TOWARDS AN UNDERSTANDING OF REALITY AND THE THE NATURE OF EXISTANCE

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Abstract

Our consciousness enables us to know about and experience our reality. It also allows us to ponder our existence and our relationship to the cosmos. Consciousness includes a mind / brain process that receives information, processes and evaluates it and applies meaning to it. It also forms an intention to take action on the external information it receives. For living entities without brains, information is processed in the most fundamental of ways resulting in little more than blind quantum, electromagnetic and chemical responses and reactions to external stimuli. At this level awareness and its mechanisms are a result of a fundamental aspect of nature pertaining to the interconnectedness and ultimate properties of matter. We refer to these properties as intrinsic awareness. They are built into the fabric of the universe and include the irreducible quantum principals of entanglement, correlation and non-locality.

As we move up the evolutionary ladder and consider organisms with brains, from the most primitive to the most complex, sensory mechanisms and brain / mind processes are utilized along with intrinsic awareness to collect and evaluate the information received from the environment. We call this process perception. Based on the degree of mentality (e.g. richness of consciousness) of an organism's mind / brain, information is processed and correlated with prior memories and experiences for the purpose of assigning meaning to the information it receives. The organism can then either choose to ignore that information, store it for later use or act upon it by forming an intention to do so. Meanings that have either positive or negative consequences are reinforced over time and tend to become hard wired which form habits or beliefs that often control an organism's actions. These, in turn, affect future perceptions, meanings and intentions. Derived meanings with no consequences or that do not require the organism to act do not form habits but instead wither and slowly fade from the organisms memory store.

The degree of mentality of the organism (including humans) determines richness of its experiences with external reality and the meanings it derives from them. These meanings are based on what consciousness derives from current perspectives, perceptions, prior experiences and previously stored memories. These meanings are not cast in concrete but can change over time as the organism's experiences changes unless they have already been hardened and hardwired to fixed beliefs (e.g. habitualized).

The key point about consciousness is that our view of external reality is based on the current meaning consciousness assigns to the information it receives and processes. It does this by filtering all perceived incoming information by evaluating it against prior experiences and beliefs already stored in its

memory. Information that is consistent with these prior memories is processed further reinforcing existing behaviors with that which is not is rejected or ignored.

Underlying all mentality is a view of reality that is based on three pillars of physical existence: energy, matter and information. This view suggests a model of how information is utilized and processed by nature at a fundamental level and is called the Quantum Hologram. QH also describes the basis for intrinsic awareness which serves as the underlying scaffolding for all higher levels of consciousness. QH explains some of the ways that living organisms know and use whatever information they know and utilize. It also explains an organism's instinctual and fixed behaviors.

QH elevates the role of information in nature to the same fundamental status as that of matter and energy. We speculate that QH is one of nature's fundamental information processing, storage and retrieval mechanisms and one that has been used since the beginning of time. This would promote QH as a theory which is basis for explaining how the whole of creation learns, self-corrects and evolves as a self-organizing, interconnected holistic system.

Key Words: Awareness, Beliefs**,** Cognition**,** Consciousness, Entanglement, Existence, Information, Intention, Intrinsic Awareness, Intention, Intuition, Mentality, Mind, Non-Locality, Perception, Phase Conjugate Adaptive Resonance, Perspective, Quantum Hologram, Reality, Resonance, Zero Point Field

Definition of Consciousness

We experience the external world through our senses. The information from our external environment is coded, processed and interpreted by our mental facilities. The process by which this occurs we call consciousness. Note that with this definition, all living organisms are consciousness to some degree. The difference between the consciousness of the simplest organisms to that of the most complex with the richest brain processes is simply a matter of degree of molecular complexity and not in kind. For organisms without brains, we call this process of assigning meaning to information simple awareness.

If we want to understand the nature of the reality we live in and our existence within that reality, the best place to start is to understand consciousness and how it evaluates the external information that an organism receives through its senses. It is also necessary to understand how it uses that information and the meaning it assigns to it in order to make sense out of or to manipulate external reality. Only by studying these aspects of consciousness can we have any hope to understand our external reality, how it came to be, how it is evolving, and our individual roles in participating and influencing it all.

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Let us begin by further clarifying and defining what we mean by consciousness. One common dictionary definition is "the ability to be aware of and to be able to perceive the relationship between oneself and one's environment". The most basic definition, however, is simply "awareness". Another definition suitable for more complex organizations of matter such as animals with a brain includes a description which contains some of the following ideas: "thoughts, sensations, perceptions, moods, emotions, dreams, and an awareness of self". Just like life itself, consciousness is one of those things that is easy to recognize but very difficult to define. It has been debated by philosophers in the West since the time of ancient Greek civilization over twenty five hundred years ago.

Eastern traditions have been wrestling with the concept of consciousness for millennia and seem to have a much better handle on it although still not nearly complete. In the West, explanations of consciousness have been mostly ignored or left to our religious traditions. This is certainly true since the

time of Descartes and the philosophy of Cartesian duality. It has only been in very recent times that a serious effort to understand mind or consciousness has been undertaken by the scientific community. Much of the effort now underway is based on the assumption of epiphenomenalism, that consciousness, or mind if you prefer, is a byproduct of the functioning of underlying physical structures of the brain and that mind is confined entirely within the brain's processes. However, there is a considerable amount of accumulating experimental and anecdotal evidence suggesting that this interpretation is not correct (Chalmers 1996; Penrose 1994).

At a basic level consciousness seems to be associated with a sense of recognizing the separation and awareness of the surrounding environment from the conscious entity. It also seems to be associated with the ability to process, store and / or act on information gathered from that external environment. Clearly with this description, consciousness is a process of the mind / brain.

But is consciousness restricted to a functioning brain? Are microscopic organisms such as viruses, amoeba, and algae conscious in some primitive sense? Clearly they do not have brains let alone a nervous system or even neurons. And yet they demonstrate purposeful behavior and are aware of their environment. Amoeba, for example, search for food by moving on pseudo pods toward prey that they eventually surround, engulf and digest. Several types of algae are so versatile that they change the process how they obtain food based on available sunlight. When light is plentiful, they gravitate towards it, which they sense through a photoreceptor at one end of the cell. If the light is too bright, they will swim away toward more suitable lighting conditions.

At a more primitive level viruses are considered by many scientists as non-living because they do not meet all the criteria commonly used in the definition of life. They do, however exhibit some aspects of consciousness or at least some rudimentary form of an awareness of their surroundings. Unlike most organisms, viruses are not made of complete cells. They reproduce by invading and taking over the machinery of their target host cell. When a virus comes into contact with a potential host, it inserts itself into the genetic material of the host's cell. The infected cell is then instructed to produce more viral protein and genetic material instead of performing its normal functions. Is that purposeful behavior or intentionality by the invading virus?

The Roots of Consciousness

It would seem that based on our definition, even simple living entities are conscious to some degree, since they display a level of awareness and intentionality to, in some way, manipulate their environment. And, it's not just restricted to living entities. We find certain properties all the way down to the subatomic level, particles in some sense aware of their environment. How is this possible? At the molecular, atomic and subatomic levels it is through the quantum phenomenon such as entanglement and non-locality that particles act and react to other particles with which they have become entangled.

Could it be that at the most fundamental level consciousness begins with these ubiquitous quantum events? We believe that is, in fact, the case. Luo (2010) has proposed a fundamental state of consciousness called intrinsic awareness (I.A.) which is defined as a fundamental ability to be aware in some primitive sense and to know. I.A. cannot be further divided into sub-components but is irreducible. It is built into the fabric of the cosmos. In this paper we define it as a collective term for irreducible quantum principals of entanglement, correlation and non-locality. Consequently I.A. does not depend upon our normal sensory mechanisms but, but along with prior memories and prior experiences is the basis on which our awareness is built upon.

Since I.A. does not depend on our ordinary senses, could it be the basis for intuition or is what is commonly known as our 6th sense? Perhaps it would be more appropriate to label this as our 1st and recognize that it has been present since the dawn of time being the most primitive of all our sensory mechanisms. For organisms with a brain likely this mechanism operates below and is independent of our mental activities but instead in some sense influences and is a prerequisite for them.

Recent evidence suggests that certain quantum phenomena (Schempp 1998, 2007, 2008; Mitchell 1995, 2003, 2008) operate at the macro level as well as the micro level and are responsible for many phenomena that living entities experience that cannot be otherwise explained. This would explain how twins or mother and child seem to communicate telepathically when at least one of them is under extreme duress as we have seen is so often reported anecdotally in the literature. In fact, as we shall soon see, several of these so called quantum group effects including a whole class of so-called psychic phenomena have been documented throughout recorded history. As we shall show shortly, some of these phenomena have been either demonstrated or suggested in recent laboratory experiments.

As one moves up the evolutionary chain of increasing complexity in living organisms, nature seems to have a preference for building upon the foundation of what has come before. For consciousness, we propose evolutionary scaffolding and increasing richness of consciousness. At the lowest level reside the most basic aspects of intrinsic awareness and, as we have seen is really the utilization of quantum principles of entanglement, non-locality and coherent emission / absorption of photons between physically disconnected matter. These phenomena are irreducible and ubiquitous and are the most fundamental properties of all matter at the most elementary level.

While a review of quantum physics is beyond the scope of this paper, let us briefly diverge to discuss the most important of the quantum principles that pertains to consciousness. In the macro world (e.g. human scale sizes), all objects appear to be independent of each other. If something happens to one object, nothing will happen to a second object unless that second object is in direct contact (e.g. locally connected) with the first object. In the quantum world, things can behave significantly different. Particles can become “entangled” or “correlated” with one another when they interact initially (e.g. locally) with each having a certain momentum after they become entangled. Later, even after the two entangled particles have become separated by large distances, when something happens to change the momentum of one of the entangled particles, the momentum of the other one is immediately affected as provided by the law of conservation of momentum. The problem is that in the quantum world, this happens with no time having elapsed between the changes in both of the particles which is a violation of the theory of relativity. This means that either quantum mechanics or special relativity is wrong and yet these are the two most successful theories in all of physics.

Einstein referred to this strange interconnectedness as “spooky action at a distance” and this prediction of quantum physics led to many exchanges (attacks and counter-attacks) between Bohr and Einstein. Eventually Einstein along with two colleagues, Podolsky and Rosen, conjured up a thought experiment that became known as the EPR paradox. The basis of their argument was that of the idea of “locality” which is consistent with how objects behave in the macro scale world as described above. If you want to affect an object that is not close by, you either have to get to the distant object or have to send information to it to affect a change in it. Since the speed of light is the ultimate speed limit, it takes a finite amount of time for that to happen thereby preventing a violation of the special theory of relativity. Unfortunately with non-locality this is not what happens. Figure 1 depicts this situation.

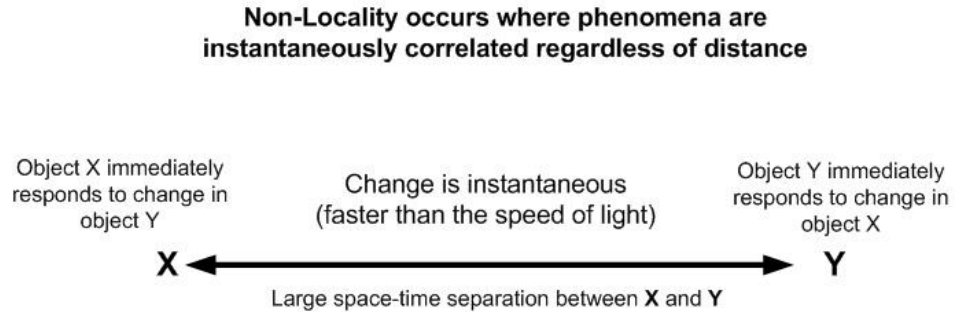

Figure 1 Non-locality

In the 1960's John Bell established a mathematical theory called Bell's Inequality which supported this non-local (instantaneous) communication between the two particles. This result has been tested since numerous times, first by Alain Aspect in 1982. The experiments proved that Bell's Inequality is violated, and the predictions of quantum mechanics are correct. Entanglement and non-locality are therefore indisputable aspects of reality. This means that entangled particles can somehow communicate with or influence each other instantaneously even though a message from one particle would have to travel to the other at speeds much faster than the speed of light. The big question is, if nothing can travel faster than the speed of light, how can this happen?

Another strange property of the quantum world that has been demonstrated by experimentation is that properties of objects do not exist until they are measured. How can we explain this? We have only a few options to explain what is happening here. Another implication is that there is no real time ordering behind quantum correlations, an event like measuring the spin of X (or Y) above cannot be considered to be the cause of the other. The options are: either there is no physical reality; or events have a common cause outside space-time reality; or that consciousness is somehow responsible for or related to the physical properties of matter. Clearly it is not the first for as Einstein said "The moon does not disappear when no one is looking at it". The second option implies that there is something else responsible for non-locality (to which we shall turn our attention to later, called the Zero Point Field). In the last option, perhaps non-locality is somehow related to the very basis for consciousness at the most fundamental level of reality. We shall discuss all three of these possibilities later and show how the seeming paradox of non-locality and possible explanations for them play a major role in awareness.

Just as an aside, the quantum correlations we have been referring to do not decohere over distance or time and therefore have astonishing consequences. This was expressed by David Darling (2005) as follows

> "Some 14 billion years ago, all the matter now scattered across the vast reaches of space was huddled together inside a ball far smaller than the period at the end of this sentence. The mutual set of interactions between particles – the overlapping of their wave functions – at this early stage ensured that entanglement was, and is a cosmos-wide phenomenon. Even today, with matter flung across billions of light years, there remains in place this extraordinary web linking every particle in existence. It means that when you make the slightest change to the smallest thing in existence here and now, it will have some effect, however tiny, instantaneously, throughout all known physical reality."

