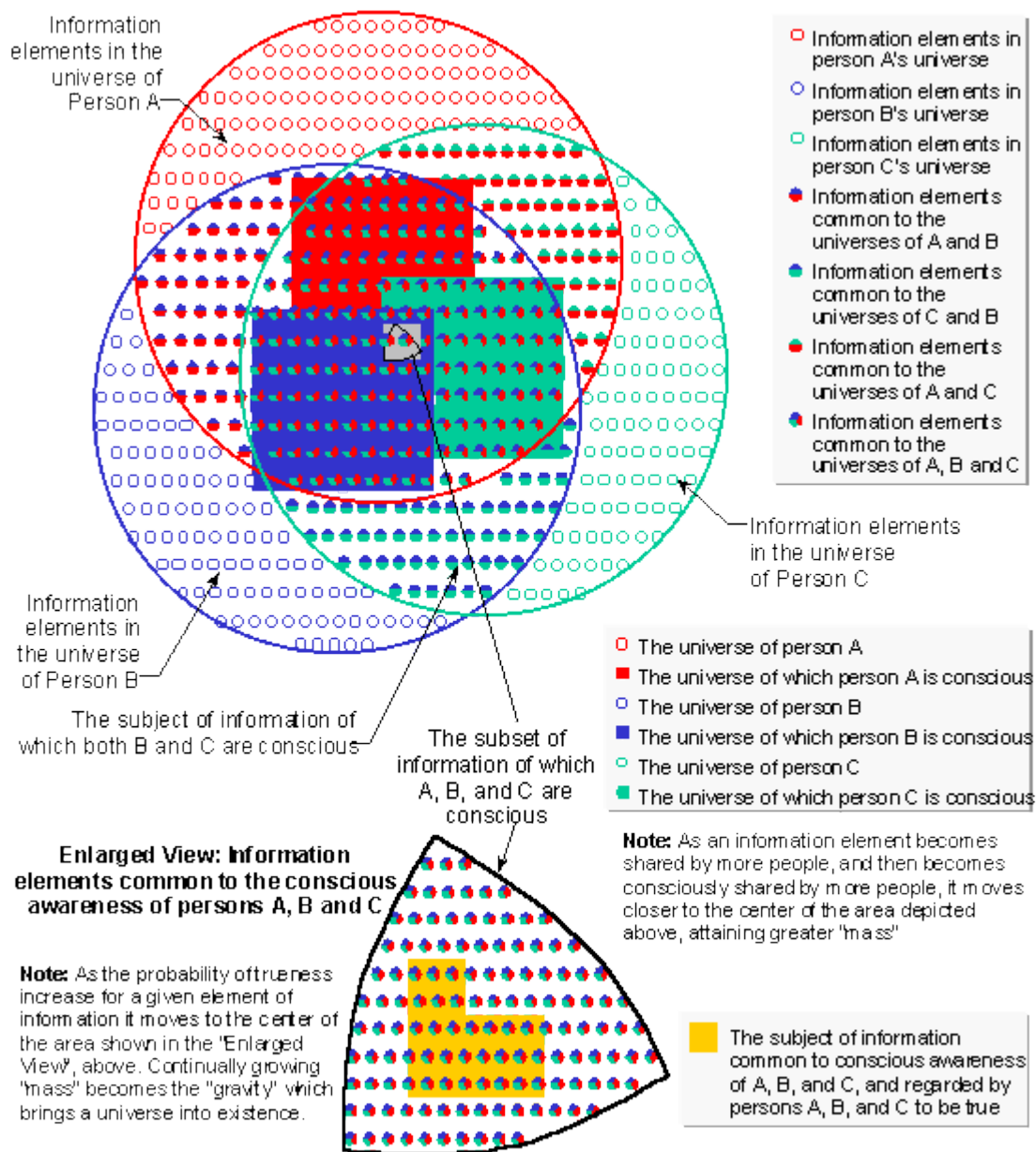


Figure 5. A Cross-Section of the Universe, as Elements of Information, Depicting a Population of 3 People

The combination of a quantum wave function with the double aspect theory of information presents a number of truly interesting possibilities. With regard to the question of cause-and-effect pertaining to human consciousness and the existence of the universe, the author would offer this quote from Peter Russell (*The Global Brain Awakens*, McNaughton & Gunn, 1995) "...Vaclav Havel, former President of Czechoslovakia, speaking to a joint meeting of the U. S. Senate and Congress in February 1990, said that 21 years of suppression had given him one certainty: consciousness precedes being, and not the other way around ... Without a global revolution in the sphere of human consciousness nothing will change for the better in the sphere of our being as humans..."

