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On

Quantum Mechanics

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Consciousness

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Quantum physics and consciousness are thoroughly woven into each other. According to the physicist John Wheeler, the world does not exist without our sensing it.[1] Therefore, you cannot have consciousness without quantum mechanics. The affect they have on each other is furthered when one considers that the observer affects what is being observed; we create our own realities. Quantum physics also points towards the *arche* as being an Eastern and indigenous belief in the concept of the "one," and further discoveries since the founding of quantum mechanics also point to the inextricable link between quantum mechanics and consciousness. In addition, a modified version of the Copenhagen interpretation of quantum physics combined with Bohm's undivided wholeness, with influence by Everett's many-world interpretation, along with the view that consciousness creates reality which Eugene Wigner so supported, is the view that I will argue which constitutes consciousness. I will also avoid the pitfalls of creating a language to describe this relationship, for it would be incomprehensible.

It's important to understand the framework for which quantum mechanics and consciousness work. One must also be careful of adapting a new scientific outlook to other disciplines, as has been the trend in the past. The framework of physics, and arguably philosophy as well, came from the "new" science essentially began with Isaac Newton. Newton's work *Principia Mathematica Philosophiæ Naturalis*[2] is described by Eugene Wigner as establishing the basic physics that would dominate the next 300 years. What the *Principia* did was be able to explain a wide array of phenomena with relatively simplistic principles. These simple principles govern the first laws of gravity discovered

[1] Fred Alan Wolf*, Mind and the New Physics*, p.187
[2] Ragnar Granit, Wolfhart Pannenberg, Karl Popper, Richard Rorty, John A. Wheeler, Eugene Wigner *Mind in Nature*, p.118

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by Galileo to the trajectory of distant stars. Gravity was now a widely accepted fact and Newton's discovery of its laws allow us to do everything from flying on an airplane to sending men to the moon. Space was a three dimensional plane of geometry, and time was absolute. According to Newton, "Absolute space, in its own nature, without regard to anything external, remains always similar and immovable."[3] Atoms moved around in this space, and Newton's laws of motion proved the basis of classical physics, as Newtonian physics would later be called. Philosophy was even influenced by this new physics of the quantum system. Determinism and causality were in vogue, following the mechanistic view the world now had. David Hume, coming a generation after Isaac Newton, was in the first wave of intellectuals to analyze the Newtonian revolution proper. Hume saw the world as being very *causal*, which is the logical relationship where the physical event B results from the physical event A. This is a direct reflection his Newtonian worldview. Furthermore, Hume asked the question: What do an open-ended series of events where we assume A and B, just because A preceded B in time? This question will become relevant later when the topic is explored upon further. Furthermore, the world was viewed objectively, with the individual having no power to control events, or to even play a part in the unfolding of reality. But this would eventually change. In his 1864 paper *A Dynamical Theory of the Electromagnetic Field*, James Clerk Maxwell proved the connection between light and electromagnetism. This would have profound implications for physics. The discovery basically allowed for light to be both a wave and a particle.

When scientific measurements are taken, on one day light will appear as waves; on another, it will appear as particles. This was made famous in the double split

[3] Fritjof Capra, *The Tao of Physics*, p.55

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experiment. The 18th century physicist Thomas Young is most memorable for his double slit experiment on light, demonstrating the effect of interference by the wave theory-effect.[4] In this experiment, two slits in a barrier are cut, through which the light source passes through. Then a screen is placed behind the barrier. When a light source is shined on the slits, an interference pattern results. Waves interfere with each other; particles do not, thus proving light must be some sort of wave. The great physicist Richard Feynman regards the result of the double split experiment as the most fundamental mystery in quantum physics. But light was also known to be a particle, a photon, proven by Einstein in 1905. If a solitary photon is used in the experiment, the apparent result is that the photon will interfere with itself. Interference here is the ability of two waves to add to or detract each other depending which phase the electron is in; the term interference is a misnomer however, since the *superposition principle* (to be defined later) makes sure that waves do not interfere in the classic terminology. This basically means that light exhibits wave properties and particle properties, based on probabilities of us observing light as either a photon or a wave. In the double split experiment, each photon went through both slits instead of one, and its impact on the screen depended on when it was viewed by an observer. The second screen causes the photons to pass through either one slit or the other. A tiny imprint or dark spot is found from where the photon strikes the second screen. If you close one of the slits, more particles find their way to the screen than when both slits were opened, if a stream of particles is project in that direction. If you only allow a photon at a time to be released, every single particle transmitted will avoid the final screen if both slits are open. Under the Copenhagen interpretation of quantum

[4] Amir D. Aczel, *Etranglement*, p.18

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physics, the photon passes through both slits at once, and interferes with itself to produce the interference pattern. When the particles pass through the slits, they stop being particles and instead become waves. These waves explain why there would be no imprint on the final screen, for the waves interfere with each other. But point-like dots are recorded on the final screen at other times, showing that photons must be both particles and waves. Louis de Broglie won the Nobel Prize in 1929, being credited as proving the de Broglie Principle, that electrons also exhibit wave phenomena. Not only that, but so do particles and atoms.[5] This would have profound implications in the quantum theory.

The quantum theory is credited with having its origins with Max Planck. Planck based his theory of quantized phenomena on the 1st and 2nd Law of Thermodynamics, the latter becoming known as the Law of Entropy. The Laws of Thermodynamics were worked out in the late 19th century, and it was Max Planck who concluded that randomness will always increase, as will entropy since it is a quality related to randomness. Thus entropy always increases. In 1900, Planck discovered that energy levels are quantized. The field of quantum physics was now born. Energy does not increase or decrease at a constant rate, but is instead a multiple of a *quantum*. This quantum is known mathematically as 'hv,' where 'h' is a fundamental constant known as Plank's constant, roughly 6.62621x1034- joule-seconds, and 'v' is a characteristic frequency being considered in the system.[6] Oscillating charges produce radiation, it was thought at the end of the 19th century. The formula for the energy levels was E=0, hv, 2hv, 3hv, 4hv etc. This formula proved influential in understanding the General and

[5] Amir D. Aczel, *Etranglement*, p.21
[6] Amir D. Aczel, *Etranglement*, p.34

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Special theories of relativity, and began the field of quantum mechanics. In addition, it proved why an 'ultraviolet catastrophe', where if all heated objects emitted ultraviolet light, we couldn't see and cause the destruction of the planet being predicted could not happen.

In 1925, Erwin Schrödinger generated his famous equation, which advanced quantum mechanics to a new level. At the time, it was believed that the corresponding concepts and laws surrounding the wave function of a particle when acted on by a force, and should use the laws of classical particle physics as limiting cases.[7] Following Newton's 2nd law, Schrödinger's equation described the space-time dependence of quantum mechanical systems. The equation is expressed as such;

$$H(t)\,|\psi(t)\rangle = i\hbar\frac{\partial}{\partial t}\;|\psi(t)\rangle$$ [8]

where H(t) is the Hamiltonian description (a system linking classical and quantum mechanics devised in the early 19th century) of the total energy in a system, **ψ(*t*) is the time dependent wave function, *i* is the imaginary unit, $\hbar$ is Dirac's constant, and $\partial/\partial t$ is the partial derivation with respect to *t*. A time-independent Schrödinger equation soon followed,[9] but the true implication of Schrödinger's equation was that it gave birth (along with Heisenberg's work with matrix mechanics and Dirac's contribution of the Superposition Principle) to quantum mechanics.[10] If not for Schrödinger's equation, quantum mechanics would be a much duller, uninteresting**

[7] Wolfgang Pauli, *General Principles of Quantum Mechanics*, p.23
[8] Bernard d'Espagnat, *Conceptual Foundations of Quantum Mechanics*, p.5
[9] Bernard d'Espagnat, *Veiled Reality: An Analysis of Present-Day Quantum Mechanical Concepts*, p.36
[10] Willis E. Lamb, Jr. *The Interpretation of Quantum Mechanics*, p.61

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theory. Schrödinger is also remembered for his famous Schrödinger's Cat Paradox, which he formulated in 1935 as a response to Albert Einstein's attack on the then generally accepted Copenhagen interpretation of quantum mechanics.