So, does entanglement mean that all things in our universe are in some sense interconnected? That is a topic we shall explore further later in this paper.

Returning to our model of consciousness, at the most fundamental level all matter seems to be interconnected with all other matter and this interconnection even transcends space and time in the manner just described. We refer to these quantum principles as intrinsic awareness. We postulate I.A. is the basis for the most fundamental aspect of consciousness which we describe as simple awareness. This mechanism of basic perception is the framework that supports a very primitive form of awareness extends up the entire evolutionary chain of increasing complexity of living organisms. The differences in awareness being in degree and not in kind as one moves up the consciousness ladder.

Moving beyond I.A. towards mentality, the next level of awareness pertains to the consciousness of simple life composed primarily of single celled organisms. Here we have the beginnings of a crude capability of awareness and intentionality through the use of molecular structures that are sensitive to their environment utilizing quantum, chemical and / or electro-magnetic means. In the latter case this is especially prevalent at those frequencies in the EM spectrum corresponding to visible light, infrared and ultra-violet waves. Sensing the external environment by these means has been considered the primary mechanisms of perception that have been the focus of classical science for quite some time now.

For simple organisms, like plants, amoeba, viruses, etc. clearly there are no brain structures to facilitate perception. Marcer (1997) has applied a theory he called the Quantum Hologram to propose that life at the most basic level, including such things as prokaryote cells and neurons in higher organisms, exchange information with their environment by utilizing the quantum properties. The implication here is that all organisms from the simplest to the most complex are interconnected at a very fundamental level using information obtained by emission and absorption of photons, entanglement, resonance and nonlocal quantum coherence (Ho 1997). Furthermore they are even interconnected with their external environment by their coherent quantum emissions via the mechanism of the Quantum Hologram as we shall soon demonstrate (Marcer et al. 1997).

As we move up the evolutionary ladder as shown in Figure 2 and consider organisms with brains, intrinsic awareness, sensory mechanisms and brain / mind processes (e.g. consciousness) are all utilized to receive, process and assign meaning to information received from the external environment. This applies whether considering the most primitive organisms with simple brain structures to the most complex and only varies by degree. The richness of the conscious experience of an organism determines how extensive external information is processed and subsequently correlated with prior memories and experiences. The primary purpose of consciousness is to assign meaning to information received via normal sensory mechanisms and / or by intrinsic awareness. The organism's consciousness either ignores that information, stores it for later use or acts upon it by forming an intention to do so. In all cases the meaning assigned serves the purpose of supporting the organism's survival.

Meanings that have either positive or negative consequences are reinforced over time and tend to be hard wired forming habits or beliefs that often control the organism's actions. In higher organisms, experiences with heightened emotional content, particularly those affecting the survivability of the organism, are hardwired very quickly and become extremely difficult to change even in the light of subsequent strong and contradictory experience. A classic example is the training of young elephants to stay in a particular place without fencing them in. When very young they are equipped with a leg collar that is tethered to a stake by a short chain. The young elephant quickly learns that not amount of tugging on the chain will free him from his tether. Eventually the stake and chained are removed but the leg collar is not. Since by this point the elephant has habitualized the feeling of the collar on his leg and its implications, it no longer will try to wander away even though there is no longer a chain or stake preventing it from doing so.

Once these habitual memories are firmly established, they, in turn, affect future perceptions, meanings and intentions. They serve as the filters as to how the organism subsequently perceives its

reality. Meanings with no consequences or that do not require the organism to act or serve any apparent useful purpose do not form habits but instead wither and slowly fade from the organisms memory store.

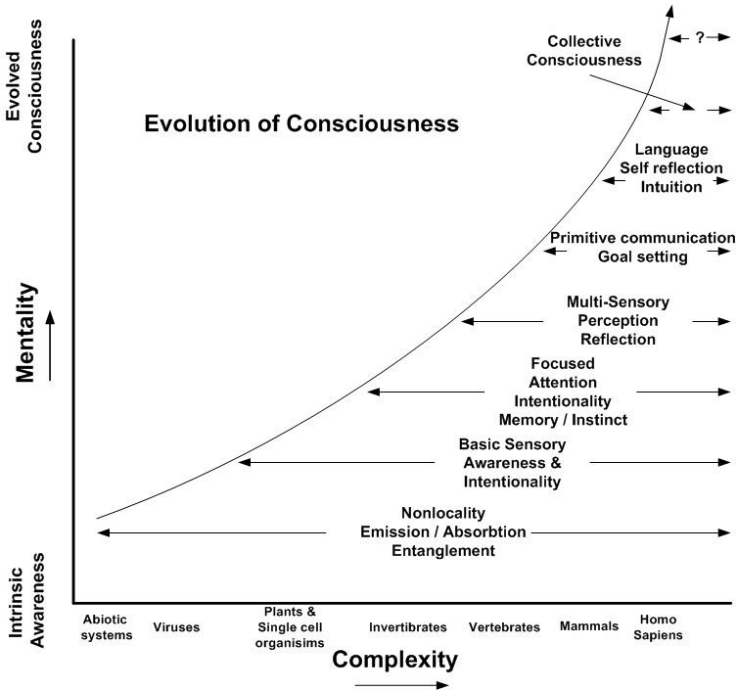

Figure 2 - Evolution of Consciousness

For higher level organisms such as Homo sapiens, complicating the roles of consciousness is the role of beliefs in addition to previous stored memories. These beliefs and their associated memories are processed by consciousness and act as filters that direct conscious awareness to focus on specific incoming information. These perceptions tend to support these existing beliefs at the exclusion of other information which does not. For organisms with a very rich of consciousness experience, the old adage of self-fulfilling prophesy applies. For example, humans tend to focus on information that supports existing beliefs and tend to ignore that which does not even in the face of overwhelming evidence to the contrary. Perhaps this is what led Max Planck one of the great scientist of the early 20th century to conclude that "science advances funeral by funeral". It seems, generally speaking, that the older one gets the harder it is to maintain an "open mind" especially when one has a lot to protect by maintaining belief in the status quo.

In times past when an organism faced little changes in its environment, this built in bias to hard wired beliefs was probably an effective survival strategy. After all when being chased by a tiger, what pre-human would want to take the time to figure out if running away was still the best strategy when he felt the tigers breath on the back of his neck? However in modern times when change is the order of the day being both extremely rampant and rapid, fixed beliefs that filter how reality is perceived and are also difficult to change will surely lead to our demise. Surely this is a key issue for the long term sustainability of our sustainability as a civilization and will be discussed in more detail later. The end result is that our view of reality is based on the current meaning consciousness assigns to the information it receives and processes by evaluating it against beliefs, meanings and experiences already stored in its memory.

The degree of mentality of the organism (including humans) determines richness of its experiences with external reality and the meanings it derives from them. As we have seen, these meanings

are based on what consciousness derives from its current perceptions, prior experiences and previously stored memories. These perceptions are not cast in concrete by may change over time as the organism's experiences and memory store changes. Habitualization takes place below the level of ordinary awareness while open mindedness and flexibility of interpretation require expanded awareness and conscious attention.

The good news is that humans can utilize higher level cognitive processes to train themselves to change embedded beliefs but to do this it generally takes an expanded awareness along with considerable effort and practice. A quicker way is to create cognitive dissonance with a strong emotional content so severe that the mind is forced to reevaluate its long held and uncontested beliefs. This can be done in several ways. Crises which threaten survival or shatter prevailing beliefs about reality have also been known to weaken or break fixed beliefs. Transcendent experiences such as near death experiences, out of body experiences, UFO encounters and epiphanies are also ways to challenge and weaken or eliminate hard wired beliefs.

How We Know What We Know

Given this background on the filters of consciousness we are now in a position to ask how we know what we know of our external reality. What we know is what we think reality is and yet it is based on our personal perceptions, memories, beliefs and if we can get beyond those filters reality is still not what we think it is. Beyond the filters of perception described above there are several other filters that obscure our view of reality. Even if we can get past the perceptual filters we still must contend with the filters of perspective.

Let us now take a closer look at perception and perspective. One of the most obvious ways to know about reality is by direct observation using our five senses. The tree outside my window certainly looks real as do the bushes and the flower beds, etc. in my front lawn. If my neighbor looked out her window and I asked her, she would tell me that she also sees the tree, and if her view is not obstructed, perhaps the flower bed and bushes in my yard as well. She sees the tree whether I am simultaneously looking at it or not. But does an independent observation by my neighbor mean the tree is real? Both of us infer that the tree exists by using the information we perceive and by comparing the current view of the tree we perceive with our prior experiences (stored information) about trees that are retained in our memory. We see the green leaves rustling the branches swaying and the trunk holding fast against the force of the wind. We know what the movement of a tree looks like from our prior life experiences with trees. But what would a tree look like to a boy raised in the desert where there were no trees? Would he have any idea of what he was observing? Clearly this suggests that two people engaged in communicating meaningful information requires prior common experiences by both of the communicators.

But, even if we grow up in a forest of trees, there is also much about the phenomenon of trees we still wouldn't observe: we wouldn't see the leaves absorbing carbon dioxide from the air surrounding the tree, water from the ground being transported upwards first through the root system, then the trunk, the branches and finally to the leaves. Nor would we see simple sugars being produced in the chemical factories of the cells from the energy of the visible light striking the leaves via the process of photosynthesis. We don't see these cellular mechanisms because we don't have the direct perceptual mechanisms to see these microscopic processes taking place. We don't see the atoms and molecules making up the tree, nor could we realize that 99.9% of all the space that the trees occupy is devoid of any matter at all (e.g. the nucleus of an atom contains 99.9 percent of the mass but only occupies 1/100,000 of the space of the atom; the vast majority of the rest of the atom is empty space). Clearly we need instrumentation that extends our senses for all these additional levels of observation. With such measuring

tools to augment our senses, our perspective changes and our understanding of nature changes right along with it.

But perception goes much deeper. Instrumentation does not always help especially if *it appears* unrelated to the object we perceive. Any high school physics student can tell you that all motion is measured relative to a reference point (e.g. an observer). Near the equator, the earth is rotating on its axis at a speed of roughly 1600 kilometers per hour, completing one complete cycle of rotation in 24 hours. But the earth is also revolving in orbit around the sun at an average distance of 150 million kilometers so it is also moving in its orbit at a speed of approximately 108,000 kilometers per hour. Not only that, but the entire solar system is revolving around the center of the Milky Way galaxy every 200-250 million years. The galaxy is moving with the local cluster of galaxies, and so on. So, is the tree moving or not? It depends on the reference point you choose or, said another way, on your perspective. Even though the tree outside my window does not appear to move except, perhaps, for the rustling of the leaves and the movement of the small branches in the wind, it certainly is. Any reasonable person would have to say that movement, like most things in our objective reality, is all a matter of perspective and consequently determined by our relationship to that object. Change your perspective or your relationships and you change your reality.

Throughout history there have been many paradigm breaking shifts in perspectives. It is difficult for us to imagine the impact on society when Nicholas Copernicus proposed that the sun and not the earth was the center of the Universe. Nor can we imagine the impact on western society when Columbus proved that the earth's surface was the surface of a sphere. In modern times, perhaps the most profound change in perspective that ever came about was when humankind looked back at the earth from space. What we saw was a fragile planet with huge but finite resources as an oasis in the hostile void of space. We saw an environment that is not separate from ourselves and one where all living things are interconnected and interdependent. This is something that our ancestors knew innately but something that we somehow had seemed to have forgotten.

So, in some ways we have come full circle but in other ways we have learned much more than our forbearers could have possibly known. Our ancestors also observed trees very similar to the one outside my window and they probably had a very similar experience at some level of understanding of what it meant to experience a tree. And yet our experience and understanding of a tree is also very different than our ancestors because our reality of the object called a tree can be viewed from many different perspectives than the ones that our ancestors were aware of. Clearly our everyday experience shapes our reality. The more we experience and know, the more our reality changes and expands. We have come a long way since many our cultural traditions were rooted several thousand years ago and yet modern western society is still heavily influenced by these antiquated views.

From the proceeding discussion it should be clear that perception of reality depends on our perspective and what we already know (or think we know). Figure 3 describes three aspects of our external (e.g. objective) reality at any point in time. The smallest oval represents all that we can currently observe with our senses and/or available instrumentation to augment those senses. The middle oval represents aspects of objective reality that we infer exists but cannot observe directly due to lack of appropriate instrumentation (ex. mostly empty space within the atom). As our technology improves, portions of reality that were not available to our observation come into focus so the scope of knowledge of observable reality increases (top oval in the figure) while in the scope of that objective reality that we cannot sense apparently shrinks. But new knowledge implies new perspectives and new aspects of reality that we did not know existed before. This causes the domain of knowledge of what we cannot observe to increase again in an ever increasing spiral.

