If you can’t see me, am I really there?

- questioning contemporary western society‘s notions on how we view reality.

Abstract

"With our thoughts we create the world"
Siddhartha Gautama, Buddha[1]

In this paper I intend to explore the supposition, "If you can not see me, am I really there?" Humans have been asking questions about the nature of our reality since the beginning of our time on earth. Different cultures have devised their own answers to the big questions of life, often forming strict religious practices around their beliefs.

In the early 1900's a group of scientists began what was to be a revolutionary paradigm challenging traditional western beliefs. Early investigation into quantum physics was restricted to the study of less than microscopic particles, but as technology increased it allowed scientists to explore increasingly larger systems and relate them to the human experience.

How do we perceive reality? Cultural and societal influences play a large role in our view of the world around us, but beneath the surface are the effects of quantum physics playing a role in the way we see?

Quantum physics states that matter can be seen as both wave and particle forms, depending on the effect of the observer. The theory of non-locality or Copenhagen Interpretation states that particles exist in a state of possibility and only collapse into a measureable value when observed.

Recent research postulates that the brain may actually interpret the world in a holographic manner, translating waveform information received from the visual cortex into the recognisable images that we think we see. I say think we see because the brain seemingly edits the information received and allows us to view what it feels is relevant to our situation, stimulating basic survival responses, e.g. fight or flight.

[1] Buddha, http://www.all-famous-quotes.com/Buddha_quotes.html, 9.9.09

Does this mean that we are able to control our reality? If you can not see me, am I really there?" Investigation into quantum physics seems to be looking at the very essence of what it is to live on this earth. It requires the opening of the mind to allow new pathways of thought to be considered, but perhaps it brings us back full circle to where we began, just with a greater understanding of the path we are taking.

The research into quantum physics provided potent inspiration for a series of sculptures and paintings which seek to portray a sense of heightened awareness, the notion of the vibratory nature of reality and attempts to evoke a subconscious response in the viewer. The work endeavours to portray a sense of the entangled nature of reality, the moment before waveforms collapse when they are affected by the observer effect. Creating a sense of energy and light, relying on speed of movement, action, and resonating colour. The potential of energy before it coalesces into reality.

Index

Title

If you can not see me, am I really there?
- questioning contemporary western society‘s notions of reality.

Topic

The title, “If you can not see me, am I really there?” poses the questions; do we all see the same thing? Do we have the same experience of reality? This paper investigates scientific theory in an attempt to come to some conclusions on the big questions in life. The research topic provides a platform on which to explore a new series of creative work influenced by conclusions drawn from the investigation.

Declaration

I hereby declare that this research paper is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.[2]

L.J. Wedding-Marchioro

[2] http://www.phys.unsw.edu.au/~jw/thesis.html 20.11.09

Acknowledgements

I would like to express my gratitude to all the people who have helped me in the course of this master's degree. Mentors Deb Jones and Greg Johns for generously inviting me into their studios and providing guidance and a listening ear, supervisors Gabriella Bisetto and John Barbour for their insightful advise and direction and lecturer Greg Donovan for his continued calm presence and humour in the face of chaos.

Also many thanks to Jenny Austin for taking this ride with me and deepest thanks to my family, members absent and present for their support and love in all my endeavours.

Introduction

If an angel was to tell us about his philosophy ……..many of his statements might well sound like 2 x 2 = 13.
Georg Christophe Lichtenberg, Aphorisms[3]

What is reality? Is it a concrete experience?, set in stone and unchanging, a linear history of events experienced by all in the same way, or is reality subject to our own experience, created by the observation of events, just an illusion created by our brain to satisfy our innate need for the solid substance of existence. This paper seeks to investigate the science of quantum physics to search for answers to some of the questions which at some point in our lives many of us ask. What is the nature of the reality in which we live? In the past western society has looked to religion to answer the big questions of life, but as technology advances we find ourselves surrounded in a field of information, available to us at a moments notice, everyone of us creates our own reality based on our beliefs and inclination to step outside our own sphere of comfort, as Siddhartha Gautama, (Buddha), said, *"Believe nothing, no matter where you read it, or who said it, no matter if I have said it, unless it agrees with your own reason and your own common sense".*[4]

This paper seeks to offer a brief description of the physics of the societal view of reality, looking at how our perceptions have changed through history and how our advancing scientific knowledge has led to a greater understanding of the deeper meaning of reality.

Comment is made on the development of a new series of work based on the research of the scientific background which colours the way we process information to form our opinions.

[3] McTaggart, Lynne, The Field, the quest for the secret force of the universe, (HarperCollins Publishers, Great Britain, 2001)
[4] http://www.all-famous-quotes.com/Buddha_quotes.html 13.09.09

Historic and world views of reality OR a brief overview of how reality was viewed in history

This universe, that I have extended a thousand times…..has now shrunk to the confines of my own body. Thus God likes it; so I too must like it.

Galileo Galilee[5]

From the dawn of time humans have questioned their place in the world. Complex mythology was devised in every culture to explain the mysteries of existence. Ancient astronomers scoured the skies for portents which could change the history of the world, today we are still scanning the skies, looking for answers.

Early man lived his life by the seasons, planting, harvesting and travelling according to the movement of the stars. A deep connection was made with the world, an understanding that every system relied on another for its existence.

Greek philosophers first began questioning the nature of reality back in the sixth century in a culture when science, philosophy and religion were considered to be one, they saw no distinction between the animate and the inanimate and philosophy was considered a mystical pursuit. Early schools of philosophy were "hylozoists" or "those who think matter is alive". [6]

Towards the fifth century the idea of the division of spirit and matter took hold. The concept of a Divine principle began with the Eleatic school, the idea of a separation between spirit and matter and with this the idea of Duality began which was to take hold and become the main paradigm of Western philosophy. Philosophers began to contemplate the spiritual world rather than the physical.

---

[5] Durant, Will and Ariel, *The Age of Reason* (Simon & Schuster, New York, 1961)612
[6] Capra, Fritjof, *The Tao of Physics*, (Shambhala Publications, Boston, 1999)

The first science of space was developed by the Greeks who had also developed the first streamlined alphabet,[7] the repeated use of which over a period of time reinforced the notions of abstraction, linearity and continuity, three concepts which underpin the Greek concept of reality. The Greek mathematician, Euclid, organised the concept of space into a field which became known as geometry, space became subject to rules and developed a series of five postulates, or proofs, which bound reality into a uniform and homogenous whole[8]. Euclid surmised that space was essentially empty, having no substance, but filled with the objects of reality.

While the Greeks continued to believe in the interference of the Gods, their timeline remained cyclical, aligned to the seasons the rise and fall of the rivers and periodicity of the heavenly bodies. Aristotle demythologized this religion, turning the three weavers of fate into past, present and future[9], by doing this he was able to turn time into a linear experience, and thus the concept of creating a history was possible.

The ideas that were formulated by the early Greeks were embraced by consequent civilizations during the classical period (400 B.C. to 400 A.D), and only with the Council of Nicaea[10], and Christian concepts of space, time and reality became dominant were they challenged.