The paradox relates quantum mechanics and consciousness. One must be careful however when adapting a new scientific breakthrough into a subject such as consciousness; that happened in the 17th century, which left a meaningless, incomplete world that was firmly deterministic to many. With that noted, let us move on to explain the paradox. **Imagine a cat in a box. In this box there is a radioactive source, as well as a Geiger counter that detects and records the presence of radioactive particles. Also in this box is a glass bottle filled with deadly hydrogen cyanide, and a hammer held by a string above the bottle which will be cut by a knife if and only if the counter clicks.[11] A healthy cat is placed inside the box, and his fate will depend on the outcome of the experiment. The Geiger counter is switched on just long enough for there to be an even chance of a click in the Geiger counter. If the Geiger counter detects a decay of a radioactive particle, the thread is cut, the hammer breaks the bottle, and the hydrogen cyanide kills the cat. If the Geiger counter doesn't detect the decay of a radioactive particle, the cat lives. We only know if the cat is dead or alive if we look inside the box. Classical physics would state that the cat is either alive or dead, but quantum mechanics also applies to macro-systems (that are, those visible with the naked eye.)[12] This is important in understanding if the cat lives or dies. Genetic influence and social pressures leads one to conclude that the cat must**

[11] Willis E. Lamb, Jr. *The Interpretation of Quantum Mechanics*, p.67
[12] Danah Zohar, *The Quantum Self*, p.84

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be either alive or dead with an equal chance of both events occurring. However, John S. Bell's solution to the Schrödinger Cat Paradox, backed up in 1981 with experiments conducted by Alain Aspect, proved that the cat is both alive and dead simultaneously. On the quantum scale, probabilities dominate and indeterminism reigns.

The Schrödinger Cat Paradox can be modified, replacing the radioactive particle with a photo-cell and the Geiger counter with a photo-cell detector. A half-silvered mirror is set up on the outside of the cat's box. The mirror's reflection splits the photon wave function into two parts, one which is reflected away and one that is transmitted through the mirror. If the photo-cell detects a photon, then the photon wave function was reflected. If this were to happen, the hydrogen cyanide would be triggered, killing the cat. If the photo-cell doesn't register a hit by any photons, the photon was transmitted through the half-silvered mirror behind, saving the cat's life. Since the mirror is half-silvered, there is an even chance of the cat living or dying. Since the cat in the box is treated as a single quantum system, in accordance with the laws of quantum mechanics, then *linear superposition* between alternatives must be kept right up to the scale of the cat.[13] Both alternatives that the photo-cell registers or does not, must be present in the state, equally weighted as part of a quantum linear superposition. According to the observer outside the box, the cat is alive and dead, just as electrons are both particles and waves. It is only when the wave function collapses, and all the possibilities it describes merge into one fixed

[13] Roger Penrose, *The Emperor's New Mind*, p.293

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reality do we have either a live or dead cat. When the cage of the box is opened, a wave function collapses, killing the cat. A wave function describes the possible states of the quantum system into complex numbers. The mere act of observing the cat is what killed it. Measurements themselves impact quantum systems, in that if a camera was placed inside the box with the cat, a measurement would be taking place, collapsing the wave function. According to John Archibald Wheeler and Eugene Wigner, human consciousness is the link between the quantum world of electrons and everyday reality.[14] The mere observing of nature changes it; in affect, we create our own realities. This idea carries over well into the field of psychology. For example if one has a depressed outlook on life, they will find nothing but depression in their lives. On the contrary, if one has a positive attitude on life, positive things will happen to them. The physicist Wolfgang Pauli would probably agree with me. To Pauli, the collapse of the wave function may occur outside the consciousness of the observer, a possible explanation for what gives meaningful coincidences, i.e. *synchronicities*, their meaning. According to Nobel laureate Ilya Prigogine, "Whatever we call reality, it is revealed to us only through an active construction in which we participate."[15] Important to note however, that the observer does not "create" reality; instead, the observer evokes one of the many possible realities within that certain wave function. Roger Penrose has a further theory which holds relevance; that conscious decision making results from manifestations in the brain of the outcome of particular quantum wave function or

[14] Danah Zohar, *The Quantum Self*, p.43
[15] Ilya Pripogine and Isabelle Stengers, *Order Out of Chaos*, p.293

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group of functions, i.e. "jumps."[16] In Bohm's *holomovement*, scientific laws merely describe how the divine operates; the divine did not create nothing at the beginning of time, but continually brings each moment into existence.[17]

Werner Karl Heisenberg introduced one of the greatest scientific ideas of the past 400 years. Heisenberg's response to Schrödinger's theory of quantum mechanics was based on matrices, a more conceptually difficult view. His Uncertainty Principle was discovered in 1926, published in 1927. Although in science the simpler of two otherwise equal scientific theories is generally true, in accordance with the Occam's razor principle, sometimes a more complex outtake is necessary to explain certain phenomena. Heisenberg's Uncertainty Principle is expressed mathematically as follows,

$$\Delta E \Delta t \geq \frac{h}{4p}$$

Where (h-bar, Dirac's Constant) is Planck's constant divided by 2π, ΔE stands for the uncertainty in Energy, Δt stands for the uncertainty in space-time, h is Planck's Constant, and p is position; these are the measurements of the position and momentum. A simpler writing of the finished formula would be,

$$\Delta p \Delta x \geq \frac{h}{4\pi}$$

where each character represents the same concept in each equation. A certain thought process can be made detailing the effects of the Uncertainty Principle in an easier way to understand, and may reflect quantum mechanic's influence on consciousness. A person is

[16]B.H. Blott , C.J.S. Clarke, C.M.H. Nunn, *Collapse of a Quantum Field May Affect Brain Function*, p.127
[17] Kevin J. Sharpe*, David Bohm's World*, p.96

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affected by unpredictable and uncontrollable changes which he thereafter perceives as thoughts, only after a person attempts to observe what he was just thinking about while pondering a certain subject. A good comparison would match together (I) the instantaneous state of a thought with the position of a particle and (II) the change of general direction in that thought with the particle's momentum.[18] Peoples' thought processes changes every event remembered in the past in some way, which causes the thought processing ability to commence unpredictable and uncontrollable changes in other equally significant respects. The analogy continues in that the significance of an individual thought process seems to be indivisible in a certain way. If a person tries to apply more precisely defined elements to his thinking, the person will eventually reach the point where further analysis becomes meaningless. Incomplete connections exist with other elements of the thought process, which are indivisible and incompletely controllable. Many of the characteristics of a quantum system depend on indivisible quantum connections. In addition, these indivisible connections are incompletely controllable with surrounding objects.[19] Therefore, quantum mechanical processes and thought processes are analogous in that their 'soul' or 'intrinsic nature' of each element is a property that comes into being partially from its relationship with other elements. Humans can neglect their integral and incompletely controllable connection with other ideas. When a photon hits an electron, the electron's momentum is changed. In order for us to register this, a photon of light must bounce back, thus altering the electron's momentum to some indeterminate path. By merely observing, we change what is being

[18] David Bohm, *Quantum Theory*, p.169
[19] David Bohm, *Quantum Theory*, p. 169

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observed; we create or actualize a probability.