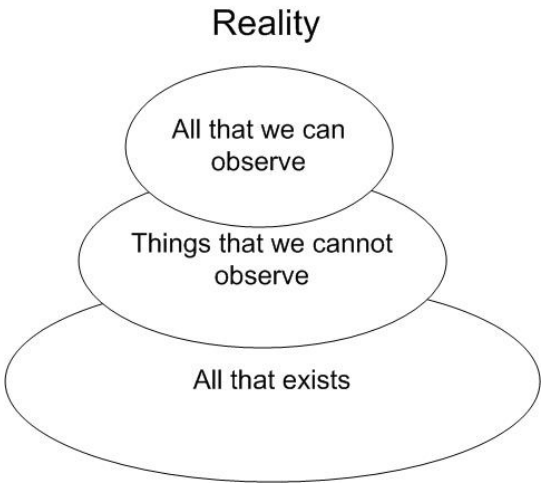

Figure 3

Science has done an amazing job at explaining objective (e.g. physical) reality given the constraints on knowing as described above but is has not been successful at explaining subjective (e.g. inner) reality. This includes aspects of our consciousness such as feelings and emotions, creativity, meaning and purpose. It also includes what it means to be alive, to be in love, to appreciate and savor beauty or to experience despair or grief. It does not explain many other phenomena involving consciousness like psychic experiences or certain aspects of quantum physics (which, as we have seen, also seems to be related to an observer's consciousness). There are many reasons for these failures but to understand them we need to review the context in which the roots of our scientific protocols for investigating nature developed.

Most of our scientific protocols were originated about the time of René Descartes. Descartes was a very influential French philosopher, mathematician, scientist, writer and scholar who was highly respected by church authorities. He lived in the first half of the 17th century, a product of a European religious society and one dominated by the church. Descartes developed a philosophy which is now referred to as the Cartesian duality. It arose because as science evolved based on the findings of several early scientists such as Copernicus, Galileo, Newton and their contemporaries, their hypotheses and experiments proved so successful in explaining aspects of the natural world that a conflict developed between theories validated by experimentation of these scientists and standard church doctrine.

Descartes' reflections on mind and mechanism began the separation of Western thought into two schools of thought: the "outer" material world (objectivity) and the "inner" world of consciousness (subjectivity). The compromise between the two, based on Descartes' philosophy, led to the separation of domains of inquiry between scientists and the church authorities. Science restricted its studies to the physical world and the church focused on matters of mind and spirit. This got scientists out from under the authority of the church and allowed the church to be the sole "authority" on consciousness and spirituality.

This uneasy truce has lasted until the present day and has been primarily responsible for the reason why, until very recently, science has all but ignored the study of consciousness and several other related disciplines such as psychic phenomena, prayer and various non-local healing modalities. As we shall see later it has also led to ignoring the role of the observer in many scientific phenomena (such as quantum mechanics). The good news is that it also got the domain of science out from under the scrutiny of the church (and its Inquisition) which is one major reason why science was able to advance so rapidly.

The bad news was, however, that it also placed other ways of knowing (consciousness & subjective experiences) outside the bounds of science, a legacy that is only just now beginning to be addressed.

Unfortunately, for most of the modern period, studying objective reality in isolation from other ways of knowing leaves out much in our ability to understand the whole of reality. Science is not purely objective because scientists (like all people) are also subjective. Scientists interact with what is being studied. As we have already seen they are just as influenced by their own bias and by personal and societal beliefs and values as anyone else. They experience the whole range of human emotions and feelings, and they are led to conclusions based on aesthetic considerations, intuition, creativity and flashes of insight all of which are part of the subjective experience.

From the perspective of mind (consciousness) there are really three ways of knowing reality, not just the aspect of knowing based on scientific materialism. Figure 4 describes a more complete view of how we know about reality. As we have already seen, knowledge can be obtained directly (e.g. objectively) by our senses or their extensions via instrumentation. These instruments augment the senses and include devices such as microscopes, telescopes, and various electronic devices that can detect all parts of the electromagnetic spectrum the human senses are not naturally attuned. But we also learn about reality by direct inner experience (e.g. our conscious experience) which is our internal (e.g. subjective) view of reality.

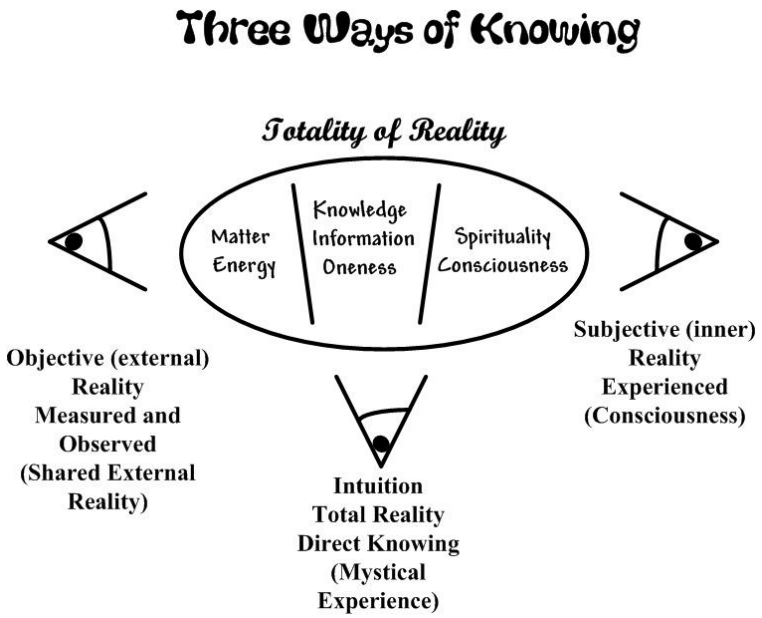

Figure 4

In both cases, whether by subjective or objective experiences, every one of us provides meaning to our experiences by our own filters of mind. These filters are habits formed from our prior experiences (memory) and knowledge of similar situations or are based on where we focus our attention. Often these filters are handed to us by cultural and social conditioning and by authority figures so early in our lives they are later accepted by us to be fundamental truths. But they are not reality; they are based on our beliefs, values, expectations, assumptions and prior experiences.

Going back to the experience of the tree described earlier, I expect that each time I look out my window, I expect (*expectation and belief*) the tree to be at the exact same location as the last time I looked

(unless it was knocked down or moved by an external force) because trees do not sprout legs and move on their own (*prior experience with trees*). What would happen if the tree was still observable outside my window but had moved 1 meter away from the house? I would assume that someone had moved it because trees don't move on their own (*prior experience*). But as we shall see later, in many aspects of science our everyday experiences and interpretations are not correct when applied to many phenomena.

Throughout most of the modern era, faith can be particularly problematic in science where we are constantly probing nature to test the bounds of reality. Faith is usually based upon a firm belief for which there is no proof, passed on to us from an authority figure or it can be an inference based on prior knowledge. Being open minded in science is essential to its advancement and therefore it is necessary to understand where our faith or beliefs come from. Blind faith is the antithesis of scientific discovery but, if history is any indication, even in science faith directs scientific investigation more often than one might otherwise believe.

As an example, for almost 2000 years, it was assumed by everyone that heavier objects fall faster than lighter ones did because the highly respected ancient Greek philosopher Aristotle said so. It took Galileo in the early 1700's to finally prove by experiment that Aristotle was wrong. How many of our earliest scientists were burned at the stake by so called authorities of the time whenever a new idea violated established doctrine? And the problem still continues to this day. However instead of being burned at the stake, mavericks are ostracized or ridiculed by their peers and sometimes even forced to leave their chosen profession when they oppose accepted paradigms! History is full of examples where new ideas are first ridiculed, then with new evidence, persistence and persuasion they become a revolutionary new theory and eventually become accepted and viewed as self-evident.

More subtle examples of blind faith or hard core beliefs can be seen today especially in areas related to consciousness studies or psychic phenomena. These beliefs can easily cause us to become blind to the obvious. These limiting beliefs can be summarized, according to Willis Harman (President of Institute of Noetic Sciences) from 1977 to 1997) as "the only limits to the human mind are those we believe in". One of the common problems of investigating psychic phenomena and experimentation in the laboratory is the often negative correlation on the outcome of experiments as influenced by participants or experimenters that hold negative biases - the belief that psychic phenomena cannot possibly be real. Statistical evidence to the contrary is now overwhelming to anyone who cares to look (Radin, 2006).

Knowledge is defined by the dictionary as what results from perception, learning and reasoning. We either perceive the object under investigation directly by observation or acquire facts of the object based on experimentation and inference. These resulting facts are the evidence that furnishes the proof one way or the other of our understanding of the phenomena being investigated. If repeated experimental or observational evidence by many independent investigators supports our hypothesis, we have verified our hypothesis. If the evidence does not support the hypothesis we are testing, we have falsified the hypothesis and will have to consider alternatives. Such is the nature of the scientific method. But, implicit in this is that the experimenters' beliefs do not affect the outcomes of the experiments. Unfortunately we know that this is not the case especially when those beliefs are emotionally charged. Experiments at the Institute of Noetic Science have now decisively demonstrated how experimenter bias can affect experimental outcomes.

We are all familiar with how beliefs and expectations can affect our state of mind and what we pay attention to. To demonstrate this assume, for example, you have just met a person of the opposite sex that you have experienced an attraction and interest in. In that first encounter you did not have time to exchange phone numbers but you both agree to meet downtown in the park by the bench near the statue commemorating the town's founders tomorrow afternoon at 2:00PM. In anticipation of the meeting, you arrive early, take a seat on the bench and enjoy the scenery. Your mind is filled with romantic thoughts

and you find yourself exploring the possibilities and excitement of a new relationship. You notice the birds, the people and the children on the playground. You are at peace and harmony with your environment and are experiencing a wonderful sense of wellbeing.

Continuing with our little story of anticipation, at 5 minutes after two o'clock, your excitement has been tempered slightly but you still look forward to the encounter. At 2:10 you start getting concerned, upset and wonder if something has happened. By 2:15 a dark cloud begins to form in your mind and you notice feelings of irritation are stirring. No longer are you focused on the beauty of your surroundings and your mind is running through all kinds of scenarios including the possibility of being stood up. You fail to notice the fender bender on the street less than 100 yards away as your mind considers various options. By 2:20 you are now questioning what you should do and find that the concern has turned to anger and humiliation. You are contemplating leaving the park when you suddenly notice a familiar face walking toward you looking slightly hassled. After an apology for being stuck in traffic, your feelings of anger and humiliation quickly evaporate and you find yourself in a state once again of hopeful anticipation.

As this simple example shows, we provide our own meanings, our own interpretations to all events (or lack of them) that we experience in our lives. And, they can change instantly based on the stories that we tell ourselves. These situations have a powerful effect on our emotions, feelings, beliefs and our perceptions of what we are experiencing. Our thoughts affect what we focus our attention on and on the assumptions we create about what we are experiencing. Scientists, of course, just like the rest of us, focus their consciousness based on their feelings and expectations. Perhaps this is why people make such unreliable witnesses in criminal investigations. It may also be the reason why it is difficult to get repeatable results in doing experiments involving consciousness when a skeptical participant is involved with the procedure.

So far we have discussed two ways of knowing: objective reality which is based on measurements and observations and subjective reality which is based on our conscious inner experiences. Figure 4 indicates that there is also a third way of knowing. This has been talked about and described in the literature and in cultural myths for millennia. Stories come from shamans, sages, aboriginal tribes, near death experiences, meditative states and states of higher consciousness. They all describe a holistic way of knowing. This is the same experience that sometimes happens during epiphanies. It is called by many names: Universal Mind, morphic fields, the collective unconscious, the noosphere, the akashic record or the inner wisdom voice. It is a way of knowing or / and a sense of oneness with all that is. In animals it is called instinct. In humans it is sometimes referred to as intuition. It happens to scientists, musicians, artists and anyone engaged in creative activities. Oftentimes flashes of breakthrough insight are the result of a period of intense conscious investigation and thinking lasting weeks or months which is finally put to rest and, as some would say, turned over to our subconscious mind. At some point later, a profound insight suddenly pops into consciousness and a new perspective or understanding is found often accompanied with a deep sense of truth and conviction.

Whether it is by objective, subjective or intuitive ways of knowing, it is clear that all ways of knowing have one thing in common and that is *our consciousness*. So, if we want to understand reality we better understand consciousness and the factors that influence it. The problem is that consciousness is not well defined or understood. In science, the mind has been treated pretty much as a black box because it cannot be directly detected with instrumentation. Provide some input into it (e.g. objects of awareness or stimulation) and observe the outcome (attention or intention). Twenty five hundred years ago Buddha made the observation that "We are what we think. All that we are arises with our thoughts. With our thoughts we make the world". So it seems that we have known for over two millennia that we cannot remove ourselves from interacting with what we are studying.

During the modern era in our studies of brain / mind, the accepted paradigm is the notion that consciousness is an epiphenomenon (e.g. an after-effect) that emerges from complex physical brain structure. However this is an assumption that has never been observed and certainly not proven by the scientific method. In many cases alternative explanations for consciousness have not been considered. By studying people that have experienced brain damage and how it affects those individuals, the claim is made supporting epiphenomenalism. But these studies with their so called clinical evidence do not prove that the brain produces consciousness. They only show that consciousness is associated with the brain. And so it is for all organisms with brains. But, what about living organisms that do not have a brain? As we have seen, amoeba are aware of their surroundings and therefore have some aspect of consciousness (awareness and intention) but without brains.

An analogy often sited to illustrate this point is that of a television set. If I tamper with the color circuitry of the set such that the picture is only displayed in black and white, have I found where the color in the picture originated from? Clearly not, it came from the TV station that broadcast the image. All the TV set did was to decode the received signal and display the resulting images in the form that we could recognize. Damage the color reception and decoding circuitry in the TV and the picture is affected but the incoming TV signal is still intact. Similarly, with regard to consciousness, there have been many well documented cases of people who were declared clinically dead (EEG totally flat) that when later resuscitated recalled detailed experiences during the time they were clinically dead (Ring, 2000). How would such a phenomena be possible if consciousness was an epiphenomenon of the brain?