Christian philosophy demanded that reality was viewed purely as a construction by the Word of the Divine being, the earth being the centre of all attention, the land flat and all celestial bodies rotating around a central creation which had been manifested 5000 years before. To believe in anything else labelled one a heretic and as such, subject to torture and eventually death.

Nevertheless, cleric, Nicholas Copernicus (1473-1543), felt drawn to investigate the heavens. Convoluted theories had been constructed to explain the strange orbit of the planets, Copernicus put forth the supposition that the Sun and not the Earth was centre of the universe, and the planets revolved around the Sun. Being a man of the cloth, Copernicus knew he would suffer persecution if his theories became widely known and so left instructions that his theories not be released until after his death.

---

[7] Schlain, Leonard, Art & Physics, (Morrow, New York, 1999), 30
[8] Ibid, 30
[9] Schlain, Leonard, *Art & Physics*, (Morrow, New York, 1999), 32
[10] Council of Nicaea was convened by the emperor Constantinople to bring together the disparate sectors of Christian belief and sort them into one homogeneous whole called the Bible.

Inspired by Copernicus, Galileo Galilee raised his telescope to the heavens and formulated a theory of relativity, based on his observations. Galileo was the first to discover the theory of inertia, and also the laws of the pendulum and therefore influenced the building of better clocks. This ability to measure time brought about the concept of speed, the distance travelled in space in a certain amount of elapsed time[11], and so the fundamentals of space/time evolved. As Copernicus had feared, Galileo found himself interrogated by the Inquisition for heretic beliefs[12] and rather than face the rack, he recanted his beliefs and spent the remainder of his life under house arrest, ironically, close to blindness as a result of having stared into the sun with his telescope trying to discover the secrets of the universe.

In 1687, Isaac Newton published his *Principia Mathematica*, a work which brought about a new scientific paradigm, encompassing discoveries in gravity, motion and light, seemingly solving the mysteries of the world and consigning God to the role of Grand Designer.

The underlying message of the text implied that the world should be as understandable as the workings of a clock; everything reduced to a mechanism explained by the realm of mathematical calculation.

Newton contained the world into five commonsense stances or laws; Determinism, Physical Reality, Seperability and Reduction[13]. These laws became the cornerstone of western scientific thought, Newton's theories formed a solid basis to move man into a new era of independence, no longer reliant on the capricious whims of the gods; science was to become the new paradigm.
For two hundred years Newton's theories reigned supreme, all questions could be answered within the Newtonian framework, many scientists made comment that the book of physics could now be closed.

---

[11] Schlain, Leonard, *Art & Physics*, (Morrow, New York, 1999), 62

[12] Heretic beliefs - Those whose beliefs or practices which deviated sufficiently from the orthodoxy of the Catholic Church became the object of efforts to bring them into the fold. Resistance often led to persecution. The Inquisition was a permanent institution in the Catholic Church charged with the eradication of heresies. In 1616 these consultants gave their assessment of the propositions that the Sun is immobile and at the center of the universe and that the Earth moves around it, judging both to be "foolish and absurd in philosophy," and the first to be "formally heretical" and the second "at least erroneous in faith" in theology.
http://galileo.rice.edu/chr/inquisition.html

[13] Rosenblum, Bruce and Kuttner, Fred, *Quantum Enigma, Physics encounters consciousness,* (Oxford University Press, 2006) 32

In 1905 a young scientist appeared whose questions about the universe couldn't be so easily answered, Albert Einstein. Initially lacking the mathematical ability to answer his questions, Einstein was 26 when he burst onto the scientific scene, unveiling his "Special theory of relativity"[14]. Newtonian notions of space, time and light are commonsense and self evident, Einstein threw every thing up in the air by stating that space and time are relative and only the speed of light is constant, perceptions of the world being observer dependant.

These discoveries exploded the field of physics into a whole new direction. The special theory of relativity also challenged the idea that the world outside our conscious is an objective reality[15]. Throughout history philosophers and scientists had based their view of reality on the precept that regardless of where you were or how fast you were moving the world outside was not affected by you. Einstein's formulas introduced the notion of subjectivity; he was known to have said; "Something that is *'real'* for one observer, but an *'illusion'* for another, depends solely upon ones point of view". This statement is an accurate definition of subjectivity[16].

The quantum effect

Alice laughed. "There's no use trying", she said: "one can't believe impossible things."

"I daresay you haven't had much practice", said the Queen. "When I was your age, I always did it for half an hour a day. Why sometimes I've believed as many as six impossible things before breakfast."

Lewis Carroll [17]

Quantum physics deals with the very substance of reality, matter, the universe at its most elemental level. In the early 1920's a discovery was made which was to radically change and disturb scientific minds, that of Quantum Physics. Albert Einstein was heard to describe it as

[14] Special theory of relativity is based only on two simple postulates: 1. The laws of physics are the same in all inertial (=non-accelerating) reference frames, and 2. The speed of light in free space is constant. http://www.thebigview.com/spacetime/relativity.html 9.10.09

[15] Schlain, Leonard, Art & Physics, (Morrow, New York, 1999), 136

[16] Ibid, 137

[17] Carroll, Lewis, *Through the Looking glass; and what Alice found there*, (Macmillan, London, 1927)

"Spooky action at a distance", and was never comfortable, nor able to wholly condense it into his theory of relativity, although he never denied its existence.

Four scientists were instrumental in the discovery of quantum physics, Max Planck, a physicist specializing in thermodynamics discovered that light consisted of chunks of energy called "quanta"[18]. Following this research, Einstein was able to deduce that not only light but matter may come in quanta, later to be named photons and continued experimentation to establish his light-photon effect, using the double-slit experiment[19] to explain his theory, (see figure 1).

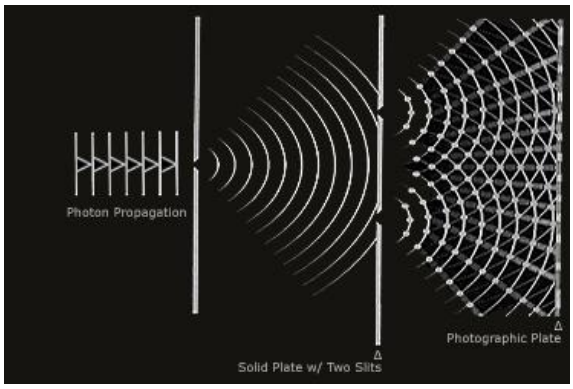


Figure 1
Diagram of the double slit experiment[20]

The double slit sets aside causality, determinism, and the notion that reality is "out there" as it blurs the line between the observer and the system being observed. In the double slit experiment, a series of single photons (light particles) are fired at a solid plate that has two slits. On the other side of the solid plate, a photographic plate is set up to record what comes through those slits. The question: What will we see on the photographic plate? The answer: If one neglects to observe which slit a photon passes through, it appears to interfere with itself, suggesting that it behaves as a wave by traveling through both slits at once. But, if one chooses to observe the slits, the interference pattern disappears, and each photon travels through only one of the slits.