Paul Dirac was one of the great modern physicists. He developed the *bra-ket* notation to describe quantum states. A simple example of this is

$$w|A> + w|B>$$ [20]

where $|A>$ is a state in which an electron has a position A (the bra) and $|B>$ where the electron is at position B (the ket), and *w* and *z* are the relative probabilities of the electron being at either point A or B. This equation describes other possible states for which the electron to exist. It is also the linear superposition of the two states $|A>$ and $|B>$.

Superposition is important to understanding quantum mechanics and consciousness. The exact definition of the superposition principle "says that a new state of a system may be composed from two or more states, in such a way that the new state shares some of the properties of each of the combined states."[21] Since $|A>$ and $|B>$ each describe two different properties that a particle possesses, then the superposition of states is written

$$w|A> + w|B>$$

yet again; the completed formula above shares something in common both with state $|A>$ and $|B>$.

Consciousness may arise from alternating phases of quantum mechanical superposition and a classical model, which communicates with the non-conscious

[20] Roger Penrose, *Shadows of the Mind*, p.258
[21] Amir Aczel, *Entanglement*, p.25

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portions of the brain. Paul Dirac also formalized a system for which we can understand the spin of an electron featuring non-locality.[22] The proven idea of non-locality would have profound implications, discussed later.

According to d'Espagnat, this bra-ket system "describes the possible states of a system, not by wave functions but by abstract entities called state vectors, whose defining property is just that they obey the superposition principle."[23] The superposition principle basically states that when waves meet, their amplitudes add.[24] When waves come together, no energy is added or taken away. For example, take a sunny window. Light passes through the window in many different directions. Since the light beams act in a "reasonable" way, the scene outside the window never blurs no matter the brightness of the light. The superposition principle keeps the window clear. To an extent, quantum theory regards the world as made of waves rather than out of physical objects; however it's important to note that a quantum wave possesses no energy.[25] The quantum wave possesses no energy because one can only predict probabilities on the quantum scale. In a traditional wave, doubling the wave's amplitude will quadruple its energy content. Taken in a quantum mechanical frame of reference, four energy units will show up at an interference site; two energy units have spontaneously appeared. If two units of energy go into the interference site, according to Penrose, then zero units come out and two units seemingly disappear. But what happens to these units, appearing or disappearing into thin air? The answer depends on your interpretation of the quantum system, which will be

[22] Bernard d'Espagnat, *Veiled Reality*, p.40
[23]Bernard d'Espagnat, *Veiled Reality*, p.40
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[25] Nick Herbert, *Quantum Reality*, p.73-75

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discussed more thoroughly later in this short essay. A scientific study was conducted to test the collapse of a quantum field (a quantum jump) and its importance to functioning in the brain.[26] It is unsure exactly what consciousness does, but awareness lags behind events in the objective present by .4 seconds. The affects on consciousness must be mediated through facilitation of possible actions. What is an actual reality really being presented through observation? The lagging of the human mind and the reality question hinder a performance of such an experiment to test the idea. However, from Penrose's conclusion of various studies along with conducting experiments of his own, has introduced an interesting spin on an answer. From his data, it can be concluded that awareness may be associated with the collapse of a quantum wave field.[27] Likewise, the collapse of the wave function, along with the influence of gravity, may be associated with what we perceive as 'insight.'[28]

The Einstein, Podolsky, and Rosen Paradox (*EPR* Paradox) was formulated in 1935. It was a thought experiment developed by Einstein, as an attempt to show that quantum mechanics results in a contradiction. What the paradox showed is "that events happening elsewhere could have meaningful acausal consequences for events happening here and now."[29] Einstein, Podolsky, and Rosen would conclude quantum mechanics as being incomplete, because it gives the physical attributes of position and momentum to an object but cannot predict the behavior of the object.[30] Using a double-slitted screen and an electron beam, it is projected by quantum mechanics that both *sufficient* and *necessary*

[26] B.H. Blott , C.J.S. Clarke, C.M.H. Nunn, *Collapse of a Quantum Field May Affect Brain Function*, p.127
[27] B.H. Blott , C.J.S. Clarke, C.M.H. Nunn, *Collapse of a Quantum Field May Affect Brain Function*, p.131
[28] B.H. Blott , C.J.S. Clarke, C.M.H. Nunn, *Collapse of a Quantum Field May Affect Brain Function*, p.131
[29] Fred Alan Wolf, *The Dreaming Universe*, p.58
[30] Fred Alan Wolf, *Taking the Quantum Leap*, p.158

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quantities were real and capable of being measured simultaneously. In addition, according to quantum mechanics, only the position or momentum of one particle in any pair of particles is physically real. The EPR paradox stated that this could not be. Thus, it is possible to know something about the particles as a pair, but not individually. Fred Alan Wolf likens it to knowing a married couple very well but knowing nothing about them individually. Essentially, the EPR proved one of two possibilities-either that nonlocality exists, or that there are certain *hidden variables* responsible for the observed phenomena. As Bell showed, nonlocality is the correct answer.

David Bohm was deeply inspired by the EPR paradox. This led him to associate quantum mechanics and consciousness as keenly inspiring and being the foundations for Eastern religion.[31] Bohm saw reality as an undivided wholeness, which he further expounds in his excellent work *Wholeness and the Implicate Order*. Bohm gained his reputation from interpreting the EPR paradox. Bohm did this by changing the paradoxical thought experiment and made it simpler; in science, the simpler solution is usually the correct one. Bohm changed the experiment so that there would be one variable of interest and not two among the two particles. Like the original EPR paradox, both particles' spin measurements are separated among space and time without direct influence on each other. Sometimes two particles become entangled. When this occurs, two or more objects being are being referenced by each other, even though they are spatially distanced. In a singlet state of entanglement, the total spin of the two particles must be zero, and their spins correspond with each other in an inexorably manner.[32] If one particle spins

[31] Kevin J. Sharpe, *David Bohm's World*, pp.60-63
[32] Amir D. Aczel, *Entanglement*, p.124

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horizontally, the other will respond vertically, even though we as observers measure or actualize the direction of spin. If Alice and Bob randomly measure one particles spin, then the other's measurement would be exactly opposite. Now when two entangled particles are emitted, and the spin of particle A is measured and found to be up, B must be down. This is also true if particles A and B are at a distance from each other in any direction. This last part was Bohm's major contribution to the EPR paradox, which would be resolved once and for all by John S. Bell in 1964. Although most scientists believed Bell provided strong evidence in favor of non-locality, in 1981 his student and partner Alain Aspect would prove once in for all that the non-locality interpretation was true, instead of Einstein's hidden variables theory. The non-locality determines why the spin of particle A and B instantly are negatively correlated with each other, across any distance of space. Bohm would also be famous for his discovering with Yakir Aharonov yet more proof for non-locality. What resulted became known as the Aharonov-Bohm effect, published in 1959. When an electron is outside a cylinder containing an electromagnetic field completely contained within, the electron will still be affected by the electromagnetic force. This can only occur through non-locality of the electrons.