The architect, designer and author Buckminister Fuller wrote that “if you want to understand the human condition, you must first understand the universe”. If you ask any great mystic, they will say if you want to understand the universe, you must first understand the ‘Self. To do that, clearly our study of reality must begin with an understanding of consciousness. We must begin by questioning the meaning we have given to the world and question all the assumptions and beliefs that we all harbor about that world.

In this section we have attempted to show the following:

- Our science is clearly incomplete and has a long way to go
- Our cultural traditions are based on knowledge and understanding or reality that is woefully out of date
- Our experiences are real but are interpretations of them may not be
- Our perceptions and knowledge are filtered by our consciousness

To gain a better understanding of reality we must include many natural phenomena which exist outside the scope of current science. That means including our inner experiences (e.g. consciousness). We must also reassess our ways of knowing about reality and how our existing paradigms, belief systems and prior experiences can affect our reality. From these expanded perspectives we will then be in a better position to develop a new and expansive view of reality and our existence within it.

The Mechanisms of Consciousness

Nature always seems to evolve mechanisms and structures that enhance an organism’s survivability in its environment. In addition to what we have already discussed, other higher levels of perception and awareness are necessary to locate objects in space-time. These go beyond the normal sensory mechanisms and include the non-local quantum simple awareness effects and intrinsic awareness. So, as we move further up the evolutionary ladder, we continue to enhance mentality as shown in Figure 2. At each level, the organism has access to the perceptual mechanisms of the levels below. Clearly, at

each level the organism is utilizing information (e.g. patterns of energy and matter) obtained from its environment. As we have seen, this implies that there is a process (e.g. consciousness) that uses and assigns meaning to this information. Note that "meaning" is also information that places the perceived information into context for use by the organism.

Penrose and Hamereoff (1998) have proposed that microtubules in brain cells might be responsible for more fundamental forms of perception. They also postulate that these microtubules provide the foundation for the emergence of higher orders of consciousness in species with a brain. Microtubules are hollow cylindrical polymers of the protein tubulin which organize cellular activities. These protein lattices exist in the cell's cytoskeleton found within the brain's neurons. Penrose and Hamerehoff claim that tubulin states are governed by quantum mechanical effects within each tubulin interior and these effects function as a quantum computer using "quantum bits" that interact non-locally with other tubulins and with the Quantum Hologram. When enough tubulins are entangled long enough to reach a certain threshold a "conscious event" occurs. Each event results in a state which regulates classical neural activities such as triggering neural firings that ultimately affect perception, learning and / or memory. Is this the mechanism for intrinsic awareness?

At first glance, quantum states in biological systems seem difficult to maintain in brains because these quantum states generally require extreme cold (e.g. close to 0°K) to eliminate thermal noise produced by the environment. Some researchers argue that this is necessary to prevent decoherence of these quantum states. However Penrose and Hameroff claim that decoherence may be prevented by the hollow microtubules themselves which act as shields to the surrounding "noisy" environment.

It has been suggested that the brain processes and stores information holographically as a massively parallel processing and associative computer system. Pribram (1999) and others have studied this extensively and demonstrated it in both the laboratory with animals and in operating theaters on humans. In the latter case the brain has been exposed and stimulated with low voltage electrical signals while the patient was conscious to describe the resulting experience. These subjects have recalled extremely detailed and vivid memories as if they were actually reliving the experiences being recalled. Animals that have had portions of their brains damaged or removed have been able to recall memories (ex. optimum ways to run a maze) even when the damage has been extensive. These experiments and several others provide evidence that suggest that brains store information holographically (e.g. stored as images contained within interference patterns). Marcer has further extended this to postulate that not only information is stored in this manner but that information is processed holographically in the brain as well. He has also attributed this processing to, in effect, creating a detailed three dimensional movie generating the stream of consciousness that the mind experiences.

Holographic processing is accomplished with the brain acting as a phase conjugating device (e.g. a phase gate) which is type of logic circuit where the inputs are sensitive to the phase of the input signal producing. The result is a "virtual" signal which is a mirror image of the quantum emissions (e.g. photons of light) actually emitted from the object being perceived. The brain acts as an information receptor utilizing adaptive resonance with a specific range of EM frequencies (e.g. wavelengths) in its input path. The input signals received are a representation of the external object resonating with similar virtual signals generated (output) by the brain. This sets up a resonance condition which may be interpreted as a standing wave between the object and the brain. The input signal is really the quantum emission spectrum of the object being perceived.

Like all holographic processing, the associative pattern that is created facilitates retrieval of information in a resonant loop utilizing the overlapping reference signals of quantum emissions from the external object. It enables the perceiving organism's brain structures to perform pattern classification and recognition of the resonating signals. This resonance process is called phase conjugate adaptive resonance

(PCAR). *We believe that PCAR is the basis for the most fundamental level of perception in all living organisms in the evolutionary tree of life* (Mitchell 2001). As an example think of bats, dolphins, whales that use sonar to send out signals and receive reflections back to locate targets. PCAR is the brain analog of that process.

One of the most important aspects of a laser hologram is that it exhibits the distributive property. This means that even a small part of an entire holographic record contains the entire record of the recorded image but with less resolution (e.g. definition) when reconstructed. Figure 5 is an actual quantum hologram or wave interference pattern of a patient's brain that would appear when exposed on a photographic plate. The left column labeled "A" represents the resulting interference pattern and the right column labeled "B" shows the corresponding 3 dimensional brain image. These images were produced by a typical Magnetic Resonance Imaging (MRI) machine similar to the ones used in medical diagnosis. In the left column (labeled "A") in the middle, and bottom row of pictures, the outside and inside respectively of the entire interference pattern shown in A (top row) have been removed to show the reduced resolution of B, compared to B (top) to illustrate A's holographic nature.

Quantum holography operates similarly in that quantum emissions from complex matter, for example, bio-matter, carry information about the entire organism. Stem cell research supports this concept. The fact that living cells in any organism evolve and grow from more simple stem cells, implies quantum entanglement throughout the organism and its composite parts, with an associated instantaneous exchange of information through PCAR. Thus some information about the entire organism is carried in the quantum emissions from its parts.

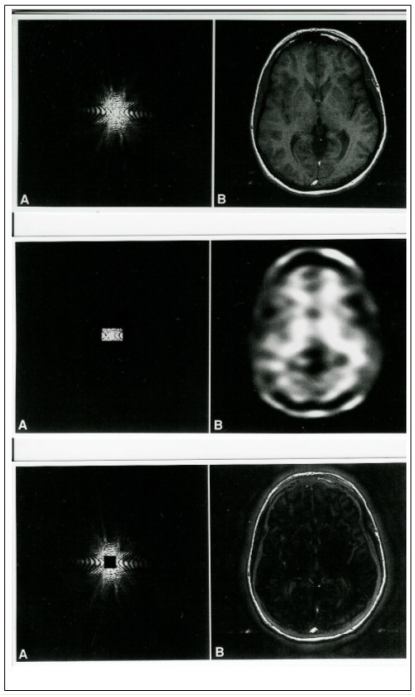

Illustration retrieved from: http://www.bcs.org.uk/siggroup/cyber/quantumholography.htm

Figure 5 Quantum Hologram

A problem that has plagued astronomers since the invention of the telescope has been dealing with the aberrations in the telescopic images caused by the shimmering from the earth's fluid atmosphere. Recent developments in laser technology and high speed computing have allowed astronomers to

eliminate these aberrations. A coherent laser beam is targeted to follow the same path that the telescope is focused on. As the laser beam is reflected off the shimmering atmosphere back to a receiver, the phase delay in the returning signal is processed and compared in real time against the reference beam transmitted. This comparison enables the computer to correct for aberrations with the telescope's optical imaging system caused by the atmospheric distortions. The result is that we are now able to receive clear images on earth based telescopes just like we can do with the Hubble Space Telescope which, of course, is outside the earth's atmosphere. This concept of self-correcting optical imaging telescopes is not unlike the PCAR process described above.

PCAR is necessary for the brain to perceive objects as they really exist in three dimensional space. If the brain had to rely solely on the visible light spectrum that was reflected off the external object and onto the retina of the eyes, the object would appear two dimensional just as it would be if a picture of the object was recorded photographically with a camera. Contrary to the popular opinion that we see objects in three dimensions entirely because of binocular vision, just close one eye and observe an external object with the remaining open eye. The object appears "out there" and not as an image "in the brain" because of PCAR. This clearly presents a survival advantage to an organism allowing it to accurately see and locate objects (especially predators and food) in three dimensional space.

Holographic processing is not restricted to processing sensory information in the visible light portion of the electromagnetic spectrum but it applies to enhancing all of the five normal senses. Consider snapping your fingers. The sound seems to originate from the location of the fingers in 3-D space and not at a point within the brain. As before, this experience results from the fact that the signal carrying the sound to the brain is resonating with the conjugate virtual signal created in the brain.

Figure 6 is an illustration describing the PCAR process. Emissions from the object of attention (e.g. the apple) are received (e.g. input) by the brain. The brain in turn creates phase conjugate (mirror image) "virtual" waves to identify the object. The standing wave that results allows the brain to locate and associate the object in space. The standing waves are created by interference of the two waves traveling in opposite directions. Recall that standing waves are waves that do not appear to propagate but are fixed in position and just move in the vertical direction about the zero point on the reference line. This standing wave creates the resonant condition that allows the brain to process the information so as to locate the object in 3 dimensional space.

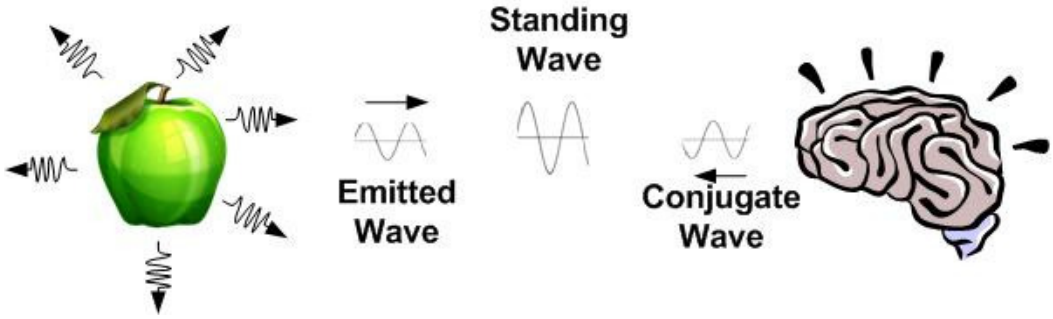

Figure 6 – The PCAR Process

Max Planck, considered by most as the founder of Quantum theory solved the problem of the so-called ultraviolet catastrophe in the late 1890's. He postulated a theory, now known as the Planck postulate, that electromagnetic energy could be emitted or absorbed only in discrete quanta which formed the basis of the description of black body radiation. This was ultimately extended and used to describe how all matter absorbs and reemits photons (quanta of energy) from and into the quantum foam of the

zero point field (ZPF) that pervades all matter and even the vacuum of space (Haisch et al. 1997). Normally these emissions are random exchanges of energy between particles and the ZPF. However, the emissions from complex matter (e.g. living organisms) have been shown to exhibit quantum coherence and also carry information non-locally. Recall that the quantum phenomenon of non-locality implies instantaneous transmission of information across space and time (Darling 2005).

Quantum Emissions and Non-Locality

As we shall demonstrate, non-locality also applies to macro scale objects and is referred to in this paper as a "group" phenomenon (Schempp 1998 and 2008). As a simple example, consider visiting a sacred place of worship such as the Notre Dame Cathedral in Paris. As one enters the cathedral, it is hard not to feel a sense of hush, awe and reverence. Over the centuries, countless people have entered this majestic cathedral with these very feelings. And these feelings were literally absorbed by the structure over the years through the process of quantum emission from the people and resonance with the very atoms and molecules of the cathedral structures. The longer the exposure to this resonance, the more coherence has been achieved with the molecules and atoms in the structure. This coherence re-manifests as emissions back into the environment which then resonate with the visiting people (via the cellular mechanism proposed above) entering the structure. The result is the subjective feelings of hush, awe and reverence which is exactly what a visitor experiences when entering the cathedral. This is another example of PCAR.

In Figure 6, we showed the emissions from the apple resonating with and being absorbed by the brain. However, the opposite is also true. The associated biomass of the entire body is also emitting coherent quantum fluctuations that are being absorbed by the apple and is therefore having some effect on the apple as well. Now add in everything else in the environment surrounding the apple and the human, which would lead one to conclude that every object, in some sense, has an effect on every other object. Like it or not, we appear to live in a participatory universe – there is no such thing as pure objective reality and we influence everything that we interact with. Perhaps this is the same mechanism why we "feel" positive energy from some people while others seem to emit negative energy?

Quantum Holography (QH), which we have alluded to several times above, is a recently discovered attribute of all physical matter and has been validated by experimental work with functional magnetic resonating imaging (fMRI). In his work with MRI tomography, Schempp (1999) used a mathematical formalism to expand quantum information theory. He validated his approach by significantly improving the definition and specificity of MRI and, in the process, discovered the inherent information content of the emitter-absorber model of quantum mechanics. This work provides a model to understand quantum level information processing of biological systems, specifically how the reception and processing of information leads to the functions of memory, awareness, attention and intention. We extend Schempp's work and postulate that all the cells of any biological entity and all its other organ systems, including the brain, have evolved as a massively parallel, learning, computing system. And the key ingredient of understanding this computing system and its processes is the quantum hologram which we will now describe.