---

[18] Electrons vibrate at a constant energy without losing any to radiation, then randomly without cause, or impressed force, they suddenly lose a quantum of energy, radiating it as a pulse of light.
Rosemblum, Bruce, Kutter, Fred, Quantum Enigma, Physics encounters consciousness, (Oxford University Press, New York, 2006) 56
[19]Donley, Carol C., Friedman, Alan J., *Einstein as myth and muse*, (Cambridge University Press, Cambridge, 1985)

[20] ibid

The formation of the interference pattern requires the existence of two slits… But how can a single photon pass through two slits simultaneously? At that point, we are forced to consider each photon as a wave that travels through both slits… Or we have to think of the photon as splitting and going through each slit separately — and wondering how the photon "knows" a pair of slits is coming. The only solution is to abandon the idea of a photon — or any other quantum system — as having a location in space-time until it is observed.[21] These discoveries were to lead to his ground breaking theory of special relativity which states that observation of an event is relative to the viewer.

Figure 2
"Can you see what I see?"
Enamel on paper
100 x 120

Work based on the wave/ particle theory in quantum physics.

[21] http://theobservereffect.wordpress.com/the-most-beautiful-experiment/, 10.9.09

Neils Bohr, using research already made into quanta established that electrons revolve around a nucleus and was able to calculate specific spectrum of frequencies of light unique to each element, which were discharged when the element became "excited".

Later in his career Bohr was also instrumental in forming the Copenhagen interpretation, which asserts that observation produces the property observed[22]. Louise de Broglie, a student of Einstein's expanded on the idea that light is both wave and particle proved through mathematical calculations that matter also came as both wave and particle.

The work of these four scientists laid the basis for the theory of quantum physics firmly establishing that not only light but matter appears as both wave and particle. This anomaly became the inspiration for the Quantum series of paintings, which explore not only the paradox of matter appearing as both wave and particle, but the concept of quantum entanglement or non-locality.

"In classical physics the mass of an object has always been associated with an indestructible material substance. Relativity theory has shown that mass has nothing to do with any substance, but is itself a form of energy. Energy however is associated with a dynamic quantity associated with activity or process. The fact that the mass of an object is associated with a certain amount of energy means that the particle can no longer be seen as a static object, but has to be conceived as a dynamic pattern, a process involving the energy which manifests itself as the particles mass."[23]

This would mean that when you view an object you are not looking at the solid object you perceive it to be but a collection of vibrating molecules held together by the force of observation and belief. Initially the science of quantum physics was thought to apply only to objects of the molecular level but recent research is proving that all aspects of the world from the minuscule to the universe are governed by the laws of quantum physics.

Physicist's N. David Merman of Cornell University Ithaca, N.Y., interpretation of Quantum Physics is the most widely accepted; being that the basic elements of physical reality aren't individual objects, but the relationships between individual objects. Physics therefore is not about atoms, molecules and quarks, but it is the relationship between those objects which is fundamental. Apply that on a larger scale and you begin to see that everything is directly affected by its relationship to what is around it, we have a direct and relational effect and connection not only other human beings, but the wider environment surrounding us.

---

[22] Rosemblum, Bruce, Kutter, Fred, Quantum Enigma, Physics encounters consciousness, (Oxford University Press, New York, 2006) 100

[23] Capra, Fritjof, *The Tao of Physics*, (Shambhala Publications, Boston, 1999), 77

The observer effect

Moments are not universal; the present is a parochial concept, valid for each observer, but with a different meaning for any observer in any other inertial frame.[24]

One of the core precepts in quantum theory is the concept of entanglement. Physicists now believe that entanglement between particles exists everywhere, affecting not only atomic and microscopic particles but the general world and the way we relate to and inhabit our environment.

Studies into the theory of entanglement show that when two particles have come into contact with one another, they become entangled. In certain situations a measurement made on one particle, (known as an EPR measurement, for Einstein, Podolsky and Rosen), appears to affect instantly the properties of the other particle, no matter how far apart the two particles are[25]. The rotation or speed of the particle measured is also directly affected by the effect of an observer. The particles only collapsing into a measurable value upon observation, until then the particles exist in a state of potentiality, undecided what form to take. This instant communication between particles seems to directly violate the laws of relativity as anything moving at faster than the speed of light is actually moving backward in time.

Tests have been conducted with two photons which had been in contact with one another to find out how they would react. The photons are separated and transported to different locations at any distance from one another. The expectation is that the photons tested would come back with varying results depending on their outside influences, but results showed that on measurement of one photon, the other was directly affected, showing that the photons were communicating instantaneously to one another over space and time, faster than the speed of light[26].

---

[24] Donley, Carol C., Friedman, Alan J., *Einstein as myth and muse*, (Cambridge University Press, Cambridge, 1985)
[25] This phenomenon is known as Bell's Inequality principle.
[26] This phenomenon is known as *Violation of Bell's inequality*.

Albert Einstein was aware of this experiment and refused to accept non-locality as it violated his special relativity theory, calling it "*spooky action at a distance*".[27]

The notion of entanglement [28]changed the world of physics; matter could no longer be considered a separate entity. Particles that had been in contact with one another would continue to communicate their influence indefinitely; *the world at its most basic exists as a complex web of interdependent relationships, forever indivisible*[29]. This would mean that not only particles but ultimately all objects in the universe[30] would be connected with one another through the laws of non-locality.

One of the main features of quantum physics is that the observer[31] becomes crucial in the measurement of the properties of a particle. Experiments have shown that particles exist in a state of superposition or potentiality until they are affected by the observer[32]. This means that a particle exists in the possibility of infinity different states until an observer begins to define the properties of the experiment, at which time the wave/particle function collapses into the expected outcome. The particle does not exist as such until it has interacted with the observer. "*What we observe is not nature, but nature exposed to our method of questioning*".[33]

The gedankenexperiment (thought experiment) has proved to be very useful in quantum theory. Physicists often conduct thought experiments prior to an actual experiment or when a particular physical experiment is impossible to conduct. (It was Einstein's gedankenexperiment of chasing a light beam which resulted in Special Relativity theory.)[34]

---

[27] McTaggart, Lynne, The Intention Experiment, (Free Press, New York, 2007), 8
[28] Entanglement is also known as non-locality.
[29] McTaggart, Lynne, The Field, the quest for the secret force of the universe, (HarperCollins Publishers, Great Britain, 2001) 11
[30] The laws of non-locality apply not only to the micro structures of experimentation but to the macro structures, the very planets and stars, which although not in physical contact with one another as they are speeding away from each other at a rate higher than the speed of light, in the early moments of the big bang, during Planck time, (the first 10-35 second following the big bang), all parts of the universe were in contact with each other.

[31] Observer – The person, who is conducting the experiment, decides upon a result and affects the action of the particle in question.
[32] Copenhagen Interpretation – that sub atomic particle exist in a state of potentiality.
[33] Capra, Fritjof, *The Tao of Physics*, (Shambhala Publications, Boston, 1999), 140
[34]http://theobservereffect.wordpress.com/schrodingers-cat/ 14.9.09

The most famous gedankenexperiment was published by Erwin Schrödinger in the mid 1930's. To explain wave function collapse in relation to large objects, he imagined putting a live cat into a steel chamber, along with a very small amount of a radioactive material tied to a Geiger counter, which was rigged to a vial of poison.