In support of our model of all information elements existing, and only those crossing a threshold of "trueness" probability representing a universe, the

following quote is offered from Michael Lockwood (*Mind, Brain, and the Quantum*, Basil Blackwell Ltd,

1989) *"I am not claiming that nothing ever really happens. Rather the reverse: On a relative state view, absolutely everything that (physically) can happen does happen, in the sense that it is to be found somewhere in the cosmic wave function. What I think of as the history of the world is really its history relative to a particular biography, and only one history as one ordinarily thinks of it is something abstracted from an underlying matrix that contains countless alternative histories. And the assumption that this entire system is, in its own right, changing or evolving (or that it is not) is at best gratuitous: and at worst meaningless."*

Another supporting position offered by William Seager (*The Metaphysics of Consciousness*, Routledge, 1991) is as follows: *"Fundamentally, information acquisition reduces uncertainty; we can take this to mean that one's acquiring some information shrinks the set of possible worlds which one may take the actual world to inhabit. An epistemic state is represented as the set of worlds in which one's current believing or, better, one's knowledge is true, which set can be considered the 'über-proposition' which encodes all one's knowledge. A new piece of information for the second set of worlds, a new proposition, and the rest of accepting this information is, if it be genuinely informative, a contraction of one's 'über-proposition' (the new 'über-proposition' is the intersection of the original 'über-proposition' and the new proposition.). The quantitative theory of information can also be accommodated in such a possible world's model for probabilities are represented as propositions of possible worlds."*

Finally, Wojciech Zurek may have understated the situation when he said *"The distinction between what is and what is known to be, so clear in classical physics, is blurred and perhaps does not exist at all on a quantum level."* (*Complexity, Entropy, and the Vacancies of Information*, Addison-Wesley, 1989.)