As we have previously described, quantum emissions from any material entity carry information non-locally about the event history (e.g. an evolving record of everything that has happened) of the quantum states of the emitting matter. Recall that these quantum emissions are in the form of EM waves of many different wavelengths (or frequencies if you prefer) and that the information associated with these emissions is contained in both the amplitude and the phase relationships of the emitted waves as interference patterns. This is similar to the way that information is stored in the interference pattern on a

holographic plate as described previously. These interference patterns can carry an incredible amount of information including the entire space-time history of living organisms.

Zero Point Field

One of the pillars of modern quantum theory is the Heisenberg Uncertainty Principle named after the brilliant physicist Warner Heisenberg. This principle states that it is impossible to predict the position and momentum (velocity really) of a subatomic particle. The more you know one value the less certainty there is in knowing the other value. Quantum mechanics uses this principle to predict the existence of what is called the Zero Point Energy (ZPE) for all electromagnetic interactions. (There are several terms frequently used in the media to describe this phenomena and include zero point energy, zero point field, quantum vacuum and quantum foam to name a few.)

This energy is called zero point because it represents the energy of any quantum mechanical system at 0° K (or -273°C) which is also referred to as "absolute zero", the coldest temperature known in nature. It is the point where the movement of atoms ceases due to thermal vibrations (e.g. no thermal vibrations.). Since temperature is really an indicator of average kinetic energy of the molecules or atoms of the substance being measured, absolute zero represents the lowest quantized energy state of any quantum mechanical system. Absolute zero represents the energy that remains when all other energy is removed from a system and is therefore sometimes called the ground energy state or simply "ground state". So it seems that even at absolute zero, all particles have some energy remaining. The question is "Where does this energy come from?"

Heisenberg resolved this energy dilemma by using his uncertainty principle as described above. At absolute zero if a particle stops moving, since the velocity of the particle is known, its position must remain unknown so the particle must still be moving around (e.g. oscillating around a reference point) otherwise it would violate the uncertainty principle. It turns out that this uncertainty principle also applies to energy and time. The implication here is that the residual energy of empty space is not constant and varies with time. From Einstein's famous equation of describing the equivalence of energy and mass, $E=mc^2$, zero point energy must be able to create this energy as EM waves and their equivalent mass as "virtual" particles of empty space. In fact, these energy waves and particles pop into and then out of existence in a time interval dictated by Heisenberg's uncertainty principle. These "virtual particles include photons along with positron-electron pairs. They are called virtual because of their very short period of existence. It turns out therefore from both quantum theory and verified by experiment, that all empty space (e.g. the entire universe) contains vast amounts of this so-called residual background energy. Furthermore electromagnetic fields of all frequencies are produced by this ZPE and are also continuously fluctuating about their zero baseline values.

Evidence for the energy of the zero point field was first suggested by Hendrick Casimir in the late 1940's using forces resulting from zero-point energy. Casimir determined that two metal plates brought sufficiently close together will attract each other. The reason for the attraction is that the narrow distance between the parallel plates allows only small, high frequency (e.g. very small wavelengths) electromagnetic fluctuations of the zero point energy in between the plates. The outer surface of the plates does not block these lower frequency EM fluctuations (e.g. bigger wavelengths), so the resulting overpressure forces the plates together. In 1997, this prediction was experimentally demonstrated in the laboratory by Steve Lamoreaux at the University of Washington with the results very close to the values that Casimir had predicted.

The Casimir experiment has provided confirmation of quantum mechanics that predicts the all-pervading vacuum continuously spawns particles and waves with all possible wavelengths that

spontaneously pop in and out of existence. This quantum foam extends everywhere throughout the universe, the vacuum of space and even fills the empty space within atoms. Furthermore moving electrically charged particles such as an electron will be disturbed (e.g. wobble) as they experience the vacuum electromagnetic fields. All atomic and subatomic particles are clearly influenced by the zero point field.

For macro-scale objects such as a person, standing in still air one would not feel the random motion of the air molecules constantly bombarding their body because this "air pressure" is uniform in all directions (e.g. it is isotropic). This is not unlike what a fish would feel swimming in water. For the same reason we can't detect the zero point field because it uniformly surrounds and permeates us. Thus it is virtually impossible to detect its presence whether we are at rest or moving through it at a constant speed. However when we begin to accelerate through it we begin to feel its effects. We have all experienced pressure while in a car which accelerates rapidly. Your body gets pressed into the seat of the automobile. Earlier we talked about Newton's first law of motion also known as the Law of Inertia and the resistance an object feels to changes in motion. This resistance is known as inertia.

Physicists Hal Putoff and Bernard Haisch have written a series of papers describing inertia as a kind of electromagnetic drag caused by the acceleration of objects through the zero point field. Alfonso Rueda and Haisch have even gone one step further and have derived the most famous law of classical physics, Newton's Second Law of Motion (F=mA), from the properties of the zero point field. Since inertia and mass are related to gravity there are also intriguing implications that gravity may also be an effect resulting from the zero point field. This was first proposed in 1967, by the Russian physicist Andre Sakharov. Specifically he proposed that gravity is not a fundamental force in the universe but is, instead an induced effect brought about by changes in the quantum fluctuation energy of the ZPF when matter is present.

In the late 1990's astronomers observed that the expansion of the universe (e.g. space) is accelerating. This acceleration is believed to be caused by dark energy which is also attributed to the zero point field. It is called dark energy because scientists are not exactly sure what it is composed of. It seems to compose over 70% of the mass energy of the universe, and yet, no one knows for sure what it is. This has had a major impact on cosmology, which had always assumed that the positive attraction of gravity by all matter in the universe was slowing down the rate of expansion. When Einstein originally developed his general theory of relativity, he added a term to his equations called the cosmological constant (a term for negative gravity or a repulsive force) to counteract the attractive (positive) force of gravity so the universe would remain in a steady state (neither expanding nor contracting). In the 1920's when Hubble produced evidence that the universe was expanding, Einstein removed the cosmological constant from his equations, calling it "the biggest blunder of my career". Now it seems that, thanks to the ZPF he may have been correct all along.

There are a few additional properties of the zero point field that are relevant for our purposes here. The ZPE is likely the mechanism for instantaneous transport of information between correlated particles (e.g. non-locality) through their wave properties. Furthermore the ZPF exists everywhere and waves transported through it, do not attenuate (e.g. they last indefinitely) and cannot be shielded in any way. Normal EM waves can be shielded. These shields, called Faraday Cages, are very effective at blocking out all outside information that could otherwise be transmitted via EM waves of any frequency. These cages are often used in all experiments where potential outside influences or interference caused by the transmittal of EM waves can affect the experimental results.

It is interesting to note that just as nonlocal affects cannot be shielded by these cages neither can gravitational effects. This further suggests that gravity also seems to be property of the ZPF and is probably related to the same mechanism as non-locality. Since non-locality requires some sort

instantaneous communications and all particles exhibit the duality of both waves and particles, *it would seem that everything in the physical universe is interconnected in a very fundamental way and this interconnection occurs beyond space and time*.

In summary, the ZPF has been verified experimentally to be a real phenomenon and a vast source of energy. It appears to be the plenum that sustains all matter and energy in the universe and is the fundamental medium of the cosmos. It is possible in the future that it may provide a new and virtually unlimited useable source of clean energy. It has a wide variety of potential applications including everything from new technologies to energy generation and even to spacecraft propulsion. Our current understanding of zero point energy is still primitive but it is reasonable to expect that as our knowledge of this ubiquitous quantum foam is further developed, it will have a major impact in science and technology in the coming years.

The Quantum Hologram

Mounting evidence seems to indicate that every physical object (both living and nonliving) has its own unique resonant holographic memory and this holographic image is stored in the Zero Point Field (Marcer et al. 1997). Information in the ZPF is stored non-locally and cannot be attenuated. Furthermore this information can be picked up via the mechanism of resonance as we described earlier. This information, its storage and its access is collectively called the Quantum Hologram (QH).

We can think of an organism's QH as its nonlocal information store in the ZPF that is created from all the quantum emissions of every atom, molecule and cell in the organism. Every objective or physical experience, along with every subjective experience is stored in our own personal hologram and we are in constant resonance with it. Each of us has our own unique resonant frequencies or our unique QH which acts as a "fingerprint" to identify our non local information stored in the zero point field. Since the event history of all matter is continually broadcast non-locally and stored in the QH, the QH can be viewed as a three dimensional vista / movie evolving in time which fully describes everything about the states of the object that created it. Not only do we each have our own unique QH, but it is also possible for others to tap into parts of it through resonance. We shall develop this idea more fully later in this paper.

To illustrate how resonance with an object's or living organism's QH might work, consider the following example. Take two identical guitars, tune the corresponding strings on each guitar to the same frequencies and place them on the opposite sides of a room. Now pluck a string on one of the guitars and notice what happens to the corresponding string on the guitar at the other side of the room. It will begin to vibrate in resonance with the first guitar. This is not unlike the example with singer Ella Fitzgerald and the shattered champagne glass that has been popularized on TV commercials several years ago. It turns out that the vibrating strings on each guitar will produce a standing wave. The vibrations cause the wave to travel down the string (incident wave) to the point where the string is attached to the guitar. The wave will reflect off that point (producing a reflected wave) and travel back in the opposite direction as a mirror image of the incident wave. As the waves meet they will interfere with each other and produce our standing wave which is then propagated through the air.

Now add a third identical guitar with the corresponding strings also tuned to the identical frequencies as the other two. If the corresponding strings on each of any two of the guitars are plucked simultaneously at the same point on the string, the corresponding string on the third guitar will again begin to vibrate as before but with one slight difference. Since both plucked strings were struck at the same point and at the same time, the sound waves produced from each will constructively interfere and

reinforce each other in the air resulting in sound waves of greater amplitude. So as before, the string on the third guitar will begin to resonate again but this time with greater amplitude. This assumes that the guitars are place at appropriate locations such that the sound waves from the other two guitars arrive so that the waves arrive in phase. The result will be that they will constructively interfere with each other. If the distances are such that the signals arrive out of phase and destructively interfere, they may cancel out at the third guitar.

Now, repeat this process adding a 4th guitar with the proper placement and so on. In each case the amplitude of the resonating standing wave will continue to increase (unless the responding guitar string should happen to break from the large amplitude of the wave it is receiving). This analogy of the strengthening of the resonating wave shall be of particular importance when accessing information stored in the ZPF. The simple reason is the larger the amplitude of the standing wave, the easier it is for another object to resonate with it.

The analogy of the guitars is similar to how information is stored in the Quantum Hologram with the ZPF. Since the brain operates as a massively parallel quantum computer. The brain does this by setting up a resonant condition with microtubules scatted throughout the brain tuned to the same frequency as the standing waves of the same frequency located in the ZPF. As we mentioned before every macro-scale physical object in nature has its own unique quantum hologram. It exists in 4D space time reality and is a non-local information structure that never attenuates. And, most importantly, it carries the entire event history of the physical object it was created from or, in the case of living organisms, the entire subjective and objective reality experienced by that organism. All this information about the entity is carried in the amplitude, frequencies (e.g. wavelengths) and in the phase relationships of those waves from the emitted entity. Perhaps, most important of all, is the fact that the information stored in the QH is recoverable through the process of resonance not only with the individual organism that created it but with other organisms as well if they are "tuned" to it. This seems to happen most commonly in humans when strong emotional connections exist between the two.

Note that we are not suggesting that we are all virtual beings living in a "literal" holographic reality as interference patterns on nature's holographic plate. We are all real beings living in a very real material existence consisting of matter, energy and information just as we experience it. Also the quantum hologram is not about the discovery of some new kind of subtle energies such as "élan vital", qi or prana suggested by many throughout history. Neither is it about multidimensional theories nor living in other planes of existence other than our normal 4 dimensional space time reality. But this does mean that we now have a mechanism to describe how mind can manipulate matter. We will have considerably more to say about this later in this paper.

The Quantum Hologram is a model of how reality works. Like all models it enables us to make predictions and create interpretations about how nature operates. We can test those predictions to validate and refine the model and perhaps someday even design, build and utilize technologies that implement various aspects of the model's predictions. But the map is not the territory and, like all models, it must be refined as more information becomes available and our understanding improves. And, most importantly, models are subject to interpretation based on our prior knowledge and experiences.

Our QH model seems to explain many effects including aspects of mind, memory, stream of consciousness, various factors affecting health, psychic events, Jung's collective unconscious, the Akashic record and other phenomena that arise out of the resonance with the QH residing in the zero point field. Before the discovery of quantum holography we had no mechanism to model or account for these phenomena let alone for information transfers between objects that these effects imply.

We believe that QH is supported by both experimental and anecdotal evidence suggesting it is also a model that describes the basis for consciousness. It explains how living organisms know and use whatever information they know and utilize. It elevates the role of information in nature to the same fundamental status as that of matter and energy. In fact the QH seems to be nature's built-in vast information storage and retrieval mechanism and one that has been used since the beginning of time. This would promote QH as a theory which is basis for explaining how the whole of creation learns, self-corrects and evolves as a self-organizing, interconnected holistic system. Since the laws of nature appear to be the same throughout the universe there is no reason that it should not also apply to extraterrestrial consciousness as well.