If even a single atom of the radioactive material decayed during the test period, a relay mechanism would trip a hammer, which would, in turn, break the vial of poison and kill the cat. Then Schrödinger imagined sealing the steel chamber shut.

Because the steel chamber is sealed, an observer cannot know whether or not an atom of the radioactive material has decayed, and consequently, cannot know whether the vial has been broken, the poison released, and the cat killed. According to quantum theory, since we cannot know, the cat is both alive and dead for as long as the chamber is sealed, in a superposition of states. It is only when we open the chamber and observe the condition of the cat (thereby collapsing the wave function), that the superposition is lost and the cat becomes either alive or dead.

This paradox demonstrates that observation itself affects an outcome, as an outcome, as such, does not exist until it is observed.[35] *This paradox demonstrates that observation itself affects an outcome, as an outcome, as such, does not exist until it is observed.*[36]

The quantum series of work seek to capture the spirit of entanglement or non- locality, the moment just before wave function collapses and the object observed comes into being. As all objects remain in a state of potentiality until observed, then the subject of the painting could be whatever the viewer desires.

---

[35] http://theobservereffect.wordpress.com/schrodingers-cat/ 14.9.09
[36] ibid

The works have been given titles to inspire the viewer to create a story for themselves, in the same way as the Buddhist Koan[37] the title seeks to inspire reflection on the subject. The work seeks to create a connection with the viewer encouraging them to ponder on the nature of reality, and how as Siddhartha Gautama, Buddha said, "*Our thoughts create the world*"[38].

Figure 3

If you can't see me, am I really there?
Enamel on canvas
100 x 100

In figure 3, the painting "*If you can't see me, am I really there?"* invokes a sense of playfulness, almost reminiscent of a game of hide and seek. At the same time provoking a philosophical debate, how do we know what is true, is it based on faith?

[37] Buddhist koans are small presentations of the nature of ultimate reality. Most koans involve a paradox that cannot be solved by reason or intellect. The resolution forces the student into a different level of consciousness or comprehension.
[38] Buddha, http://www.all-famous-quotes.com/Buddha_quotes.html, 9.9.09

Perhaps it is an unquestioning belief in what others who seem far more knowledgeable have said; does our cultural upbringing tells us what is true. What has always been so will always stay the same, or is it a process of education whether voluntary or forced that creates the parameters for our sense of truth, what is real.

The research into quantum physics creates a paradox; conventional thought would have us believe that when viewing an object it is a solid presence, unyieldingly real and not to be questioned, a table is a table. Quantum physics tell us that the table is in reality made up of a series of vibrating particles whose presence only inhabits the space because we expect it to manifest as a table. The question remains how is it that we all see a table?

How the brain sees

The seeing plays the most important role in Buddhist epistemology, for seeing is at the basis of knowing. Knowing is impossible without seeing; all knowledge has its origin in seeing. Knowing and seeing are thus found generally united in Buddhist teaching. Buddhist philosophy therefore ultimately points to seeing reality as it is. Seeing is experiencing enlightenment.[39]

When we view the world around us what we are seeing is not a reality unchanging and set in stone but a construct created by our own mind, coloured by expectation and life experience.

Light in the nature of vibrational waves of different frequencies floods through our eyes and transfers a jumble of information to the primary visual cortex where it is transmitted through receptors into the brain. The data is filtered into different subsystems and processed according to the nature of the information, the brain has over thirty different section devoted to this task. Neuroscientists call this parallel processing and believe it is done to make the process of vision seem instantaneous.

[39] Suzuki, D.T., *On Indian Mahayana Buddhism*, (Schocken Books, New York, 1963), 235

Our eyes are only able to capture static images which travel to the back of the brain where they are edited and modified by the temporal lobe before being incorporated into the sensation of seeing movement. The brain acts as a filter only processing certain aspects of the scene , picking out key things to register. The eyes work as slaves to the attention system of the brain. Actively deciding what is relevant, the brain actually processes very little of what comes in through the eyes.

Much of what we think we are seeing is actually a construct of the mind. The brain is constantly generating reality, it invents, ignores and distorts the information received through the eyes. As much information as comes into the brain and is sent to the memory system is sent back the other way to be processed.

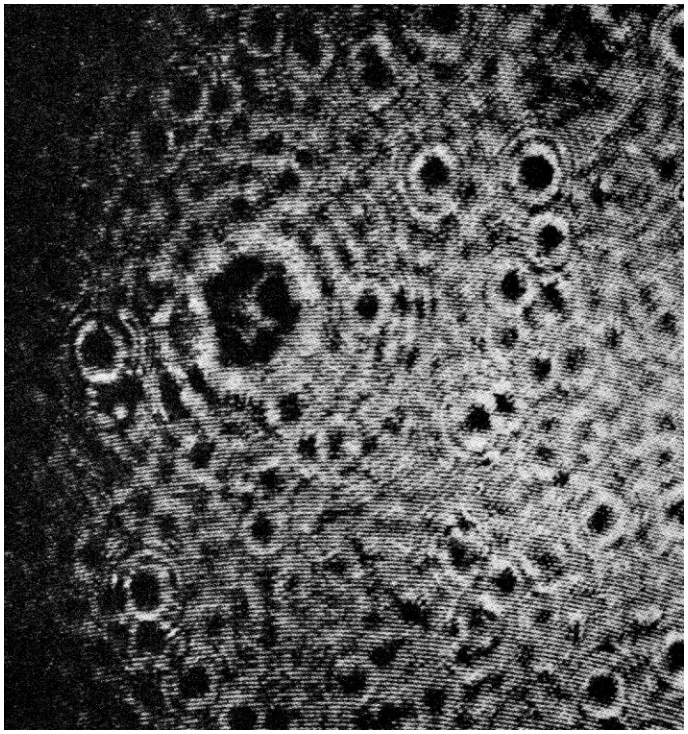


Figure 4
A piece of holographic film containing an encoded image. To the naked eye the image on the film looks nothing like the object photographed and is composed of irregular ripples known as interference patterns. However when the film is illuminated with another laser, a three dimensional image of the original object appears.[40]

[40] Talbot, Michael, The holographic universe, (HarperCollins Publishers, New York, 1991), 16

Pribram concluded that the visual cortex is able to process information in the same way, reading light wave frequencies to create a type of internal hologram with which to view the objects of reality. As with a hologram, see figure 4, it has been concluded that the brain is encoded with information throughout its matrix and is able to function even when parts of it have been removed.

The brain will often take short cuts to seeing, assuming that what it has seen and experienced in the past will be recreated and so rather than processing new information it will just use information stored in the memory to fill in the gaps, visual memory influences what is right before your eyes. The eye actually has a large blind spot in the centre of the retina, which causes large blanks to appear in our vision; this does not affect the image we see as the brain uses its own judgment to fill in the gaps according to its expectations.