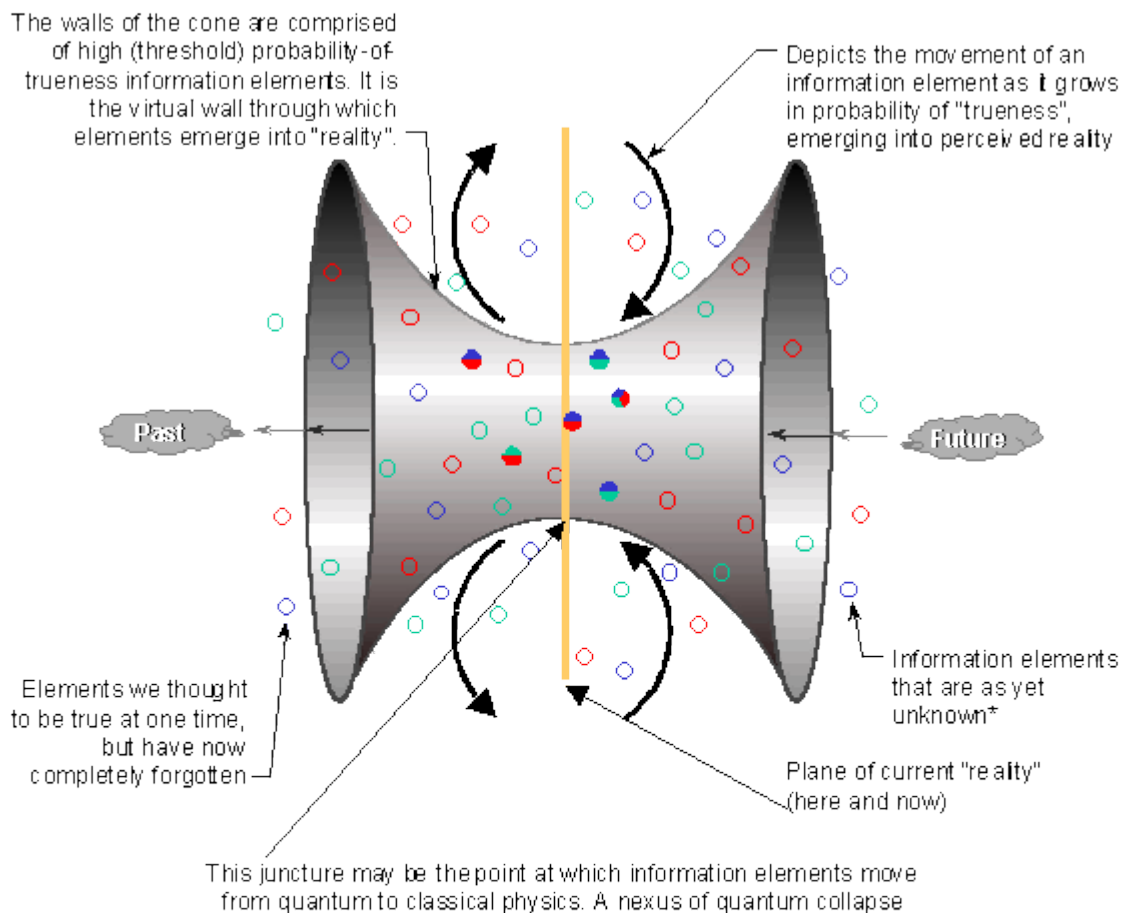
For many years, it has been assumed that the universe exists independently of human perception. Why would scientific minds now alter their perspective? The answer is based on a fundamental aspect of quantum mechanics, sheer observation affects the observed – its potentiality collapses. Therefore, if information is fundamental, exists in a duality of nature, and is affected by observation, there is strong evidence that observation itself may cause it to exist – and even if that is not correct, certainly that shared knowledge of existence affects the "probability of trueness", and the emergence of an information element into what humans recognize as "reality" – a part of our universe.

V. Expanding the New Model of Reality to Include the Concept of Time

When we view this model in its universal context, we may recognize that the "mass" created by the sharing of a set of information elements as perceived

"truth" squeezes down the population of "probably true" information to a relatively small set, and that this set is dynamic; that is, it changes from moment to moment. In fact, the set of information regarded to be true at a given point represents reality as humans know it, and the alteration of that set of information elements is what humans regard to be the "passage of time." (See Figure 6)

In this manner altering the set of "probably true" information alters the universe, and alters one's position in "time." Therefore, "time" moves forward when the population of the "true" information set is altered in a manner that causes information elements to move into the "true" probability range, and others that were previously regarded to be "true" to be pushed aside into the "no longer true" area of our model. Moving backward in "time", then, would require a reordering of information elements' probability of "trueness", such that the information most recently added to the set regarded as "information of which humans are aware" and "information regarded to be true" is eradicated (cast back into the "below the threshold" area of our model.) (See Figure 7)



Notes:

- The plane of reality is comprised of a very large number (probably $>10^{24} < \infty$) of information elements that have breached the threshold of probability-of-trueness.
- The dual cone shape contains what may be regarded as our realm of existence.

*"...only certain kinds of qualia force themselves on us as essentially the experience of a mind, and other kinds, with very different characters from those we know, might subsist outside of minds." - G.H. Rosenberg, "Rethinking Nature", from Shear's book.

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Figure 7. Formation of Our Reality: Quantum Wave Collapses, Producing "Trueness" Breakthrough in Elements of Information, and Results in the Content and Form of Our Universe

It is also interesting to note that the position of information elements within their spectrums of "probability of trueness" may be related to the position of other elements referred to as "Quantum Entanglement" (Roger Penrose, "Shadows of the Mind", 1994, Oxford Press.) This could be the underpinning mechanism responsible for the phenomenon of non-local causality.

One intriguing question presented by this model is: "Does the range of possible universes branch off at the nexus, into an infinite number of multiple universes, based on the information set changes which occur?" The model seems to suggest not, as the one universe is continually altered into new shapes with the addition and removal of "true" information elements, but it is not ruled out. If "parallel universes" exist, they would ostensibly be reflected as shown in Figure 8.