Applications & Implications of QH

We will now look at many previously unexplained phenomena and describe how they can all be explained with the quantum holographic model. Then we will attempt to describe some of the profound implications and ramifications to which this theory leads. We will discuss anecdotal evidence, actual experiments, their implications and potential further applications of the Quantum Holographic (QH) model. Before we begin, let us briefly summarize what was earlier in this paper. We described how QH describes a real phenomenon of nature that has been validated in the laboratory. We postulated that it is a description of reality that is based on a mathematical formalism (e.g. a theoretical model) of how nature implements and utilizes information, memory, perception, attention and intention. Furthermore we suggest that QH explains many phenomena in nature where no adequate mechanisms were previously known to describe them. This is particularly true in accounting for the transfer of information between material objects or between objects and their environment.

QH offers a hypothesis and convincing evidence that explains how living terrestrial organisms know and how they utilize information. In doing so, it elevates information to the same fundamental status throughout the universe as matter and energy. Furthermore when energy, matter and information are utilized in processes, QH leads us to the very basis of consciousness itself. So, perhaps the most profound implication of all is that the QH model provides a basis for explaining how the whole of creation learns, self corrects, evolves by being, in some sense, conscious of itself. In other words, QH describes the universe as a self-organizing inter-connected conscious holistic system.

We postulate that the storage mechanism for the Quantum Hologram resides in the zero point field (ZPF). This field is ubiquitous, nonlocal, cannot be attenuated, lasts indefinitely (e.g. never loses coherence), can store unlimited quantities of information and any portion of it encodes the whole just as a hologram does. It can be thought of not only as nature's information storage mechanism but also as nature's information transfer mechanism. QH information is contained in the amplitude, frequencies and the phase relationships of the underlying interference patterns from the emitted quanta. This information is emitted and absorbed by all objects and exists in four dimensional space / time reality. QH applies to all scale sizes from the smallest subatomic particle to the largest structures in the cosmos and takes place at all temperatures (even down to absolute zero). It exists simultaneously beneath the classical descriptions of how information is exchanged between non living objects and below the normal five senses for living organisms.

For living organisms QH applies to intra and inter communications between cells, organs and organ systems, and finally between organisms as well as with the larger environment as suggested by Lipton (2005) Sheldrake (1981) and several others. It applies to all living organisms on earth as well as to all biological entities that exist throughout the cosmos. Whether abiotic or biotic, the entire event history of all matter anywhere in the universe from the micro scale to the macro scale is being continuously

broadcast non-locally by coherent quantum emissions. This history is also reabsorbed by (e.g. received) and interacts with all other matter and the ZPF through the exchange of quantum information.

The mechanism of QH applies to all of the cells of the human body (approximately 50-100 trillion) and answers the question that is often posed dealing with how all these cells cooperate and work together to make the whole human. While they are actively cooperating, thousands of cells are dying continuously every second; so many, in fact, that over the course of one week the body will have billions of new cells and yet you remain you with the same memories and the same functionality and the same distinct features. How does that happen?

Every one of our cells contains the same genetic blueprint of DNA and clearly that DNA and environmental influences exert major influences over the development and functioning of our cells. But cells are not only subordinate to DNA; they also function and maintain homeostasis by communicating and cooperating simultaneously with many other cells of the body and by the information they receive from the environment. Much of this inter-cellular signaling is electrochemical in nature but biologists still struggle with some aspects of the mechanisms utilized in this information transfer. With up to 100 trillion cells it is hard to imagine how that many cells can remain in harmony by the slow process of electrochemical signaling especially under times of great distress when survival of the entire organism is at stake and / or requires extremely rapid and coordinated responses.

The primacy of DNA as the master blueprint for an organism has been the central dogma for biology for a long time. There is now very convincing evidence that all organisms on earth from plants to mammals acquire characteristics through the interaction with their environment and can then pass these characteristics on to their offspring (Lipton 2005). This process is called "epigenetic inheritance" and has spawned a new field in biology called epigenetics which is the study of the mechanisms by which the environment influences cells and their offspring without changing genetic codes. This is forcing scientists to rethink evolutionary theory and harks back to the days of Lamarckian evolution. Lamarck's theory, developed 50 years before Darwin, hypothesized that evolution was based on cooperative interaction between organisms and their environment. This interaction enabled these organisms to pass on adaptations necessary for survival as the environment changed.

Lipton states that "*results from the Human Genome Project are forcing biologists to the recognition that they no longer can just use genetics to explain why humans are at the top of the evolutionary ladder on earth. From this effort, it turned out that there is not much difference in the total number of genes found in humans and those found in primitive organisms*". So where does the information come from that defines who we are? Lipton further goes on to state that "*cellular constituents are woven into a complex web of crosstalk, feedback and feedforward communication loops and that thousands of scientific studies over the years have consistently revealed that EM signaling affects every aspect of biological functioning*". How does this mechanism work? Could QH offer an explanation?

In addition to DNA and environmental influences in all earth based living organisms, inter-cellular communication is especially critical in embryonic development. From a single fertilized egg, the embryo divides thousands of times and each time producing identical offspring cells called stem cells. Then at some critical point when the embryo has reached a certain size, something truly miraculous happens. Cells begin to differentiate and form groups of like cells that will eventually become all the highly specialized tissues and organs that make up the human body. Out of the entire mass of undifferentiated cells making up the embryo, how does a particular stem cell suddenly know that it is to transform into a heart cell, liver cell, neuron, etc? Clearly, some of the differentiation results from electrochemical signaling with the immediate surrounding cells. This exchange is certainly necessary and provides information about how a cell must change to express itself correctly to become the right type of

cell at the right place and at the right time. But is it possible that this signaling, by itself is not sufficient to explain the full development of the embryo into a complete organism?

Sheldrake (1997) has studied this problem and has proposed a theory called the Hypothesis of Formative Causation. It describes an alternative explanation for how the structure and form (morphology) of an organism develops. In his model, developing organisms are shaped by fields which exist within and around them and these fields contain the form and shape of the organism. He proposes that each species has its own information field, and within each organism there are fields nested within fields. All of these fields contain information derived from previous expressions of the same kind of organisms. He further states

> *That a field's structure has a cumulative memory, based on what has happened to the species in the past. This idea applies not only to living organisms but also to protein molecules, crystals, even to atoms. In the realm of crystals, for example, the theory would say that the form a crystal takes depends on its characteristic morphic field. Further, the morphic field is a broader term which includes the fields of both form and behavior*;

Sheldrake's view is that nature forms habits (e.g. memories) and over time these habits strengthen and influence following generations. Similarly, other habits atrophy over time from lack of continued use. In fact Sheldrake is not alone in proposing such a mechanism. The great psychologist Carl Jung has proposed "the collective unconscious" which represents a vast information store containing the entire religious, spiritual and mythological experiences of the human species. According to Jung, these archetypes have existed since ancient times and are inherited where they exist deep with the human psyche and heavily influence the thinking mind. In a similar manner, Teilhard de Chardin proposed the concept of the "noosphere" which represents the collective consciousness of the human species that emerges from the interaction of human minds. De Chardin asserted that as individuals and the global society evolve into more complex networks, the noosphere evolves along with it.

Finally there is the Akashic record which was developed in the Sanskrit and ancient Indian culture. It is described as an all pervasive foundation that contains not only all knowledge of the human experience but also the entire history of the universe. Our normal five senses cannot access this information but it can be accessed through spiritual practices such as meditation. In the last few years, Laszlo (2004) has also been promoting a theory he has named the A-field which contains many aspects that are also very similar to the concepts described in this paper. All these concepts imply a mechanism very similar to our description of QH.

Resonance and the Quantum Hologram

Whatever name this mechanism is called, we postulate that the primary means for accessing transcendent information is via the process of *resonance*. Remember, that since the laws of nature appear to operate the same everywhere in the universe these is no reason to conclude that QH would not also apply to biological entities anywhere in the universe. In higher organisms with brains, the massively parallel processing capabilities of the brain structures are capable of simultaneously resonating with QH information at an incredible range of frequencies. This is shown in Figure 7 where the effects resulting from varying degrees of resonance with the QH is depicted.

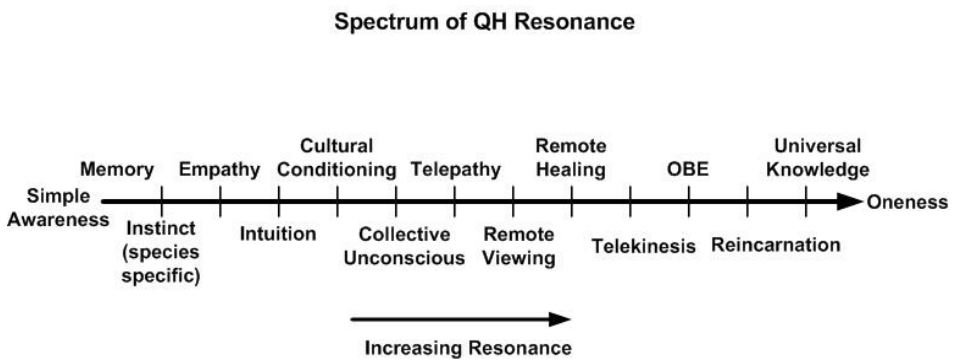

Figure 7 - RESONANCE SPECTRUM

The simplest form of resonance (e.g. entanglement) is shown on the left side of the graph. Moving to the right we show phenomena that manifests with increasing degrees of resonance and frequencies. We have included several phenomena on this graph such as Out-of-Body-Experiences (OBEs) and reincarnation but, as we shall soon see, our explanations of them are based on QH theory and require a different interpretation than those commonly found in popular literature. Finally, we shall describe how the degrees of resonance can occur along with techniques to facilitate them.

We have indicated earlier that information is nothing more than what is contained in patterns of matter or energy. The meaning that is derived from these patterns is developed in the mind of the percipient based on prior experience (e.g. knowledge and memory). In other words, all events are subject to interpretation and that in turn is based on the prior experiences and beliefs of the percipient. The more knowledge and experience we gain the more likely we will interpret an event closer to actual reality.

Changing beliefs especially when they are not based on knowledge but instead are based on faith, however, are another matter entirely. For example, in colonial America, most people attributed thunder and lightning to evil spirits. At that time the obvious solution to the problem was to ward off the evil spirits by ringing church bells. Needless to say that was not very effective. More than a few well intentioned souls were electrocuted while in the bell tower ringing those bells. We now know that the premise of evil spirits is totally incorrect and that thunder and lightning are merely the results of electrostatic discharges between the atmosphere and the ground. How did we get to this understanding? We evolved our understanding and beliefs by investigating and learning about how nature really works through trials, by observation and by experimentation (remember the Ben Franklin experiments with kites we learned about in grade school).

Experimental Evidence

We shall now describe some of the experiments testing the concept of non-locality and their findings. There is considerable experimental and anecdotal evidence, although some of it controversial, to suggest that simple organisms perceive and respond to nonlocal information. In the area of human experimentation, results have likewise been mixed for much of the last 75 years. However meta-analysis by Radin (1997) and independently by Utts (1991) across a large and appropriate spectrum of experiments demonstrates compelling statistics that the perception of non-local information exists and is real. Meta-analysis is a new tool which has become essential in many of the soft sciences including ecology, psychology, sociology and medicine. The essence of meta-analysis is that outcomes of collections of previous experiments are analyzed by statistical methods which combine results from different existing studies that address a set of related research hypotheses.

Perhaps if there were a larger body of experimental evidence for simple life forms, similar results of meta-analysis would emerge. Failure to replicate results in well constructed experiments does not, in the case of subtle consciousness phenomena, prove that the phenomenon is missing but rather that a hidden mechanism below the threshold of classical measurement may be operating. For example, the most telling experimental evidence to explain the sometimes inconsistent results relates to direct nonlocal and / or experimenter effects. These effects are unintentional biasing effects on the results of an experiment caused by the expectations, beliefs or preconceptions on the part of the experimenter.

Schmiedler (1972) isolated the "sheep / goat" ("sheep" is a label for believers and "goat" is a label for non-believers in psychic experiments) effect in human experiments decades ago. Experimenters and /or participants in human telepathy (or similar nonlocal) experiments exhibited results statistically above or below chance results depending on their subjective bias towards the experiment. In other words 100% wrong answers would be as statistically significant as 100% correct answers in such tests, and in addition would betray the mind set or intention of the subject whereas only chance results would be inconclusive. More recently, a series of experiments by Schlitz (1997) investigating intentionality clearly demonstrated that experimenter bias (intentionality) affected the outcome even in double blind experiments. Thus, in the subtle realms of mind and consciousness studies, bias, belief and intention clearly have an effect.

The lack of an existing theoretical structure in classical science to support any type of perception of non-local information, much less to support bias, belief or intention as having a nonlocal effect, is quite sufficient to account for anomalous results in many scientific experiments. The prevailing dogma of classical science against any type of non-local action at the level of macro scale reality has not prevented experiments from successfully being conducted. It has sometimes caused positive results to be dismissed as anomalous, of faulty design or outright fraud when in most of these cases the results were defensible had proper nonlocal theory been available.

Radin (2006) describes a series of experiments conducted in the latter half of the 20^{th} century on a whole range of psychic phenomena that suggests that experimenters are obtaining far more correlations than can be expected by chance. This was done by performing meta-analyses for random number generators (RNG) studies subjected to psycho-kinesis (PK) intention which resulted with the odds against chance of 35 trillion to one over the entire database. This analysis followed a decade long series of experiments by Dunne and Jahn (1988) at Princeton University provided overwhelming evidence that human subjects could produce statistically skewed results in mechanical processes normally considered to be driven by random processes. A similar study with Ganzfeld meta-analysis by Radin demonstrated results with odds against chance of 29×10^{18} to one (e.g. one chance in 29,000,000,000,000,000,000). Radin goes on to describe several other studies showing similar results.