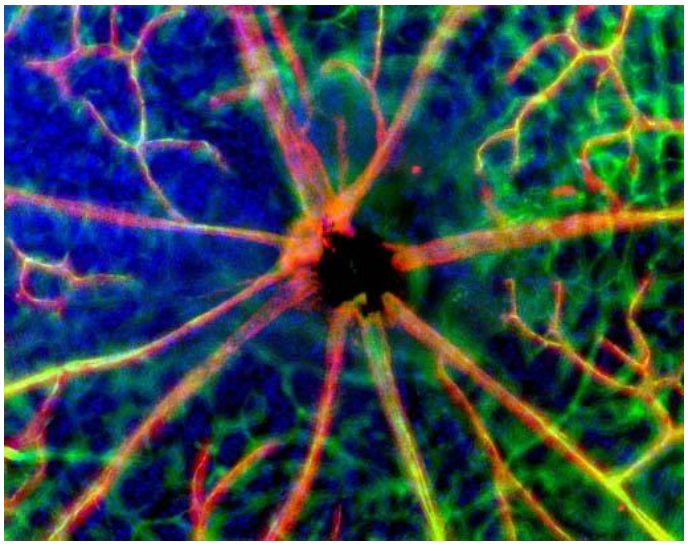


Figure 5
Blind spot in the eye[41]

Experiments on the attention system have been conducted in which the participants have been instructed to count how many times a basketball is passed to others in their team, the viewer is so intent on counting the passes correctly that they fail to notice a person dressed up in a gorilla suit strolling around the basketball field. This phenomenon is called sustained inattention blindness.[42] The brain was so busy concentrating on the task at hand that it does not consider that the gorilla important information and so totally discounts that information.

[41] http://www.nikonsmallworld.com/gallery.php?grouping=year&year=2005&imagepos=36, 10.9.09
[42]http://codeidol.com/other/mind/Attention/Make-Things-Invisible-Simply-by-Concentrating-(on-Something-Else)/

This is why it is so easy to fool the brain into believing optical illusions and magic tricks. Subconsciously the brain is aware of discrepancies but does not pay attention to detail as it is focusing only on the information which it regards as important.

In the Ponzo illusion the converging parallel lines tell the brain that the image higher in the visual field is further away therefore the brain perceives the image to be larger, although the two images hitting the retina are the same size.[43]

Physical tests have shown that when a subject is shown the illusion and asked to pick up the bars, although the brain has told them that one object is larger, the subconscious knows that not to be true. Computer analysis on the way a subject picks up the bars in question, shows that the fingers work the same way for each, holding them the same distance apart in an unconscious action.[44] This would mean that the brain is working on two levels, the deeper subconscious not informing the conscious brain information it regards as unimportant.

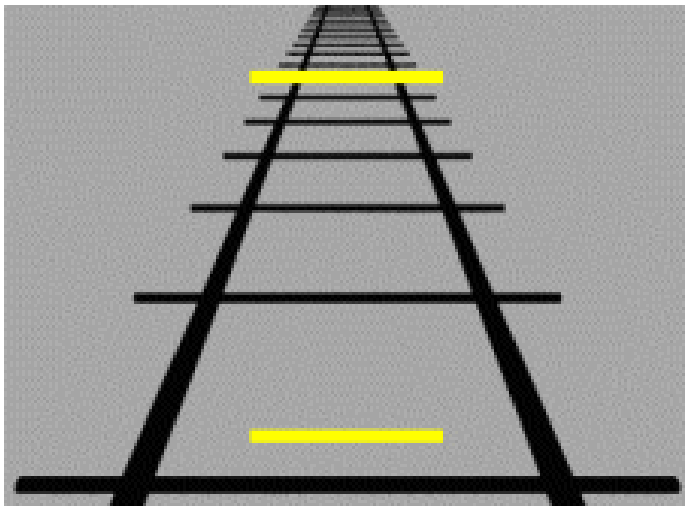
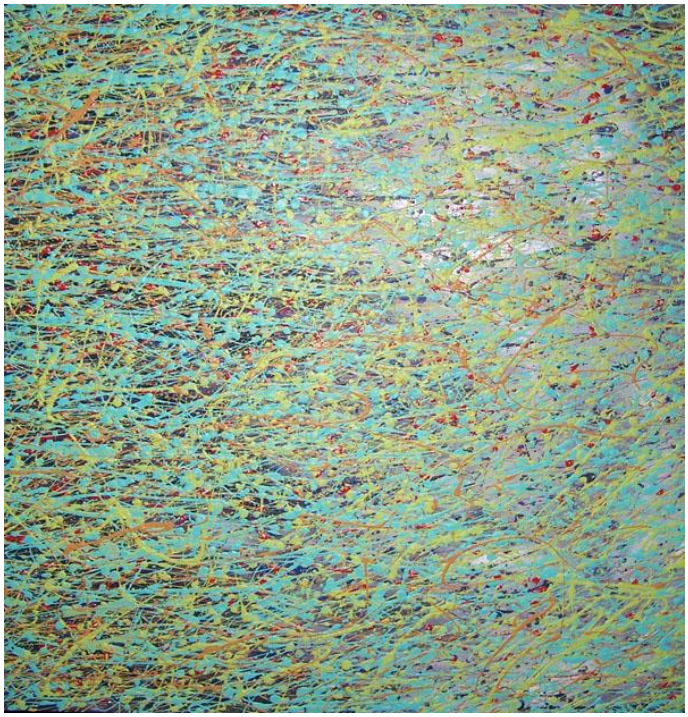


Figure 6, Ponzo Illusion[45]

The brain is made up of three sections which have been added to during the evolutionary process, the most ancient section is the reptilian brain which includes the cerebellum and the brain stem this section controls the fight or flight mechanism our first response to visual stimuli.

[43] http://www.123opticalillusions.com/pages/Ponzo_illusion.php
[44] Brain story, the minds eye, http://ww.abc.net/compass/s249014.htm, 13.9.09
[45] http://www.123opticalillusions.com/pages/Ponzo_illusion.php , 14.9.09

This part of the brain often overrules the information received by the higher orders of the brain the limbic system[46] and the Neocortex[47], making decisions on the relevance of visual information received. Thus depending on the state of mind of the observer an event may be viewed as either a threat or neutral. For example walking around a corner – bumping into a stranger if the observer is feeling confident the stranger is seen as shorter or smaller, more helpless and less threatening than in reality, whereas if the observer is feeling threatened the stranger will be seen as being larger, more aggressive and possibly carrying a weapon[48], this explains why when witnesses to crimes are asked to describe an event the resulting testimonies often come back with surprisingly different results depending on the emotional state of the witness.



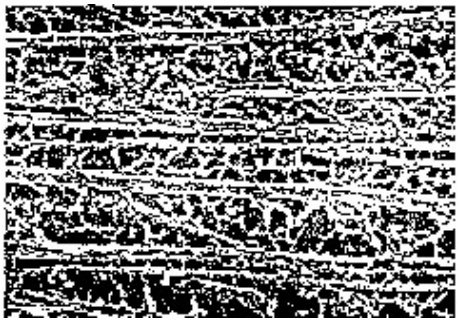


Figure 7, Left

Cool dappled sunlight
Noisy silence fills the air
Sense of peace prevails.[49]

Enamel on canvas
100 x 100

Figure 8, Above

Microtubuli and neurofilaments[50], the lowest neurophysiologic level, at which quantum processes have been proposed as a correlate to consciousness.