An unanswered question: Does altering information content result in altering the future universe

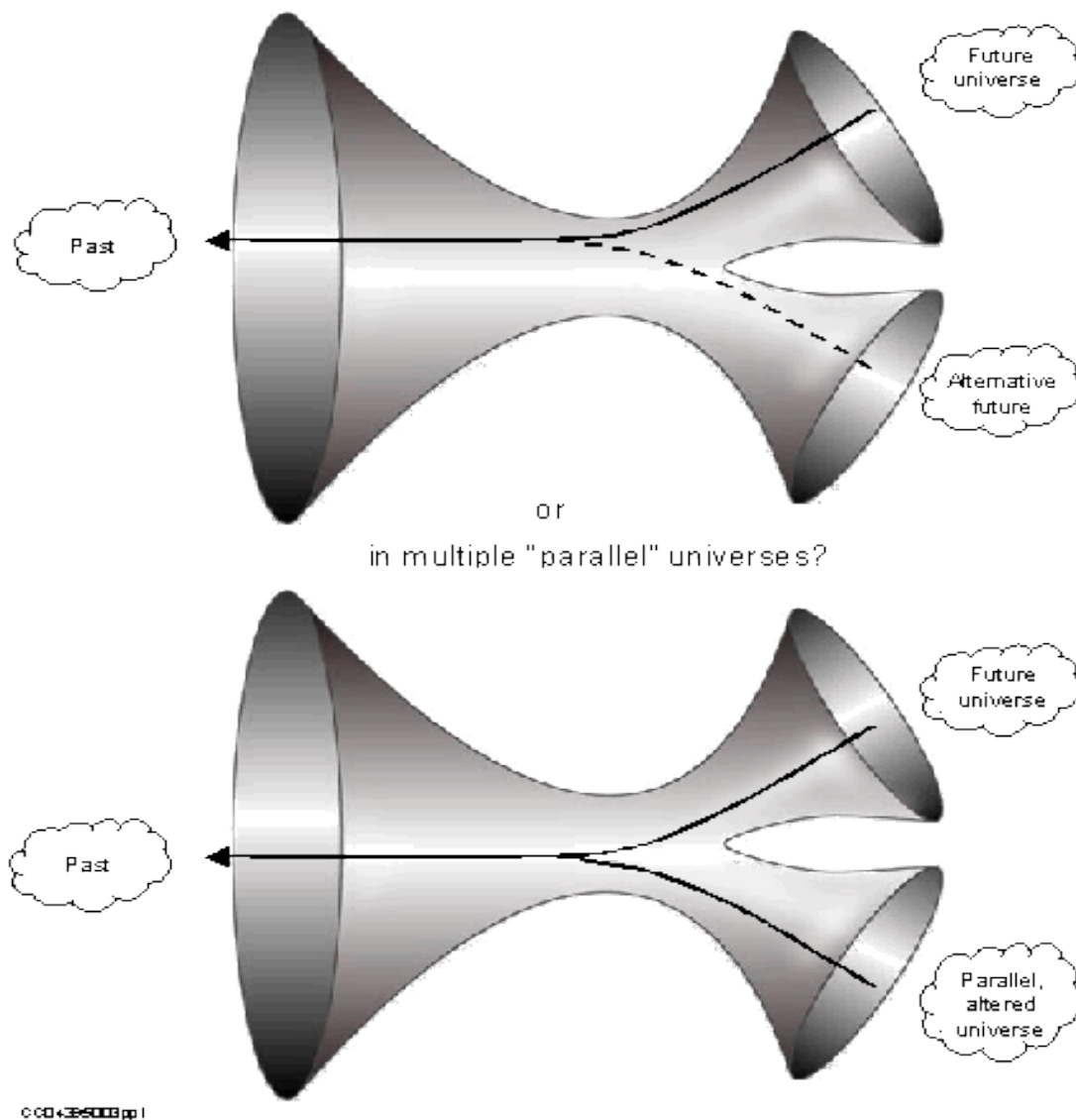


Figure 8. Parallel vs. Alternative Universes
"Alternative Views"