Around this same time, Bohm attempted an experiment to determine that the force of entropy or disorder "could be understood in terms of the forces we believed were controllable."[33] This means that human beings inability to control both the electron's location and momentum prevents an electron from escaping from an atom; this is due to an invisible influence of human capacity rooted in its lack of being able to change the future. Attempting to analyze continuously, flowing ideas into separate parts changes

[33] Fred Alan Wolf, *Mind and the New Physics*, p.109

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their meaning. However, concepts including classification, or archetypes, can be present at times in which we can ignore, or tune-out, the indivisible and incompletely controllable connection with other ideas. A rather poor comparison can be made between these archetypes, as well as with ideas being connected to Plato's *forms*. It is important to note that in the modern view of the term 'forms', i.e. a perfect, ideal image unobtainable to human thought, doesn't necessarily have to be a feature of the quantum system. Without the evolution of logic in human beings a few thousand years ago, we would have no way to communicate effectively our thoughts and to check their validity. Therefore, life as we know it could not exist without the world of quantum mechanics. But humans are also emotional beings, with the emotional half of the brain at times dominates and often over-rides logical thinking. Humans can be described as being dominated largely by emotion, but logic is ever present. People sometimes find a new idea comes to them after a long and fruitless search, seemingly spontaneously. Perhaps during momentarily lapses of consciousness, those where one enters a trance, suffers from a deadly fever, starves oneself, strives through meditation, or in some other way experiences visions, can cause the mind to enter a higher state of awareness with the underlying existence of the universe. This could explain the feeling of 'oneness' that individuals who engage in these techniques of ecstasy often experience. Perhaps these people are merely observing the world from a different relativistic position, as explained by Einstein's General Theory of Relativity.

If one were to restrict themselves to purely logical thinking, then the creation of new ideas creates a strong analogy to a quantum jump. In the words of David Bohm, "In

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a similar way, the actual concept of a quantum jump seems necessary in our procedure of describing a quantum system that is actually an indivisible whole in terms of words and concepts implying that it can be analyzed into distinct parts."[34] Furthermore, the generation of a new idea is akin to the concept of a quantum jump; the indivisible, nonlogical, intermediate step is from attaining a new idea

Bohm noticed a similarity between the quantum processes and the holism, *contextualism*, of our thinking processes. Unbroken wholeness is essential for the existence of the quantum world. According to Bohm, "One is led to a new notion of unbroken wholeness which denies the classical analyzability of the world into separately and independently existing parts…The inseparable quantum interconnectedness of the whole universe is the fundamental reality."[35] Bohm also coined the term *holomovement* on his view of what reality is. As part of this holomovement, Bohm includes an *implicate* and *explicate* order. The implicate order is carried by the holomovement, which is undivided wholeness.[36] This view evolves to allow *soul* to become the fundamental, universal element, discussed later. As humans, we are limited in that taking a brief 'snapshot' of any particular train of thought would render the 'snapshot' senseless. Thus we cannot easily separate a single element of our thought and still have it make sense. In order for thoughts and sentences to make sense, they must be part of a larger whole to give it context and meaning. If one takes the sentence, "It's all in your head" and breaks it down into individual words, they cease to make sense without the whole sentence. In addition, Bohm recognized many similarities between Heisenberg's Uncertainty Principle

[34] David Bohm, *Quantum Theory*, p.170
[35] Nick Herbert, *Quantum Reality*, p.18
[36] David Bohm, Wholeness and the Implicate Order, p.151

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and some uncertainty relations in our field of consciousness.[37] A parallel can be drawn between the uncertainty of knowing both a particle's position *and* momentum, where knowing one increases the uncertainty of knowing the other, with our consciousness having to choose between a peripheral thought or focusing on just one specific thought. As with the uncertainty principle, we cannot know or do both simultaneously. In addition, thought processes appear to have indivisibility of a sort.[38] Eventually if one focuses on a subject of thought, one would reach a limit as to where further analysis cannot be given a meaning. Part of each thought process originates in its indivisible and incompletely controllable connections with other elements. Additionally, some characteristics of the quantum system depend on indivisible and incompletely controllable quantum connections with surrounding objects. So consciousness and the quantum system are analogous in that the intrinsic nature of each thought process or quantum system cannot be derived further to an "intrinsic" nature of each element. Consciousness is comprised of a wide array of phenomena, including free will, subjectivity, creativity, imagination, the sense of self with the environment, and sapience (i.e., judgment). A Newtonian worldview, which became so accepted in everything from philosophy and its reductionism to astronomy quickly adapted to a static, deterministic epistemology. If determinism holds true, then what of the problem of free will? From a Newtonian viewpoint, free will cannot exist. What we perceive as free will is either a physiological process occurring, or a spiritual, ethræl substance such as the soul communicating with the physical body. Although quantum mechanics is in its roots deterministic, the

[37] Stuart R Hameroff, Alfred W. Kaszniak, Alwyn C. Scott, *Toward a Science of Consciousness: The First Tucson Discussions and Debates*, p.442
[38] David Bohm, *Quantum Theory*, p.169

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processes involved in devising the quantum system are strictly indeterminate, as proven by Schrödinger's equation and Heisenberg's Uncertainty Principle. The need to understand new concepts is also necessary to understanding the indeterminism of the quantum system. The concept of continuous motion, without interruption, should be replaced by causality as a statistical trend, complete determinism should be replaced by causality as a statistical trend, and the replacement of the idea that the universe can be divided, e.g. wave or particle, by the idea that the universe is an indivisible whole.[39] Therefore, in order for free will to exist, I argue that quantum systems, at both the quantum and macro scales, are necessary in order for us to not only have free will, but consciousness in general.

How are people to take in sensory data into the mind and comprehend phenomena that have meaning and value? How is it we find meaning in our lives, in a way that we all see the same aspect of reality? The answer must be that our consciousness alters the world by altering us.[40] Ultimately, we determine our own future. Nobel laureate Eugene Wigner proposed this solution that involves people simultaneously creating the past and future; Wigner's Friend Paradox would prove this. It also led to the idea that the observer is the one who collapses the quantum wave function, actuating a potentiality. Professor Wigner's friend is conducting an experiment, and places a particle in a box and closes it. According to quantum mechanics, the particle has an uncertain position as well as momentum, and also forms a standing wave pattern inside the box.[41] Wigner's friend then commences to open two sides of the box at once. When the two opposing sides are

[39] David Bohm, *Quantum Theory*, p.144
[40] Fred Alan Wolf, *Taking the Quantum Leap*, p.214
[41] Fred Alan Wolf, *Taking the Quantum Leap*, p.216

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removed, the standing wave patters splits into two polar opposite wave pulses. Then the pulses will pass through each opened wall, and the friend will see and record the particle on the right in his observations. Then, Professor Wigner appears. Wigner explains to his friend that he just conducted an experiment involving a particle and the friend. In accordance with quantum laws, the friend's observation of the particle was split into two "forms." In form A the friend observes the particle on the right side of the box, in form B on the left. Wigner's observation of his friend and the particle "actualized" the friend while observing the particle when Wigner opened his bigger box (the room). The friend and the particle thus exist because of Wigner's observation. To resolve this paradox, one must understand that our consciousness is affected by physicochemical conditions; that is, by the micro/macroscopic, atomic, and particulate phenomena in chemical systems. Wigner supposedly viewed inside the room what was already there. Hence, the physicist Hugh Everett invented a theory that the universe is composed of an infinite number of parallel universes. All possible versions or potentialities of reality must therefore exist. The quantum wave function can thus represent archetypes in the underlying order of nature. These wave functions only represent reality however; although it may be possible to view these other universes in a trance or other change of consciousness, the wave functions occur in the "real" world. Therefore, it is human consciousness that is the missing link between the quantum world and everyday reality.[42]