Radin has also discovered that audiences watching stage performances would skew the output of random number generators during periods of high emotional content in the performance. In a wide-ranging audience participation experiment, he recorded the output of computer random number generators during the television broadcasts of the O.J. Simpson murder trial. Most television news programs covered this event live for weeks on end with millions of viewers. Again, the results of random number generators set up to monitor this event were skewed corresponding to emotional peaks during the trial drama and corresponding to the number of people watching. A similar effect was noted on 9/11/2001 at the time of the World Trade Center disaster in New York City.

The thesis in the Princeton experiments was that participant intentionality created non random effects to bias the skewed distribution. In the Radin experiments, the results were not the result of intentionality because the participants were unaware of the experiment, but his hypothesis was that rapt attention drove the system away from randomness and toward greater order. These results suggest that

attention and intention provide closely correlated outcomes and further, that randomness may not be a property of nature but what may be perceived as random noise in a system may just be awareness that is not in resonance at that moment with the particular perceptual system.

Many types of mind-to-mind or mind-to-object experiments have been rigorously and routinely conducted for decades with statistical significance but they are often dismissed or ignored by mainstream science because the implications of non-local action are so foreign to the mainstream view of objectivism and the possibility of mind-matter interactions. However, if we consider the condition of resonance is necessary (specifically PCAR as described earlier), then we must also consider the perceived object (e.g. the target) and the percipient's perceptual system as entrained in a phase locked resonant feedback loop. The incoming wave from the target carrying the emitted information may be labeled as "perception" from the view point of the percipient, and the return path may be labeled as attention (or intention) depending on what the percipient is trying to achieve. Note however that this is a two way street, the act of perceiving also affects the target object being perceived! Therefore we do live in a participatory universe. There is no such things as pure objectivity.

In the case of non-local effects at a distance, outside the body, simple correlation of entangled particles is the most basic form of perception. And these correlations between entangled particles are reciprocal. Action on one particle creates an effect on other entangled particles instantaneously and even across large distances. This phenomenon is no less important for macro scale objects.

Sheldrake (1999) has conducted experiments with dogs whereby the animals correctly anticipated their owner's departure from a remote location to return home. He has also conducted other successful experiments on previously unexplained behaviors of animals. In one example rats that were learning to traverse a new maze benefited non-locally from the experience of others that had previously learned the maze in the total absence of classical space time information. Other examples include distant (e.g. nonlocal) awareness of deaths and accidents, animals that heal humans and those sensitive to forebodings of natural disasters.

It is not surprising then, that humans exhibit an even wider range of reactions to non-local information. The evidence suggests that humans can perceive, recognize and give meaning to nonlocal information across a broad range of complexity, from inanimate objects, simple organisms, animals and other humans (refer to Figure 4). The existence of QH provides an adequate informational structure to permit a theory for the observed results. This is a classical example, where results are repeatedly observed over time that fall outside the prevailing paradigm, and must await new developments in science before the phenomenon can be adequately explained. Perhaps this explains psychic abilities.

In humans, it is a well established meditation principle that prolonged focused attention on an object of meditation causes the percipient and the target object to appear to merge so that a much deeper level of understanding about the object is obtained. This includes information such as its history or internal functioning that would not be available through classical space-time information. The quantum holographic theory describes how this phenomenon might take place. Further, it is accepted that the mind and associated brain with its 100 billion neurons function together as a massively parallel pattern matching (e.g. information) processor, capable of performing many tasks simultaneously. Most of this processing is done subconsciously or in the right hemisphere which is attributed to the intuitive part of the mind.

Conscious focused attention is a unique and singular task that takes place sequentially mostly in the left hemisphere in the cognitive part of the brain. The condition of attention deficit disorder (ADD) is precisely the problem of a percipient being unable to maintain a singular focus for a sufficient time to complete a desired task or observation. Thus the action of focusing attention by a percipient may be

construed as a necessary condition for resonance (PCAR) to be established with the perceived object. Even for people with such a handicap, reducing stress, eliminating distractions, and quieting the mind via meditation may also improve one's ability to focus thereby improving the resonance condition.

Healers typically report such a focusing to create a resonance with the object of their healing activities. Once in resonance, they often report sensing in their mind some sort of picture which appears as a type of 3-D holographic image. They maintain that diseased or damaged tissues in the target often appear as fuzzy or appear somehow different from the normal tissue surrounding it. Sometimes they describe it as sensing energy blockages. They claim to be able to focus energy or somehow manipulate (e.g. intentionality) the diseased tissue which over time causes the image to change and take on the same characteristics of the healthy tissue surrounding it. Could this be the result of the act of intention of the healer resonating with the quantum emissions and subsequent absorptions by the diseased tissues?

Healers and other psychically sensitive individuals often enter into resonance with the object of their focused attention (or intention) by using an icon (e.g. a representation of the object of interest). Similarly people praying for others (not in a religious sense of supplication to a higher being) are suggestive of initiating a non-local resonance process with a target object. Healing prayer has existed in all cultures for millennia. If prayer did not produce some positive results, it is likely that religion would have abandoned it centuries ago. For most of its history healing prayer was attributed to supernatural agency rather than resonance with the target's QH. This is simply another example of phenomenology waiting while science catches up as in our colonial lightning example above.

In recent times Dossey (1993) and many others have attempted to document the efficacy of prayer, particularly healing prayer. Some claim the results establish the case for healing prayer. However the difficulties of controlling all the variables, the experimenter affect, etc. in such clinical studies leave many avenues for valid criticism. The fact that Radin's many studies demonstrated that attention alone produced non-local results in REGs (random event generators) and other machines in reducing randomness (e.g. increasing order) confirms that information has a nonlocal effect and may be correctly formulated as negative entropy. These results apply to healing prayer as well. In these cases, icons are often used to facilitate this resonant process. Icons can be an image, picture, representation or an article associated with the target object of the intention. What each of these modalities has in common is that they appear to provide a mechanism for the intender to "tune in" or resonate with the target. Touching an icon seems to satisfy the resonant (PCAR) requirement and probably allows the intender access to the information about the target not available from normal space-time information. Police agencies often use this modality with psychics who then focus their attention to gain information about a crime scene often with considerable success.

Healers and people praying may also utilize icons but in this case with focused intentionality to resonate with the person to be targeted by similar means. The use of icons to retrieve nonlocal information also suggests an explanation of water memory and homeopathy. Molecules of toxic substances from an original solution are removed by serial dilution. Could some of the water molecules resonate with the emitted photons from the original toxic substances and later resonate with the human immune system when absorbed by it?

If, as required in the theory of the Quantum Hologram, the icon has been in the presence of the individual or contains the signature of the person about whom information or healing is desired, the event history of the icon and that of the individual intersect. The phase relationships of the quantum emissions of the icon contains a record of the target object's journey in three dimensional space and time, as well as the quantum states through which it has passed on this journey. The sensitive individual, with a honed talent, often seems to be able to decode the information coded in these phase relationships of the photons emitted from the icon about the individual or object sought. It may also be the case with the bloodhound

that additional non-local information has been gained about the subject, even though the classical explanation is that the animal is operating only with heightened olfactory sensing.

Although perception in the three dimensional world requires and utilizes resonance (PCAR), most humans do not routinely bring to conscious awareness non-local information when operating in ordinary three dimensional reality. We perceive objects as presented by space-time information, that is, shape, color, function (tree, chair, table, etc) but are not usually aware of the additional non-local information (location in space, threats, etc) unless there is strong emotional connection. Consider the case of an infant separated from its parents during time of war or unprecedented disaster. Years later, by a chance reunion, the now unfamiliar child and / or birth mother sense a strong connection while others sense nothing. Could this be because of the resonance between mother and child during pregnancy and through the birth process?

It usually takes training as provided by many esoteric traditions and / or certain naturally sensitive individuals to routinely perceive the non-local holographic information associated with a particular target object. There is considerable evidence to suggest that the brain / mind has these latter capabilities at birth. The development of language, suppression of these capabilities by cultural conditioning and subsequent lack of practice all contribute to the atrophy of natural ability of conscious, intuitive perceptions. Perhaps cultural conditioning is one of the reasons why so called reincarnation experiences are so common in children in eastern cultures while virtually unheard of in the west. The late Dr. Ian Stevenson (2001) of the department of Psychiatric Medicine at the University of Virginia traveled around the world and investigated children usually from the ages between 2 and 5 who claim to have lived previous lives.

> *"At the same time they have often displayed behaviors or phobia that were either unusual in their family or not explained by any current life events. In many cases of this type the child's statements have been shown to correspond accurately to facts in the life and death of a deceased person; in many of these cases the families concerned have had no contact before the case developed."*

Our view is that although the reincarnation event is a real non-local event experienced by the child, the interpretation of the event is not correct. We believe that the person is in a high state of resonance with the quantum hologram of the deceased and is able to retrieve QH information about the deceased from that resonance condition. As the child ages, rational left brain processing begins to dominate and the child is no longer able to resonate with the QH of the deceased unless the child has been trained to maintain that state of altered consciousness. We would attribute a similar effect with someone who experiences an out-of-body experience (OBE). Again, this most likely represents a high state of resonance with the remote location and the experiencer is retrieving and processing the QH of the objects at the remote location being visited non-locally.

In cases like the ones just described, meditators, mystic adepts and natural psychics routinely demonstrate that non-local information is perceptible from physical objects and icons by focusing attention, quieting the left brain and allowing intuitive perceptions to enter conscious awareness. Those most practiced in meditation experience an altered sense of space-time, the dissolution of self, have access to universal knowledge and sometimes feel a unified sense of oneness with all of existence. Along with this sense of oneness comes a feeling of immense bliss and a great clarity of mind. We postulate that they have entered into a state of high resonance with the QH and have access to all the information that is implied by such unification. This seems to describe the epiphany that I (Edgar Mitchell) experienced on my return flight from the moon.

Particularly in western tradition, academic interest has been on left brain or rational processing rather than right brain intuitive functions. It is the left brain cognitive ability in humans that provides

acceptable labeling of the intuitive, creative and artistic processes taking place in the right brain. Given the fact that with training and practice, all individuals can reestablish and deepen their cognitive access to intuitive, non-local information demonstrates that learning recall is taking place within the whole brain itself and involves enhanced coherence and coordination between the hemispheres and with the QH. This process is different and distinct from the left brain function of extending and extrapolating factual data and forming conclusions based on logical deduction to leap to an "intuitive" conclusion, while omitting the immediate steps leading to that conclusion.

When an object or person of interest is not in the immediate vicinity of the percipient so that space-time information obtained by normal senses is unavailable for receiving and interpreting nonlocal information, the method is somewhat different in obtaining resonance with the target. The case in point is the subject of Remote Viewing (RV) which is another latent ability we all have to some degree. RV allows us to describe and experience activities and events that are normally precluded from us with ordinary perception from our normal five senses.

Remote viewing has been researched extensively by Putoff (1996) and Putoff and Targ (1976) at Stanford Research Institute since the mid 1970's. Their work attracted the attention and funding from the U.S. Central Intelligence Agency and was conducted in secret for almost 20 years. Some of the work involved exploring the limits of what remote viewing could do and also in improving the quality and consistency of the result. Much of the remainder of the effort was in training operatives to collect intelligence information against foreign adversaries. The government funding of the effort ended after the collapse of the Soviet Union in the 1990's.

For the purposes of our discussion with RV, the questions we are interested in pertain to the "reference signal" used to decode the quantum holographic information in the absence of any classical space time signals and also how the condition of resonance (PCAR) is established by the percipient. Experimental protocols from RV normally provide clues to the location of the target object such as a description, a picture or location by latitude and longitude or an icon representing the target. These clues seem to be sufficient for the percipient to establish resonance with the target. Space-time information (as perceived by the normal five senses) about the target is not perceived by the percipient, nor does the object usually appear at its physical location in space time like a photograph or map in the mind. Rather the information is perceived and presented as internal information and the percipient must associate the perceptions with his / her internal data base of experience in order to recognize and describe the target's perceived attributes.

In the case of complex objects being remotely viewed, the perceived information is seldom so unambiguous as to be instantly recognizable as correct. Sketches, metaphors and analogies are usually employed to recognize and communicate the nonlocal information. A considerable amount of training, teamwork and experience are necessary to reliably and correctly extract complex nonlocal information from a distant location. The information appears to the percipient as sketchy, often dream-like and wispy, subtle impressions of the remote reality. Very skilled individuals may report the internal information as frequently vivid, clear and unambiguous. The remote viewing information received in this case is strictly non-local and, based on the hypothesis of QH, the received information is missing the normal space time component information from any of the five normal senses about the object necessary to completely identify and specify it via resonance.

It has been demonstrated that this intuitive mode of perception can be enhanced by training in most individuals. Perhaps additional training and greater acceptance of this capability will allow percipients to develop greater detail, accuracy and reliability in their skill. In principle, training will not only enhance the remote viewing skill and its accuracy, but should also cause the associated neural circuitry to become more robust as well.

In the absence of normal perceptual sensory signals such as light or sound to establish the resonance condition to provide a basis for decoding the target object's quantum hologram, an icon representing the object seems to be sufficient to allow the mind to focus on the target and to establish the resonant (PCAR) condition as we have described earlier. However a reference signal is also required to provide decoding of the encoded holographic phase dependant information. It has been suggested by Marcer (1998) by that any waves reverberating through the universe remain coherent with the waves at the source, and are thus sufficient to serve as the reference signal to decode the holographic information from any object's quantum hologram emanating from a remote location.