VI. Considering Human Consciousness In Light of This Model

Returning to the concept of quantum wave collapse (referred to in Sections III and IV above), it is useful to consider these words from "Conscious Events as Orchestrated Space-Time Selections" (S.A. Hameroff and R. Penrose, from Shear's Explaining Consciousness, The Hard Problem):

"By reaching the quantum gravity threshold, each Objective Reduction (OR) event has a fundamental bearing on space-time geometry. One could say that a

cascade of OR events charts an actual course of physical space-time geometry selections. Although gravitational forces between objects are exceedingly weak

(feebler than, for example, electrical forces by some 40 orders of magnitude), there are significant reasons for believing that gravity has a fundamental

influence on the behavior of quantum systems as they evolve from the micro to the macro levels."

"In the standard descriptions of quantum physics, randomness occurs in the events described as quantum state reductions – these being events which appear to take place when a quantum-level process gets magnified to a macroscopic scale." "In the Objective Reduction (OR) description, consciousness takes place if an organized system is able to isolate and sustain coherent super-positions until its quantum gravity threshold for space-time separation is met; it then self-reduces (non-computable). For consciousness to occur, self-reduction is essential ..."

"Thus, only very special circumstances could support consciousness:

- 1) High degree of coherence of a quantum state – a collective mass of particles in super-position for a time period long enough to reach threshold, and brief enough to be useful in thought processes.*
- 2) Ability for the OR process to be at least transiently isolated from a 'noisy' environment until the spontaneous state reduction takes place.*
- 3) Cascades of ORs to give a 'stream' of consciousness, huge numbers of OR events taking place during the course of a lifetime."*

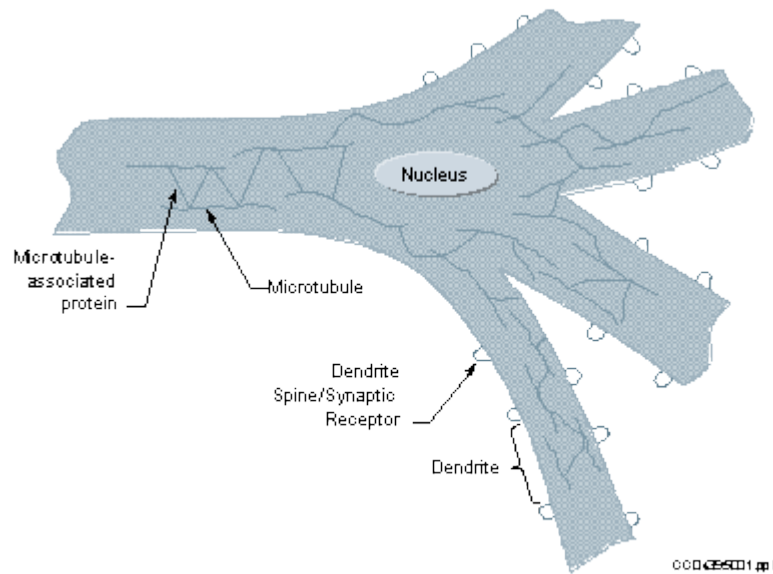
Hameroff & Penrose postulate that the ORs occur at, and therefore produce thought at, a rate of 6,480,000 per 24 hour period (1 per 0.13 msec) to (1 per 20 msec). They cite von Raspatt's 1995 work "The Buddhist Doctrine of Momentariness", and Conze's "Buddhist Thought in India" as evidence. In any case, if there is a "frequency" of these wave-like occurrences described as ORs which comprise human thought, especially given the electro-chemical nature of the brain, then we ought to be able to construct a "receiver" that monitors those occurrences and in essence reads human minds.

Taking this further, and it is important to recognize the fact that many current theorists believe that humans simply lack the mental capacity to understand human consciousness. In the Shear book, W. S. Robinson states: *"Collin McGinn suggests that there really is an explanation of how neural events give rise to conscious experiences. Unfortunately, this explanation is one that human beings are incapable of understanding. Cognitive ability comes in degrees, and the hard problem may require a degree that lies beyond our limits, just as chess lies beyond the cognitive ability of dogs."* (Colin McGinn, 1991, "The Problem of Consciousness.")