Creativity for example, cannot exist in a Newtonian worldview. Humans are constantly coming up with new ideas, learning, and changing. We are constantly in a state of flux, as Heraclitus so proclaimed in the 5th century B.C.E. The idea of constant change

[42] Danah Zohar, *The Quantum Self*, p.43

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cannot be refuted by scientists.[43] But how do our 10^{11} different neurons communicate with each other, each part contributing a portion to the whole? This is known as the "binding problem," which Descartes attempted to solve with his mind-body dualism. Quantum mechanics has the answer, since our neurons are fundamentally made up of smaller and smaller parts, possibly culminating in tiny open or closed-ended strings, the quantum system must inherently play a role in our consciousness. Quantum entities also can overlap and become entangled, since like light, quantum entities are both waves and particles, depending on when, who, or what day the observations are being carried out. The wave aspect reaches almost to infinity across space-time, whereas the particle aspect is more localized.[44] When the wave aspects of two similar quantum systems become entangled, they begin to share a commonality, an identity. Their individual properties merge into one, they can occupy the same location in space-time, yet this merging into one can be described by just one equation, which is;

$$\rho = \sum_i p_i \rho_i^A \otimes \rho_i^B$$

where ρ_i^A and ρ_i^B are pure ensembles; ensembles being the idea that quantum mechanics describes not individual physical systems but groups, or ensembles, of such systems.[45] It is in this entangled state, where identity is shared, which is relevant to the 'oneness' or unitary properties of consciousness. Order is also essential to our consciousness. Without order, our thoughts and images would be an incoherent mess. This is why the Bose-

[43] Bertrand Russell, *The History of Western Philosophy*, p.47
[44] Stuart R Hameroff, Alfred W. Kaszniak, Alwyn C. Scott, *Toward a Science of Consciousness: The First Tucson Discussions and Debates*, p.443
[45] Bernard d'Espagnat, *Veiled Reality*, p.297

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Einstein condensate must be the basis of consciousness. Bose-Einstein condensates are the most coherent structures known about in the universe; examples include superconductors, laser beams, and neutron stars. In addition, many different bits of the Bose-Einstein condensate can share an identity by achieving the same state. Laser beams are a perfect example; the photons inside are so entangled, they act as merely one. Laser beams will play a role in the holographic nature of reality.

One of Bohm's greatest ideas was his introduction of the holographic view of the universe. This idea has been furthered by such physicists as Fred Alan Wolf. Furthermore, Bohm's interpretation of quantum physics features many uncanny parallels to eastern religion, especially the *Tao* and *I Ching.* First, the holographic nature of reality must be described. Holograms are quantum structures, comprised of laser beams. A hologram can be seen as a series of pictures inherently carried by the laser beam. Each picture contains the entire full image within. The holographic view of the mind, described in more detail later on, features a high level of unity. In a hologram, the whole image is represented in each part. This fact appears to reflect consciousness in that every part of our conscious life we seem to contain a unified togetherness with our whole perceptual field.[46] David Bohm used the holographic nature of reality as being the *holomovement*, which he uses to explain nonlocality.[47] Bohm came up with a theory in that the explicate order (of which we don't perceive) and the implicate order (which we do perceive) affect each other. The explicate world can be seen as the realm of God, and the implicate order is the world of humans. Together, their unbroken wholeness is the basis for Bohm's

[46] Stuart R. Hameroff, Alfred W. Kaszniak, Alwyn C. Scott (Eds.) *Toward a Science of Consciousness: The First Tucson Discussions and Debates,* p.441
[47] Kevin J. Sharpe, *David Bohm's World*, p.95

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quantum theory.[48] Interesting to note, in early Buddhist schools, consciousness was thought to be contained in spirit; all the universe was thought to be a dream.[49]

The similarity of consciousness to a dream is also seen through the holographic notion of the universe. The dream parallel can be seen not only in quantum mechanics, but in Eastern religions as well.[50] According to Yü Fa-k'ai (fl. 364) of the early Buddhist tradition, mind is the basis of a great dream, where the Three Worlds of desire, matter, and pure spirit form an adobe of worldly existence. All that we perceive as reality happens in this great dream. When we wake up from sleeping, the consciousness that produces illusions is extinguished and the Three Worlds appear empty. When we are awake, nothing is produced from the mind and nothing is not produced from it. The idea that spirit constitutes all of matter and not physical objects was thoroughly adopted in Buddhist theology. To them, nothing is fixed and permanent; everything is in a state of change, of flux. We only see brief snapshots of reality as it passes us by.

This idea is fitting in the holographic model of reality. A hologram is constructed due to its photons becoming entangled with each other, creating a pattern of dark and light places on a photo-sensitive, film covered plate. This creates the 3-D image that we see as a hologram. Each tiny fragment of the hologram contains an entire image of the finished hologram, so the hologram is not merely a sum of all its parts. In each of our brains is about a trillion glial cells. Glial cells form the protection around neurons, and is the cement holding the nervous system together. Ionic wave movement, which is similar in form and structure to quantum waves, occurs in glial cells, making it the *æther*

[48] Kevin J. Sharpe, *David Bohm's World*, p.49
[49] Wing-Tsit Chan, *A Source Book in Chinese Philosophy*, p.341
[50] Wing-Tsit Chan, *A Source Book in Chinese Philosophy*, p.341

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which holographic imagery arises from.[51] These glial cells are capable of storing holographic memory, if one were to base the glial cells action on a quantum mechanical model. The ability to access this holographic memory is the key to self-awareness. Furthermore, a hierarchy is seen based on levels of self-inquiry. A jump from one hierarchy to the next occurs much like the electron's jump from orbit to orbit. The lowest level in this hierarchy contains superpositions of images, and consists of nonself-reflective images. At the first level, images of the glial cell are superimposed, resulting in "emotional" memory. At the second level, archetypes are integrated. At the fourth level, these archetypes are integrated to form super-archetypes. This process of gradually ascending levels is without end. When one is unconscious of having a dream, processing at the lower levels occurs, resulting in no sense of self. When one is active in a level one dream, the dreamer becomes involved in the dream. This reflects the fact that emotions now play a role in the dream. At level two, the dreamer has thoughts during the dream. Unconscious thinking, feeling, and observing take place. At the third level, one becomes aware of previous levels of participation during the dream. It is in this third level where one encounters archetypal imagery. Important to note that once one level is obtained, all levels below it are obtained as well. Thus the process builds on itself. At the highest level, "pure" awareness with no images occurs. This state can be achieved through meditation, or other changes of consciousness.

A few years later in 1964, John S. Bell solved the 'hidden variables' which revolutionized and solved the argument on the EPR paradox. Bell's theorem, according

[51] S.R. Hameroff, A.W. Kaszniak, A.C. Scott, *Toward A Science oof Consciousness: The First Tucson Discussions and Debates,* p.451

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to Alain Aspect, would "complete quantum mechanics." It brought forth the idea of hidden variables, and if given two particles in their initial preparation while in an entangled state, that carries along by each particle after their separation.[52] These hidden variables cannot imitate the quantum mechanical predictions for all possible settings carried out by the measuring device, even if it can imitate some of quantum correlations that are predicted. Therefore, in general it is not possible to understand EPR-type correlations by 'complementing' the quantum theory proposed along the lines of Einstein.[53] The exact equation for Bell's theorem is as follows;

$$C(\alpha, \phi) - C(\beta, \phi) \left| - C(\alpha, \beta) \right| \leq 1$$

where C symbolizes correlation.