[46] Limbic system, corresponds to the brain of the most mammals, and especially the earlier ones. The old mammalian brain residing in the limbic system is concerned with emotions and instincts, feeding, fighting, fleeing, and sexual behaviour, everything in this emotional system is either "agreeable or disagreeable".
[47] Neocortex, also known as the superior or rational (neomammalian) brain, the higher cognitive functions which distinguish Man from the animals are in the cortex.
http://www.kheper.net/topics/intelligence/MacLean.htm 17.09.09
[48] http://www.perceptions.couk.com/perceptions.html#use 19.07.09
[49] Haiku, Wedding-Marchioro, L.J.
[50] http://plato.stanford.edu/entries/qt-consciousness/ 20.11.09

From these examples we can see that our perception of the world depends entirely upon the observer, their emotional state at the time and the variety of experiences and memories they have accumulated over time. No two people will experience an event in exactly the same way. Only fifty percent of the information received through the eyes is used to create an image the other fifty percent being made up of preconceived information taken from the memory and the expectation of what the brain expects to see. The brain may choose its own version of reality whether unconsciously or consciously, and over time may alter their memory of the event to fit.

Holographic universe and string theory

We human beings consider ourselves to be made up of "solid matter." Actually, the physical body is the end product, so to speak, of the subtle information fields, which mold our physical body as well as all physical matter. These fields are holograms which change in time (and are) outside the reach of our normal senses.

Itzhak Bentov
Stalking the wild pendulum[51]

Since the beginning of the discovery of quantum physics scientists have been trying to come up with a theory of everything to explain how the universe works. Many scientists agree that Superstring theory as proposed by Professor Michael Green and his associate Professor John Schwartz comes close to solving the mystery. Superstring theory suggests that the entire universe, space, time and gravity are made up of tiny string like objects that only appear to be different objects because of their different vibrational patterns[52]. This theory unites the science of the very large, (the universe) and the very small, (quantum particles).

[51] Talbot, Michael, The holographic universe, (Harper Collins, New York, 1991), 162
[52] http://www.superstringtheory.com/index.html 8.11.09

When the strings move in space and time they may cause space and time to curl up into waves, or form large flat sheets called membranes. This causes the universe to be divided into different levels or dimensions. Currently we have only four dimensions available to us, up/down, forward/backward, left/ right with the fourth dimension being time. According to string theorists the universe could be composed of up to eleven dimensions[53]. Living in our universe, subject to its laws and limitations, we would not notice these extra dimension because they are outside of our three dimensional consciousness, it would be much the same as a fish in a tank, seeing the hand on the glass and being totally unaware not only of the human behind it but that there is a whole world to be experienced out there behind him. We can not see the other dimensions because we do not know how to see them, how you see something depends on having the vocabulary and measuring tools to describe it.

Figure 9
You're not really there
Kiln fired painted glass,
50 x 40 x 120

In this piece, the glass has been painted in layers with the image created from a series of dots to form a three dimensional projection of a woman's face, using the ideas of the holographic universe and the theory that the objects in reality are made from particles vibrating at different frequencies as a conceptual basis.

[53]Stephen Hawking and the Theory of Everything, http://thetvdb.com ,

An extension to the superstring theory is the theory of the Holographic universe, first proposed by physicist David Bohm[54]. Similar to the superstring theory, the idea of the holographic universe states that the universe exists in a series of layers composed of waveforms which integrate to form an implicate order[55], a deeper level of reality than we are able to perceive. Humans exist on a level of explicate or unfolded order. The constant shifting between one layer and the other explains how a particle can appear as either waveform or particle, the particle manifesting on observation by a viewer, as physicist Nick Herbert said, this makes mankind a lot like King Midas in the fable, who could never know the touch of another as everything he touched turned to gold, *"Likewise humans can never experience the true texture of quantum reality, because everything we touch turns to matter"*[56].

The existence of a holographic universe may also explain why particles become non-local or entangled[57], when reality is organized in a holographic way the notion of location becomes nonexistent, as with a visual hologram all parts are existent in every piece of the picture. Bohm further explains his theory by stating that everything in the universe is part of a continuum, each part connected to each other, to illustrate his theory Bohm describes the analogy of eddies and whirlpools in a river. At first appearance these features seem to be separate events but looking at the larger picture you see that they all belong to the same occurrence, the river. Thus the idea of separate objects in space which western society has held onto for generations becomes a limited view, animate and inanimate each being connected and created from the same substance, matter does not exist independently from space, it is part of space.

According to research by Karl Pribram the brain also works as a hologram, transferring waveform interference patterns gathered by the visual cortex into a complex realities that make up the familiar objects of our world: *Our brains mathematically construct objective reality by interpreting frequencies that are ultimately projections from another dimension, a deeper order of existence that is beyond space and time: The brain is a hologram enfolded in a holographic universe*[58].

---

[54] Talbot, Michael, The holographic universe, (Harper Collins, New York, 1991), 46
[55] Ibid, 46
[56] Ibid, 34
[57] See page 12
[58] Talbot, Michael, The holographic universe, (Harper Collins, New York, 1991), 54

Research conclusion

The universe begins to look like a great thought, rather than a great machine.

Sir James Jeans[59]

Early in the history of western civilization society was heavily reliant on the movement of the stars to track their way through the celestial year, helping them to organise the planting and harvesting of crops and providing a belief system largely dependent on placating the gods to ensure abundance and harmony. As society became more civilized life became less about pure survival and people began to move away from their deep connection with the earth, believing themselves to be superior and separate from the world around them.

The discovery of quantum physics has brought us full circle back to the knowledge that everything in the universe is not only connected, but made up of the same material; matter. Experiments have shown that the observer has a direct relationship with the form of the world around us, the wave function of matter collapsing into particle form upon observation. The way our brain perceives reality seems to support this theory. As information received by the brain through the visual cortex comes in as wave formations to be processed by the neo cortex into a rendition of the reality we expect to see. The brain filters this information using a series of short cuts and the use of previous information gathered to give us a view of the world based upon our most basic instincts and cultural conditioning.

The brain has been found to exist in a holographic state with data stored through a system of neural connections, on injury being able to reroute information and still function. In a similar manner, scientists have speculated that the universe works also exists in a holographic state allowing the universe to work in a non-local manner[60], objects perceived become nothing more than particles vibrating at different frequencies transmitted and interpreted by our brains.

[59] Rosemblum, Bruce, and Kuttner, Fred, Quantum enigma, Oxford University press, New York, 2006, 51
[60] See chapter , the quantum effect.

Quantum physics may provide us with new ways of viewing the world, traditional views on reality come into question when presented with scientific evidence. It seems that we may have been tricking ourselves into complacency, seeing things only at surface value. Perhaps with new science we will find a new way of looking at our world.