The fairly interesting question to which this then gives rise is: If such a "receiver" could be constructed to "read" the human thought frequency of .13 msec, and the person who constructed this device were able to "tune" it (like a radio receiver) to higher frequencies, would we then be able to read the thoughts of more advanced species than humans? Would slightly lower settings be able to read the thoughts of creatures such as dolphins?

Returning to Hameroff & Penrose, it is interesting to note that they propose a location for the seat of cognition in humans – the cytoskeletal microtubule:

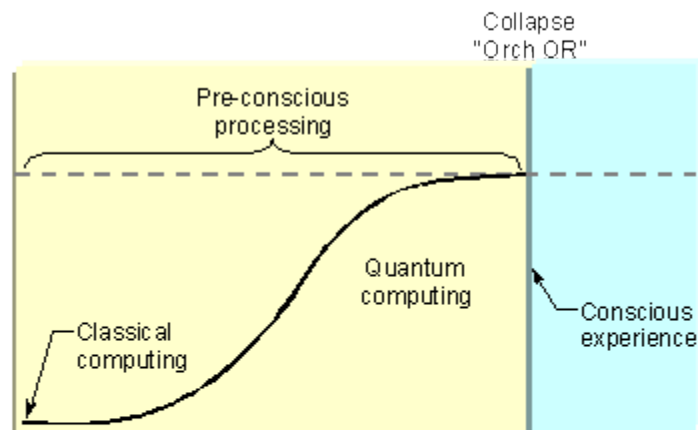
"But where in the brain, and how, could coherent superposition and OR occur? A number of sites and various types of quantum interactions have been proposed. We strongly favor microtubules as an important ingredient; however, various organelles and bio molecular structures including clathrins, myelin (glial cells), presynaptic vesicular grids, and neural membrane proteins might also participate." Hameroff and Penrose show a diagram of a single neuron – central region – within distal axon or dendrites – which is eerily like the diagram of a black hole system (See Figure 9).



**Figure 9. Schematic of the Central Region of a Neuron
(Distal Axon and Dendrites Not Shown)**
The seat of human cognition: (Hameroff and Penrose)

In addition, a diagram depicting orchestrated objective reduction ("Orch OR") by Hameroff and Penrose is consistent with the macro-level processes and associated model presented in Figures 4 through 6 of this document.

(See Figure 10)



Hameroff and Penrose's "Schematic graph of proposed quantum coherence emerging vs. time in microtubules. 500 milliseconds is time for pre-conscious processing. area under curve connects mass-energy differences with collapse time in accordance with gravitational OR."

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**Figure 10. Pre-Conscious vs. Conscious Processing:
(Refer to Figure 4)**

VII. Conclusion: From Microns and Milliseconds to Universes and

Über-propositions

The similarity of processes which appear to underpin our perceived universe is apparent from microcosm to macrocosm. If, as so many are beginning to say, information is indeed the fundamental "element" in our universe, the scope of what we know today to be "Information Systems" and/or "Information Technology" will change dramatically. Information Systems (IS) professionals could find themselves the ultimate managers of our known universe, manipulating probability-of-trueness levels of information elements to achieve desired results —perhaps in an extension of our current approach to object oriented technologies.

The pivotal concept here is how to manipulate the "probability of trueness" of any specific element of information. One factor that has been demonstrated to have an effect on the "position" of elements is sheer observation of those elements. It is conceivable that manipulating the frequency and intensity of "observation" is the variable required.

One of the intriguing possibilities that springs to mind with regard to how this might occur is the advent of the internet. It has been theorized by a number of researchers that a "global brain" is under development through the evolving

network of computers connected on the net (Peter Russel, [The Global Brain Awakens](#), McNaughton and Gunn, 1995). This global brain could certainly be viewed as a platform of unprecedented ability for widespread "observation", bringing elements of information into the awareness of a large population, and rapidly facilitating the movement of elements between "true" and "untrue" probability levels.

As work continues in the inter-related fields of quantum physics, Information Systems, and the study of human thought/consciousness, a number of incredibly profound issues will be presented to humanity. The emerging power of information management may bring with it the ability to alter the very nature of our universe.



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