This theory is profound in that it proved that a hidden variable theory, argued by Einstein to explain nonlocality, could not reproduce all the statistical predictions in quantum mechanics.[54] A hidden variable theory is technically possible in mathematics, but Bell proved that the consequences of one would result in observations that contradict quantum mechanics. Thus hidden variables, at least positioned locally, would result in entirely unreasonable consequences. Furthermore, there has never been any phenomena observed that deviates from those predicted in quantum mechanics. Einstein, despite having spent

[52] J.S. Bell, *Speakable and Unspeakable in Quantum Mechanics (2nd Edition),* p.xxiii
[53] J.S. Bell, *Speakable and Unspeakable in Quantum Mechanics (2nd Edition)*, p.xxiii
[54] Fred Alan Wolf, *Taking the Quantum Leap*, p.202

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much of his life trying to prove why there are hidden variables, should be praised for discovering the physical basis of consciousness.

The physical basis of consciousness is the Bose-Einstein Condensate.[55] For this to be true, the experiments of Fritz Popp are crucial. He discovered that living cells emit a weak "glow"; that is, photon radiation, which he believes plays a role in cell regulation. The electrical firing of billions of neurons whenever the brain is stimulated may cause the necessary energy to cause molecules in the neuron cell walls to emit photons. When the emitted photons emit at a critical frequency and are synchronized in their firing, a Bose-Einstein condensed phase results. In the case of consciousness, these synchronized firings would possess one identity. Quantum mechanical properties, such as uniformity, frictionless, and unbroken wholeness results. At the point where the phase shift transforms into the condensed phase, what human's perceive as "an experience" arises. Instead of Descartes' dualism or monism (that mind and matter are made of the same substance), a third double-aspect approach is possible. This maintains that there is an underling common substance or common reality which mental and physical properties arise, and that physical and mental differences are expressions of this underlying "oneness" or commonality.[56] There is an inherent link between the physical brain and consciousness. The use of drugs or alcohol causes damage to the higher forebrain, causing activation of the more primitive, reptilian brain, which results in more spontaneous and less rational thinking and behavior. Furthermore, certain kinds of damage to the forebrain can bring about a permanent change in one's consciousness. If

[55] Danah Zohar, *The Quantum Self*, p.85
[56] Stuart R. Hameroff, Alfred W. Kaszniak, Alwyn C. Scott, *Toward a Science of Consciousness: The First Tucson Discussions and Debates*, p.440

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one were to have the synaptic gaps linking the right and left hemispheres of the brain cut, the brain would adapt two distinct paths in controlling behavior. The brain would in effect develop two distinct "personalities." Further proof of the mind-body connection is no longer needed, as most scientists today believe not in the duality of the soul, but in monism. However, monism in itself is not enough to account for the changes that quantum mechanics has on consciousness, as already noted. Losing higher brain, forebrain functions does not result in an end of consciousness. Obviously there are people with brain damage that are still conscious, so consciousness must lie somewhere beneath our forebrain, and may extend to all living creatures, and perhaps even particles. So where does the sense of "self" or "I" come from? To help answer this question, consider a banana. When one sees a banana, the brain does not "see a banana" but instead sees shape, the color yellow, and the form. Each characteristic is placed somewhere in the brain, scattered around in different places. Only when a "whole" picture is transmitted through the brain do we register the shape to be a banana. It is with this analogy that we can see the argument that consciousness arises from a Bose-Einstein condensate more clearly. Each perceived quality of the banana is stored in the brain, and when neurons activate to establish the "whole image" do we have a perfectly coherent structure, i.e. the Bose-Einstein condensate. Without this coherent structure, without a sense of wholeness, one would not be able to identify a song, a person, or anything recognizable. There could be no experience without this wholeness.[57]

[57] Danah Zohar, *The Quantum Self*, p.69

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Danah Zohar in the article *Consciousness and Bose-Einstein Condensates* suggests that quantum mechanics is holistic.[58] The quantum world is constantly entangled with each other, each part overlapping with every other. Here, non-locality plays a crucial role. In order for the quantum world to be constantly entangled, non-locality must exist. Fortunately, non-locality has been proven. The first experiment to prove a Bose-Einstein condensate occurred at just 170 nanokelvin, barely over absolute zero; there must be an explanation for how a Bose-Einstein condensate is formed in the brain. Herbert Fröhlich proved it possible in 1986. Fröhlich-style coherence has since been noted in red blood cells, DNA and water, among other things. Microwave signals were broadcast by energy originating in the digestion of food from oscillating dipoles in the membrane of the cell wall. The microwaves would then be the coherent structure in the Bose-Einstein condensate. A subsequent quantum field is theorized to form across the cell, extending to other cells as well. The varying energy level corresponds to the amount of food digested.[59] The brain is able to formulate so many different parts into one cohesive whole that we perceive as 'reality' occurs when all neurons concerning a certain subject matter oscillate in a synchronous fashion; the quantum mechanical answer says that the neural oscillations are modulations of an underlying quantum field, with the underlying quantum field, or 'one', integrating the higher-level neural oscillations. Oscillations, and thus information, can be communicated across the brain. One would wonder if there is a quantum dimension to consciousness, that the corresponding quantum measurement

[58] Stuart R. Hameroff, Alfred W. Kaszniak, Alwyn C. Scott, *Toward a Science of Consciousness: The First Tucson Discussions and Debates*, p.441
[59] Stuart R Hameroff, Alfred W. Kaszniak, Alwyn C. Scott, *Toward a Science of Consciousness: The First Tucson Discussions and Debates*, p.447-448

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effect would be measured. Using an electroencephalogram, Nunn, Clark and Blott in 1994 seems to have observed one. Subjects were hooked up to the EEG and asked to select numbers from a random number generator, without knowing whether the EEG's electrodes were activated or not. Measuring the EEG during the number generation resulted in odds against chance being 1000:1. The authors conclude the study strongly suggests there was quantum activity involved in the task (number-generating) performance.[60]

It takes your brain 1/10th of a second to analyze all the objects in this room to form a cohesive whole. One physicist predicted it would take from now to eternity for a conventional computer to calculate that much information. It's theorized that utilizing quantum superpositions allows our brains to do this. Perhaps this could explain, as Carl Jung first described as being, *synchronicities*. As Jung defines it, a synchronicity is a "*meaningful coincidence*, .i.e., an acausal connection"[61] (Italics added by Jung) The EPR Paradox showed that meaningful acausal coincidences do occur.[62] An important advancement in the concept of synchronicities was brought forth by Wolfgang Pauli. Although warranting mention earlier, his link to synchronicities placed him here. Pauli's exclusion principle convinced most physicists that the new quantum mechanics, solidified in 1925, was indeed correct. To Pauli, at the quantum level all of nature is engaged in an abstract dance.[63] There is an asymmetric dance performed by electrons, protons, and other particles, and a symmetric dance, which includes mesons and light

[60] B.H. Blott , C.J.S. Clarke, C.M.H. Nunn, *Collapse of a Quantum Field May Affect Brain Function*, p.127
[61] C.G. Jung, *Synchronicity: An Acausal Connecting Principle*, p.10
[62] Fred Alan Wolf, *The Dreaming Universe*, p.58
[63]F. David Peat, *Synchronicity: The Bridge Between Matter and Mind*, p.16

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photons. The exclusion of particles from each other's space is not the result of a force between them; instead, antisymmetry of abstract movement of the particles as a whole constitutes the acausal connection. Therefore, the underlying, entire dance of particles have a profound effect on each individual particle. It is the Pauli exclusion principle that allows lasers and neutron stars to be so coherent, and to be Bose-Einstein condensates. The nature of symmetry between nature and psyche would have a profound affect on Pauli, for both him and his friend Carl Jung would seek archetypes which are revealed to us through dreams, art, myths, and altered states of consciousness.