Speaking about the work

"Zen art does not try to create the illusion of reality. It abandons true to life perspective, and works with artificial space relations which make one think beyond reality into the essence of reality. This concept of essence as opposed to illusion is basic to Zen art in all phases.[61]

Aims and objectives

The research into quantum physics and the nature of reality formed a basis for the creation of a body of work which explored possible creative solutions. To answer the question of the research, a number of different techniques were explored. This necessitated the acquisition of a range of new skills and experimentation with scale and processes.

Exposure to a variety of sculptural artists posed the question of the form and scale of the work. Although greatly admiring large scale monolithic steel sculpture I realised that it was necessary to find a way to express myself in a way I was capable of executing. Having come from a background as a glass artist, this experience often informed the work created, but I felt the need to expand the nature of my practice, using materials as needed rather than being tied to one technical process simply because that was how I had classified myself.

A different way of working was adopted, beginning with creating a series of paintings and drawings which were able to stand as works themselves but which informed the creation of the sculptural work. A crucial aspect of the creation of the work was a sense of enjoyment and fun in the execution of the process. The result of the emotional attitude when working is retained in the image as a residue to be read by the observer.

---

[61] http://arts.ucsc.edu/faculty/lieberman/zen.html 15.11.09

Paintings

Initial inspiration for the graphic images stemmed from the visual images of the brain's inner workings. The use of fluorescent cell imagery photography proved to be a potent starting place, dealing as it does with the microscopic elements of the human body, therefore reducing it down to a quantum level, as all these tiny elements put together create the one organism known as the human body, this reflected on a larger scale the way the humans interact with the world and the larger universe to create one organism. These images gave direction as to how the work would look, and provided inspiration for the initial visual information. Initially it was decided to work with graphic processes to allow the research to percolate and be generated as images. As I continued to paint the realisation that fractal patterns were emerging within the work gave rise to further avenues of research.

The knowledge that nature is created by never ending series of fractal[62] constructs fitted with the mathematical underlying framework, but what was interesting is that the very nature of painting, particularly the method which I was using, (laying the canvas on the floor and flinging the paint across), was also governed by its own fractal constructs.

[62]Nature builds its fractals using statistical self-similarity: the patterns observed at different magnifications, although not identical, are described by the same statistics.
Taylor, Richard , Micolich, Adam P. and Jonas, David, Can Science Be Used To Further Our Understanding Of Art?
http://www.phys.unsw.edu.au/phys_about/PHYSICS!/FRACTAL_EXPRESSIONISM/fractal_taylor.html

The very physical attributes of the artist control the mark making ability, determined by the height, reach of arm, the way the wrist may turn on application of the paint, all are controlled by the physics of the body. Each individual's body engages in a signature series of movements known as Levy flights.[63] The subject of fractals and Levy flights led to the investigation of the work of Jackson Pollock[64].

Inspired by Pollock's use of material, I founds that using acrylic house paint worked the best for the technique of applying paint being used. The liquidity of the material had the right flow to be flung across the canvas and certain wrist movements would create the wave/ particle effect used to reference the research in quantum physics. Working wet on wet to build up texture, exploiting the difference between flat painted sections and the build up of paint to create the appearance of a vibrational frequency, (see figure 10).

Initially the work seemed to follow in Pollock's footsteps, not intentionally but guided by the nature of the research. One wonders what he was thinking of when he was executing his paintings, possibly about the nature of chaos and its resonance with the world around us. In contrast I believe there is no chaos, only systems so complex that we have yet to decode them.

Not a great deal is known about Pollock's thoughts on his painting but it does seem that he was exploring his inner self, as in his quote, "*Today painters do not have to go to a subject matter outside of themselves. Most modern painters work from a different source. They work from within.*"[65]

---

[63] *Levy flights*: a special distribution of movements, first investigated by Paul Levy in 1936, which has recently been used to describe the statistics of chaotic systems.
Ibid 11/10/09

[64] Pollock's canvases seemed to create repeating patterns at different size scales—just like fractals.
http://discovermagazine.com/2001/nov/featpollock

[65] Jackson Pollock
http://thinkexist.com/quotation/when_i_am_in_a_painting-i-m_not_aware_of_what_i-m/304368.html
9.09.09

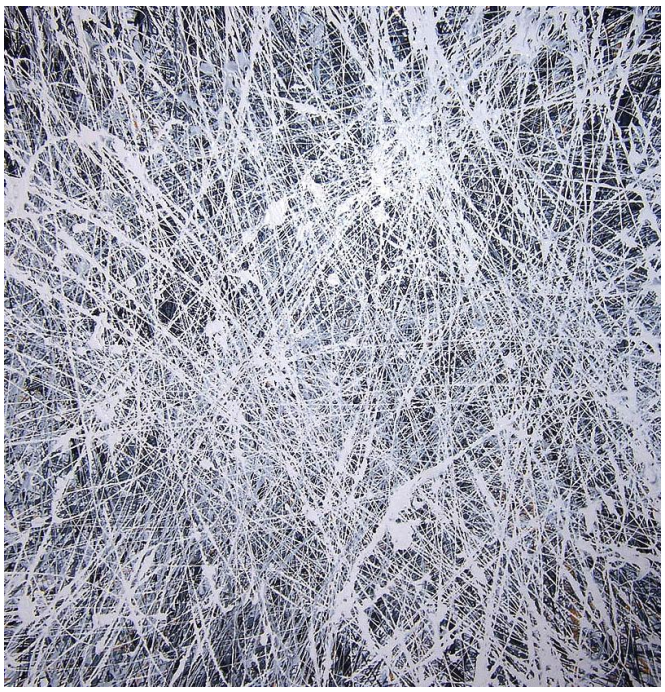


Figure 10

Endless variation
Shadows play underfoot
Scent of night descends[66]

Enamel on canvas
100 x 100

I found that the energy with which the paint was applied had direct involvement with the look of the work, fast concentrated effort was visually apparent, as was slower more contrived application. For best results the work had to be intuitive and spontaneous, not only in execution but with choice of colour.

Initially expression was formed through use of colour and energy of mark making. The colours used were strong discordant and contrasting shades set in juxtaposition to create their own form of energy and vibration, although this means of communication seemed natural, this proved to be a distraction from the message that was being portrayed as attention was brought to the colour and not the energy field which was being created. Further exploration of the subject was made controlling the tonal range to the black/ white range. This shift in focus produced a more focused result which led the way for the exploration into the three dimensional paintings and sculpture.

[66] Haiku, Wedding-Marchioro, L.J.

The physical constraint of a square canvas format was as a conscious decision, a reflection that in philosophically trying to work outside the square, I am, through my limited knowledge really only able to see through a very small window to a much greater source.

Eventually I was able to move away from the comparison with Pollock and began to find my own style, trying to build up surfaces reliant on visual energy, repetition of mark making and building up of the textural surface in an effort to create a vibrational tension. A reflection of the physical energy used by a series of quantum particles aligning themselves together to create an object manifested from the attention of the observer, in this case the viewer of the painting.