We conclude our discussion of potential QH applications with the experiments conducted by George De La Warr in the 1940's and 1950's. De La Warr was a British engineer who became interested in understanding the mechanisms associated with remote diagnosis and healing. His work was documented by Day (1966) in the 1960's. De La Warr began experiments with his wife, an accomplished psychic healer, to detect the radiation emitted in such processes. At first he thought this mechanism was related to some form of EM radiation but later realized that it was associated with resonance. He eventually built a diagnostic device which acted as a resonant cavity. Perhaps the strangest aspect of the discovery was that when the device was operated by his wife, she could focus her attention on a living target object and was able to produce a resonant condition between the target and the measuring device. She was also able to "project" this resonance condition and expose a blank photographic plate. She was eventually able to pick up resonances from plants, trees, humans and even diseased tissues.

Over time the De La Warrs built up a library of several hundred such photographic plates. Many years later Benford (2008) came across this library and had some of the photographs analyzed by modern 3-D CAD/CAM software (Bryce® 4). The analysis showed that the images were spatially encoded with a 3-D effect similar to those produced by fMRI machines but with much higher resolution. (Earlier we described the discovery made by Shempp that fMRI machines encode quantum information holographically). Recall that fMRI machines were not in existence until many years after these photographic plates were exposed by Mrs. De La Warr. These experiments along with recent discoveries associated with fMRI machines seem to provide compelling evidence that macro-scale quantum holography is a real phenomenon and is produced by conscious attention and intention by a percipient on objects of interest.

How Nature Learns

We end this section with our model of QH summarizing how nature (and all living entities) perceives, learns, adapts and evolves in its environment. This model is shown in Figure 8. In this model, we show how establishing resonance (PCAR) between a percipient and a target object, the phase conjugate (mirror image) signaling paths connecting the two, can be labeled "perception" on the input side and either "attention" or "intention" on the output side. In the case where the object is a simple physical object (like an apple), our interest is on the non-local information perceived by the percipient about the apple. However from the point of view of the apple, information about the percipient is also available to the apple. The resonant condition between the two is a reciprocal relationship.

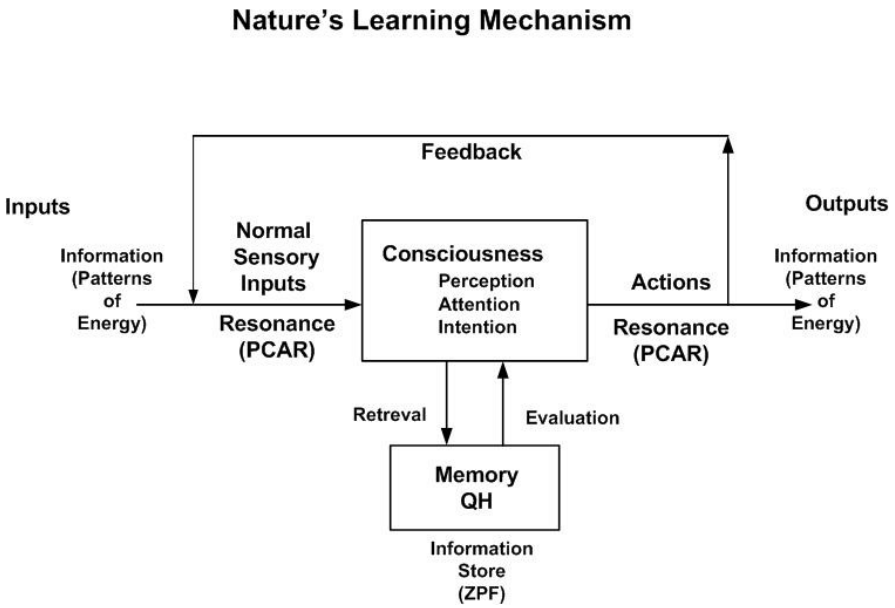

Figure 8 - How Nature Learns

The Quantum Holographic model predicts that the history of events of the target object (apple in this case) is carried in the apple's QH which implies that the "attention" or "intention" focused on the apple by the percipient causes that event to be recorded in the apple's QH. Clearly we cannot query the apple to inquire about its experience but none-the-less the interaction will create a phase shift in the apple's QH (interference pattern) which should be detectable. Although we are using anthropic labeling as we are discussing human perception with the apple, this phenomenon is rooted in natural (and primitive) nonlocal physical processes which are fundamental to the interaction between all objects whether living or not. The evolved complexities of perception, cognition, etc., associated with the brain, as yet have no obvious analogous label other than "non-locality and entanglement" to describe the interactive experience with the environment for simple objects like apples.

Once the resonance condition is established, the percipient can evaluate the results (via the feedback mechanism shown in Figure 8) and can then change its mind state with regard to the object being perceived. The perceived information can then be processed by brain functions so that cognition occurs with respect to the perceived information and thus allowing meaning to be assigned to it. Cognition and meaning require finding a relationship between the perceived information and the information residing in the percipient's memory and this information will be interpreted based on the percipient's beliefs and prior experience stored in its memory. The percipient can then form intent with respect to the object. In such cases the output labeled "action" changes from "attention" (passive state) to "intention" (pro-active state).

In self aware animals (e.g. those with a brain) cognition, meaning and intent with respect to an external object can often be described in simple terms, for example: enemy; fight or flight; food, eat; greet, etc. The nonlocal component of information, although present and creating effect, is operating below the level of conscious perception in humans and results in "instinctual" subconscious behaviors in animals. Classical modeling of this autonomous activity describes it in terms of classical information and energy flow in the central nervous system and the brain. However, as QH suggests, non-locality is operating at all levels of activity, certainly there are resonances involving this non-local information

operating throughout all the cells of an organism in parallel with classical space-time functions as described earlier in this paper.

The results for intentional effects of non-locality should be no more difficult to accept than the results for perception -- normal perception using the five senses. The resonant condition (PCAR) implies a symmetry whereby information flows in both directions between the object and the percipient such that each is both target object and percipient to the other. Only the complexity of the more ordered normal sensory mechanisms suggests a non-symmetrical relationship. In general, humans seem to have great difficulty accepting that thoughts, specifically intentionality, can cause action at a distance (remember Einstein's "spooky action at a distance"). Yet, it has been observed for centuries and only in recent decades has it been subjected to scientific scrutiny.

The case of resonance conditions via PCAR to create remote effects by transfer of non-local information between equally complex percipients like humans is not difficult to understand. Indeed, hundreds of successful experiments have established the case. In all these cases no energy transfer is required, only nonlocal information, as each percipient / target object has access to its own energy source. The case for intentionality creating remote effects in inanimate objects is more puzzling. Teleportation of quantum states has been successfully accomplished for particles as described by Darling (2005) and now has practical applications in quantum computing. Numerous studies by Radin (1997), and earlier by Dunne and Jahn (1988) show that macro-scale objects can also be changed or moved, but the energy transfer mechanism by which the classical states of a remote object are affected remains elusive but perhaps is related to utilizing energy directly from the zero point field.

Summary and Implications

Someone recently requested the authors describe quantum holography and its implications in two pages, a very difficult task indeed. It has taken us considerably more than that to get here. Nature is extremely complex and does not give up her secrets willingly. Humankind's efforts at understanding her rests on the shoulders of countless dedicated men and women who have come before and are yet to come. Clearly we have a long way to go before we understand it all. Perhaps what is truly most amazing about nature is that it appears to be knowable at all. Our investigations into the nature of consciousness leads us to believe that the best way to survive and sustain humankind as a civilization and to thrive as well is dependent upon the emergence of a new world view, one that understands our proper place in the larger scheme of nature. This includes a worldview that properly addresses, in verifiable scientific terms, our collective relationship to each other, to the biosphere, to the environment, and to the entire cosmos. Towards that end, the evidence that we have presented suggests that we live in a universe that operates according to the following principles. It is:

- **Self-organizing** – All non living and living matter seems to be the result of the emergent complexity adapting and evolving in response to changes in the environment.
- **Intelligent** – The universe utilizes information, processes it and assigns meaning to it. It seems to evaluate new experiences against stored information and "chooses" actions based on that evaluation based on feedback mechanisms.
- **Creative** – All matter in the universe appears to be interconnected and communicates with itself to continually form more complex systems. These systems seem to regulate and organize themselves in ways that are flexible, adaptable and exhibit some form of purposeful behavior.
- **Trial and error** – The habits of nature, its laws, and its operating principles, seem to adapt and evolve by trial and error. The more successful an adaptation is the more it is reinforced. The less successful it is, the more likely it would be to atrophy and eventually die out or fade away into disuse.

- **Interactive** – All matter continually interacts with all other matter. There is no such thing as independent action. Everything is defined in relationship to everything else.
- **Learning** – Experience is retained in nature's memory, the Quantum Hologram. Once information is created it is always available and never forgotten.
- **Participatory** –The role of intention in conscious matter has demonstrable effect.
- **Evolving** – Since its beginnings, nature has been developing into ever increasing levels of complexity in response to environmental changes or pressures resulting from natural processes.
- **Non-locally connected** – All things in nature are interconnected in a very fundamental way beyond time and space. The exchange of information between any two objects occurs instantaneously no matter their space time separation and these interconnections cannot be shielded or attenuated.
- **Based on Quantum Principles** – From the micro scale of subatomic particles to the largest objects in the cosmos and everything in between, all matter displays the quantum characteristics of entanglement, coherence, correlation and resonance.

This universe seems, in some sense, to be a living, evolving, adapting universe that utilizes information to organize itself and to create ever increasing levels of complexity. We are a part of it and cannot be separated from it and are interconnected with it all. Furthermore it appears to be a self referencing system (see Figure 9). As nature learns, habits form and those that lead to useful outcomes solidify and effectively become "hard coded". Even then these "habits of nature" (including us) adapt and evolve by trial and error as change occurs. It appears that nature has bootstrapped itself not only into existence but has evolved itself into the current state of complexity that we now observe all around us. Most astounding of all is that humankind has evolved to the point that we can ask questions and have begun to gain understanding fundamental to nature's very existence. Perhaps, then, we and all sentient beings really are one of nature's way of knowing about and experiencing itself. Not only that, in some sense, we seem to be able to influence its very evolution.

Our hypothesis of interconnectedness and oneness suggested by quantum attributes and processes have been espoused by ancient sages, avatars, mystics, spiritual leaders and shamans throughout all times and by all cultures. Just as modern man has evolved from our ape-like ancestors, so too must we evolve to the next level of sophistication and refinement, and by inference our civilization as well. Change, adaptation to that change and evolution seem to be nature's intrinsic mandate built in to the very fabric of reality. All creation must either perish or constantly evolve. Nature has demonstrated this principle throughout its entire history and has seen to it that there are no alternatives. The arrow of time flows in one direction only.

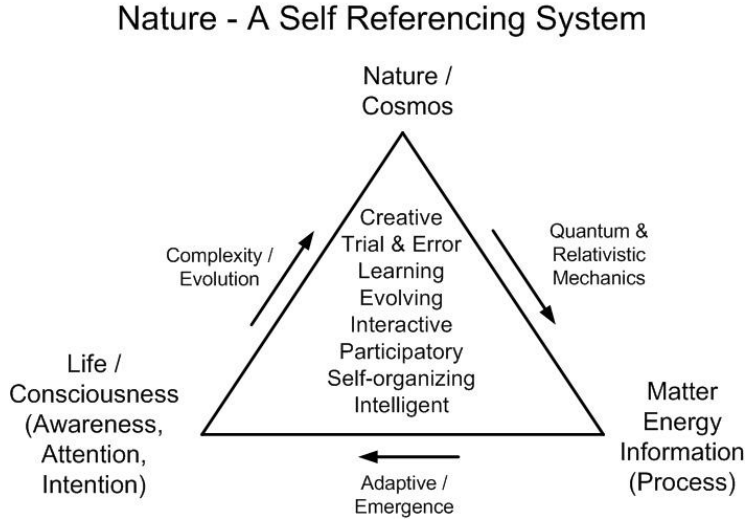

Figure 9 - Nature's Self Referencing Evolutionary Processes

We have presented our hypothesis as a map of reality that appears to match observations and experimental evidence fairly well. It seems to account for many phenomena in nature that here-to-for had no explanations to account for them. However, as we have said throughout this manuscript, the map is not the territory. Instead it is nothing more than a model of that territory that makes predictions about how the territory will behave under certain circumstances. We believe that the cornerstones of our theory are built upon known and verified properties and processes of nature and perhaps some yet to be discovered. However, like all theories in science, all that we have proposed is testable. Those parts of it that are not validated will have to be modified, revised or discarded and replaced. Such is the nature of scientific inquiry. At the very least we hope that we will encourage discussion and research to further enhance humankind's understanding of nature.

It has been said that democracy requires an informed electorate to thrive and prosper. It would seem that that is excellent advice in most areas of human endeavor. Sound bites, personal biases, self serving interests have no place if we are to adapt and evolve in our understanding. We must remain open, be willing and desirous to be informed and, most of all, willingly engage in learning and discovering new knowledge about this world in which we live and our true place within it. The issues we face are too important to ignore either by willful neglect or lack of understanding. Our survival and the survival of all life on earth depend upon it. For our future survival as well as for our external reality and the nature of existence it all boils down to whatever meaning we want to give them.

We leave you this ancient Sanskrit proverb:

God sleeps in the minerals,
Awakens in plants,
Walks in animals and,
Thinks in man.

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