Notable is the fact that archetypes are factors that span psyche and matter; interestingly, Jung believed that numbers were the only possible connection between the twin worlds of psyche and matter. Synchronicities are moments of "divine inspiration" where the psyche breaks through to a lower, deeper level of consciousness, i.e. of reality.[64] E.M. Insinna expanded the definition of *synchronicity* by including three key aspects; the first being that synchronistic events are acausal manifestations, thus allowing psychic phenomenon to manifestly transcend space and time, the second being that synchronistic events consist of two independent causal chains being connected through the quality of meaning, in the absence of meaning there can by no synchronicities; and third, that "psyche and matter show a significant correlation that suggests an intrinsic wholeness in which the dichotomy psyche-matter is abolished."[65] It has been theorized that synchronicities most often occur at momentous or otherwise life-altering circumstances in an individual. According to Jung, the activation of an archetype is in the

[64]F. David Peat, *Synchronicity: The Bridge Between Matter and Mind,* p.235
[65] Stuart R Hameroff, Alfred W. Kaszniak, Alwyn C. Scott, *Toward a Science of Consciousness: The First Tucson Discussions and Debates*, p.598

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most profound layer of the collective-unconscious, the *unus mundus*, resulting in synchronous phenomena. Jung describes an archetype as "formal factors responsible for the organization of unconscious psychic processes: they are 'patterns of behavior'."[66] In the theory of archetypes, there is the idea that all humans can be divided according to a certain, basic, inherited psychological type. At the same time archetypes develop numerous effects which express themselves as affecting a certain individual. The produced *affects*, although tapping into the underlying whole, drain energy from every other content of consciousness, thus giving the unconscious a chance to slip into the vacated space. Owing to the reduced consciousness produced by these affects, inhibited conscious can cause the affects to spring forth. The very nature of studying synchronicities, that is experiences or events that are personal to you, is hard to duplicate under scientific observation. Nonetheless, attempts have been made. Perhaps the most striking example of proving synchronicities scientific existence occurred with the experiments of J.B. Rhine and his coworkers. A pack of twenty-five cards, five each with a star, square, circle, wavy lines, and cross were arranged in a pack. The study was double-blind, and the subjects had no opportunity of seeing the cards. In certain individuals, remarkable results occurred. One subject even guessed all 25 cards correctly, which gives odds of 1:298,023,223,876,953,125.[67] The cards were shuffled by a machine independent of the experimenter. The first round of the experiment among all the subjects resulted in a mean of 6.5 hits, 1.5 times the chance probability of 5 hits. This works out to a standard deviation resulting in odds of 1:250,000. Changing the distance of

[66] C.G. Jung, *Synchronicity: An Acausal Connecting Principle*, p.20
[67] C.G. Jung, *Synchronicity: An Acausal Connecting Principle*, p.17

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experimenter to subject to another room changed the correct guesses to 10.1 per 25; increasing the distance to 4000 miles was even conducted with similar results. If energy was somehow involved in causing these incredible odds, then one would expect its force to diminish over distance. Therefore, force and energy are probably not the cause. Time was not a factor either; scanning the cards then guessing their future outcome when turned over resulted in odds well above probability as well. The exact probability was 1:400,000, which essentially rules out time being a variable as well. Phenomenal studies such as this, seemingly proving extrasensory perception's existence, have been generally ruled as 'outliers' without a cause. The cause could not be seen because scientists (except a very minor percentage) are trained in the classical, Newtonian view of nature. The obvious answer to explain these phenomena's experimental results is through non-locality. Aspect proved that non-locality occurs across space-time instantaneously, without violating Einstein's General Relativity that nothing travels faster than the speed of light, because no energy is transferred between the two electrons. The human mind, operating on a quantum mechanical frame of reference, is capable of the ability to transverse space-time through the principle that we can understand as being non-locality. These meaningful, chance occurrences are glimpses into the underlying order, the 'one' of the universe. In Wolfgang Pauli's view, synchronistic events sometimes are correlated with the observer, and that the connecting macroscopic event is what gives synchronicities their meaning. In addition, E.M. Insinna describes three commonalities between the psyche and quantum worlds: First, causality breaks down in both synchronistic and quantum events, second that complementarities exists in the psyche as

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well as in the wave-particle dichotomy in the quantum world, and third, there are resemblances in simultaneity and non-locality concerning synchronistic and quantum phenomenon.[68] In addition, synchronicities may also have a resonance in Native American science as well.

The underlying, 'one' of the universe may have been known for thousands of years. Indigenous American and Eastern religions are the best attempt to understand this fabric of reality. From Native Americans to the Chinese, a concept of an underlying order exists. Jung looked for the underlying order in the Taoist book *I Ching*, or *Book of Changes*.[69] Taoist philosophy supports monism,[70] however the idea of monism is not necessarily incompatible with quantum physics. Originating in China, the *I Ching* is the oldest of the Chinese classical texts. Parallels between quantum physics appear not only in the *I Ching*, but in the *Vedas* of Hinduism, the Buddhist *sutras*, in fragments of Heraclitus, in Sufism, and the Native American shaman Don Juan.[71] According to Werner Heisenberg, "The great scientific contribution in theoretical physics that has come from Japan since the last war may be an indication of a certain relationship between philosophical ideas in the tradition of the Far East and the philosophical substance of quantum theory."[72] Many factors went into the formation of the *I Ching*, which derived from the various interplay between *yin* and *yang*, that the Chinese then developed into a cosmic system of archetypes.[73] At the heart of Chinese philosophy and culture, the *I*

[68] Stuart R hameroff, Alfred W. Kaszniak, Alwyn C. Scott, *Toward a Science of Consciousness: The First Tucson Discussions and Debates*, p.606
[69] C.G. Jung, *Synchronicity: An Acausal Connecting Principle*, p.34
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[71] Fritjof Capra, *The Tao of Physics*, p.19
[72] W. Heisenberg, *Physics and Philosophy*, p.202
[73] Fritjof Capra, *The Tao of Physics*, p.108

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Ching is the first of six Confucian Classics. Fritjof Capra claims that only the *Vedas* or the *Bible* can compare to it in aura of respect and as a revered scripture. The *I Ching* featured archetypes, relating to the underlying wholeness of reality. This archetypical pair, yin and yang, form the basis of Chinese thought. The archetypes represent the complementary nature of both the intuitive and rational sides. The rational side is the experience we gain from everyday interaction of objects and events. The intellectual, or intuitive, sides function is to divide, compare, discriminate, categorize and measure. A world comprised of intellectual distinctions is created, full of opposites which exist only in relation to each other. This is called *relative* knowledge by the Buddhists.[74] For the Buddhists, our natural world is filled with varieties and complexities, filled with many dimensions where a line cannot be straight; this could only happen in curved space time. To comprehend this world is unimaginable. The realm of the human mind has a limit, which simply is unable to understand the concept or significance of this underlying, wholeness of reality. For the followers of the *Tao*, 道, also saw the flux in nature as being the interplay of yin and yang. For the Taoists, if one wanted to change anything in life they merely had to start with the opposite, and the natural play of nature would balance the rest. Lao Tzu, who developed many followers that became Taoists, taught the essential view also taught in Greece, by the aforementioned Heraclitus. For the psychological aspect of change, Taoist belief held that is seen as a tendency which is innate in all things, and not energy or force. *Wui wui*, or non-action, is a principle philosophy of Taoism which dictates the allowance of nature to run its course.

[74] Fritjof Capra, *The Tao of Physics*, p.27

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Fritjof Capra maintains that quantum theory reveals an "essential interconnectedness of the universe."[75] This means that the universe is composed of spirit, and not matter. One cannot break down matter into smaller and smaller bits, because what was once thought to be the smallest bit, the atom, proved to be made of smaller particles; particles that are mere idealizations which we utilize in perception, whose properties are definable only within the context of another system. If one to consider M-Theory (an attempt at unifying the five Superstring theories), it is not even the open or closed vibrating strings that are the smallest unit of 'matter.' Quantum mechanics is the interwoven fabric of relations that unite to form a whole. For Hindus, it is *Brahman* that unifies this interwoven fabric. The *Avatamsaka Sutra*, a scripture of the Mahayana Buddhists, describes the world as a perfect interaction of relations in an infinitely complex way. These patterns, mostly akin to being energy, are the fabric of the cosmos. In India, what is translated from English as being the word *energy*, *kundalini*, is in fact an energy that travels from the top to the bottom, back and forth along the spine.[76] In Japan there is *ki*, 気, roughly equivalent to the Chinese *Ch'i*, 氣. In all cases, the translated word means "life force" or "spiritual energy." For the Chinook tribe, the roughly equivalent word is *sagalie*. It is known that endorphins are released when we tap into our spiritual energy, thus having an affect on consciousness, but I will not go into detail about the subject here. R.O. Becker and G. Selden's *The Body Electric* would suffice as an introduction to the science around energy healing. To Chuang Tzu and the Taoist philosophy, the complementarity of opposites, the yin and yang, comprised a basic

[75] Fritjof Capra, *The Tao of Physics*, p.137
[76] F. David Peat, *Blackfoot Physics*, p.134

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unity.[77] This basic unity is the same as the underlying wholeness of Bohm's "implicate order" and is similar to Jung's theory of a *collective unconscious*, the *unus mundus*. It is the fabric from which all possibilities of events exist. Conceptually in quantum mechanics, complementarity can be seen with momentum and the spread of the quantum wave function.[78] The incomplete definiteness of momentum and position exists because within the range of indefiniteness in each (predicted by the Uncertainty Principle), there are factors responsible for the definition of the other. The physical properties of any quantum system must be expressed in terms of complementary pairs of variables, where one variable can be defined only at the expense of another corresponding loss in how we define the other. For example, causal and space-time aspects are complementary, as are continuity and discontinuity. This principle of the complimentary nature of matter leads to a view of an indivisible, united world.[79]

Numbers, according to C. Jung, are the basic archetypes that bridge between the conscious and *unus mundus.* The *unus mundus* is at a deep level of the unconscious that is shared by everyone.[80] Jung himself was heavily influenced by the philosophies of the Hindus, Taoists, and Confucians, and learned much from quantum physics through his correspondences with Wolfgang Pauli. Numbers were seen by Jung as the most basic archetype. Bertrand Russell likens a number as being anything which is the number of some class.[81] Numbers are merely abstractions that exist in the mind, they exist in only a mental universe. It becomes very hard to accept numbers as actual descriptions of

[77] Fritjof Capra, *The Tao of Physics*, p.114
[78] David Bohm, *Quantum Theory*, p.159
[79] David Bohm, *Quantum Theory*, p.161
[80] Peter Watson, *The Modern Mind*, p.140
[81] F. David Peat, *Blackfoot Physics*, p.163

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physical reality at the quantum level.[82] It is in the underlying order of reality where numbers exist. The Western intellectual view is to see numbers in the quantitative sense; to indigenous people around the world, numbers are a living being constantly in a state of change. The number 4 is sacred to most Native American tribes. Four digits to a hand, four limbs to a body, four cardinal directions, etc. raises this significance. Also, the balance of forces, the nature of harmony can be seen in the number 4. If one were to move in one cardinal direction, the link between it and the other three directions requires renewal to achieve balance.[83] Likewise, the number 4 is how many archetypes Jung thought there to be. The organization of archetypes can best be seen in the symbol ⊕. The four main archetypes of Self, Shadow, Anima, and Animus exist at each point in the cross, symbolizing harmony and balance. To Native Americans, this same symbol is utilized to mean the unification of heaven and earth, with the present world in the center, and is the traditional *medicine wheel*. The medicine wheel is the traditional symbol for all of creation to Native Americans, and is also a symbol of renewal of life and rebirth. As in Buddhism, Taoism and Confucianism, and quantum physics, balance and harmony along with uncertainty dominate the world.

Inherent in Native Americans and Eastern religions is the concept of energy, power, or *spirit*. Although the definition is a loose translation, what it can be defined to spirit's Latin roots as "breath" is what constitutes all perceptions and potentialities of matter. It is the essence of all things. *Spirit*, as I define it, is the incorporeal consciousness that is expressed by linking together certain physical objects. All spirit has some sort of

[82] Roger Penrose, *Shadows of the Mind*, p.257
[83] F. David Peat, *Blackfoot Physics*, p.168

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consciousness,[84] which fits in with the popular physics view that everything, including electrons, has a sort of consciousness. For example, humans all share the same spirit, because it is inherent to our nature to be human. As an explanation for the odd behavior seen at the quantum level, it has been theorized that matter in fact does not exist; soul is what comprises everything. Although I cannot adopt this point of view at this time, it is an important enough idea to warrant inclusion. The example of Thor's hammer may prove useful in understanding *spirit* as well. A certain hammer was used by the Nordic god Thor. The hammer was taken by humans, and passed down through the generations. After hundreds of years, eventually the wooden handle was in such bad shape that it had to be replaced. Still, the original blade of the hammer remained. Eventually, it too would get replaced. Now none of the original material Thor had used to construct it remained in the hammer. The hammer is still Thor's however, because of its inherent essence, its *spirit*. It shares a common experience, a divine element with Thor. The commonality of experience is also expressed in nonlocality; the two halves of the electron will spin instantaneously across an infinite distance as if they were once one electron. Coincidentally, the harmony of yin and yang can be seen in the electron's behavior. As electron A spins one direction, electron B spins the exact opposite way simultaneously as expressed through quantum nonlocality. The balance of opposites, harmony, unification, and the interdependent nature of matter are all expressed in the simple symbol of yin and yang, as well as ⊕. Something must have a certain essence in common with other similar "objects" in order for it to have spirit. To the Native American, spirit is in all things, including rocks and trees. Interestingly, Native American's do not divide their society into

[84] Kenneth Meadows, *Earth Medicine*, p.44

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different subcultures of study (e.g. history, physics) but instead see it as an entire unbroken whole. As Fyodor Dostoyevsky said, "Civilization merely develops man's capacity for a greater variety of sensations, and absolutely nothing else."[85] For more information on the fragmentation we see in Western culture, read Bark Kosko's *Fuzzy Thinking*, for I do not have time to serve the topic justice.

Quantum mechanics plays a key role in consciousness. With quantum mechanics, one is capable of giving a scientific, unprejudiced view towards the basis of profound experiences. We create our own realities through holograms from the Bose-Einstein condensate. This world is but a dream, so immensely impressive that it is impossible to comprehend its exact nature. It is simply beyond the abilities of modern man to grasp the underlying order of reality. The unity of the universe became apparent to me in a dream. In this dream, I found myself standing in the center of a citadel. Above me, the starry filled night shined down. I then commenced to "take," "absolve" or "unify" with all the stars above; they disappeared from the sky above, and became inherent inside of me. Quantum mechanics proves not only the physical, but the psychological basis for consciousness.

[85] Bart Kosko, *Fuzzy Thinking*, p.268

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