Sculpture

Exploring the subject in the field of painting enabled the work to move into a more sculptural form, bringing the work into a more dimensional form as related to in the physics concept of the holographic universe and string theory.

A wide variety of materials were used in the exploration of the theme; a consistent element in all works remained the development of the work appearing in layers, beginning with the pieces of sculpture in the "Delusions of consciousness" series, (figure 12), which had been inspired by a quote made by Albert Einstein *"A human being is a part of the whole, called by us, "Universe," a part limited in time and space. He experiences himself, his thoughts and feelings as something separated from the rest -- a kind of optical delusion of his consciousness."*[67] This work explored the notion of a human existence in dimensionality, knowledge accumulated in a lifetime which is added to a collective experience.

[67] Einstein, Albert, http://theplaceofdeadroads.blogspot.com/2005/05/einstein-optical-delusion-of.html , 25.10.09

With the advent of technology we have increasingly begun to see ourselves as individuals, separating ourselves in cocooned spaces from the world both physically and emotionally, a phenomenon which has caused many of the problems which we see in the world today, both in a humanitarian and ecological sense. It is only recently that Western society has begun a slight shift in consciousness back to the knowledge that we are all connected, every action having a reaction, and at a particle level as described in the entanglement theory of quantum physics.

Figure 11

Delusions of consciousness
Bronze, glass, copper, Monterey pine, enamel paint, water.
Approx. 140 x 70 x 55

The sculpture continued to follow a course directed by the research in to quantum physics, influenced by the graphic nature of the paintings. After experimentation with different modes of expression it was decided to create a series of three dimensional painting exploiting the textural qualities of the wood and using various grades of wire to simulate a sense of energy and movement. With these works a circular motif[68] was adopted, by combining this with the square[69] format, comment through symbolism is made on the connection between matter and reality and the aspiration to achieve a sense of oneness with creation.

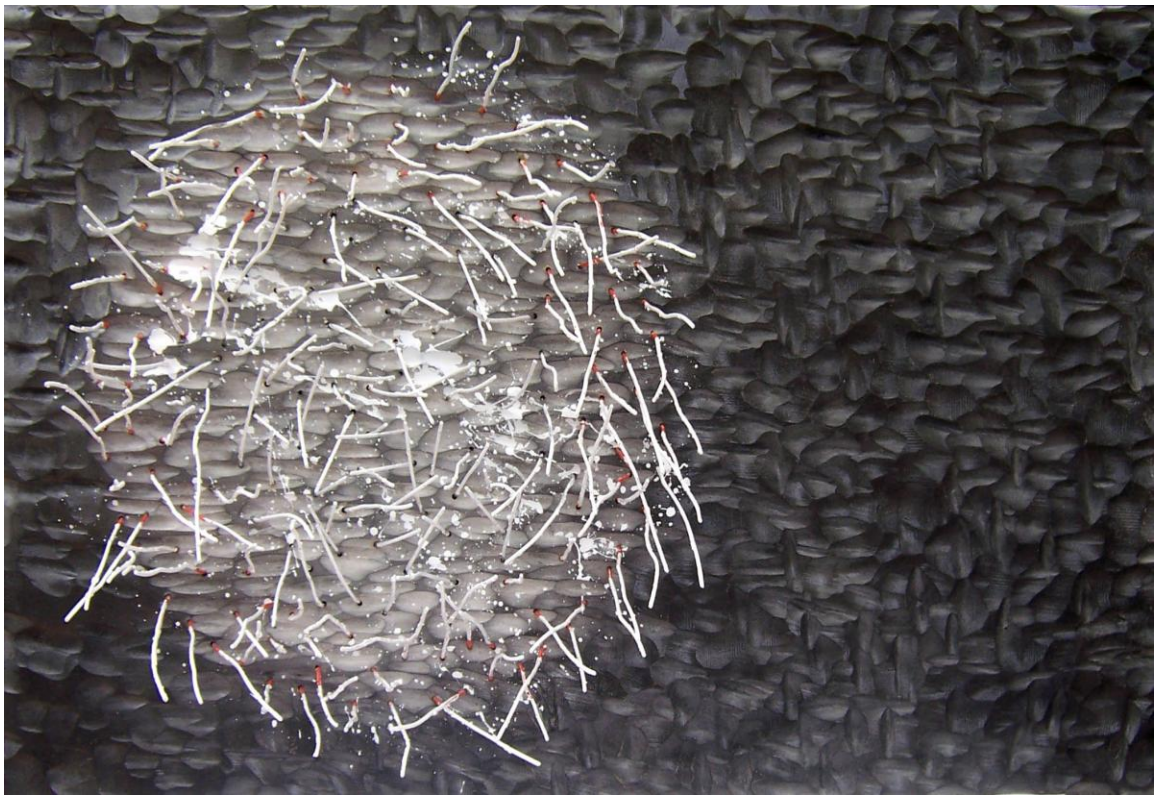


Figure 13

Light music

Particle board, galvanized wire, enamel paint, graphite powder and charcoal.

[68] The circle is a symbol of the self. It expresses the totality of the psyche in all its aspects, including the relationship between man and the whole of nature. It points to the single most vital aspect of life—its ultimate wholeness. http://www.albertchihwang.com/circle.html 17.11.09

[69]The square is a symbol of earthbound matter, of the body and reality. http://www.albertchihwang.com/circle.html 17.11.09

Methodology

Throughout the creation of the work a process of action research was undertaken, the practical work was heavily reliant on the research conducted into quantum physics and the holographic nature of the universe. The search for the best way to portray a sense of vibrational energy and the sublime involved experimentation with a wide range of sculptural materials, involving the acquisition of various new skills for working with the materials, such as welding, bronze casting and wood carving with power tools, specifically the arbortech[70]. Exploration into several new techniques such as the use of a laser cutter to cut intricate designs into Perspex sheeting involved the learning of computer software to generate images for the machine to work from. Other solutions involved the use of casting resin and glass for their clarity and potential three dimensional properties.

Throughout the creation of the work a Zen philosophy was maintained. A sense of spontaneity and confidence of movement, total immersion in the creation of the work, living in the moment and following of intuition. This was interspersed with periods of reflection, assessing the work and deciding what course of action to take.

[70] Arbortech - a high powered wood carving tool similar to an angle grinder.

Conclusion

To see a world in a grain of sand,
And a heaven in a wild flower,
Hold infinity in the palm of your hand,
And eternity in an hour.

William Blake - Auguries of Innocence[71]

Artists have always been the indicators of zeitgeist; the flag wavers of new paradigm shifts. The world today is tipping with increasing speed into a new understanding of its reality reflected in not only the work of artists but in the realm of film, text and youth music. I believe research into quantum physics allows the formation of a new and exciting definition of reality, the knowledge that we create our own small universe to exist in, whether on a so called real or existential level, offers us the opportunity to expand and explore whatever may be out there.

The opportunity is there to be taken to be involved in felicitating a shift in paradigm helping the population to reach a critical mass where an idea ceases to be an object of speculation and derision, and becomes an accepted concept of scientific knowledge. This has happened over and over in history famously with the work of Albert Einstein who, although receiving a Noble prize for his work on the photo-electric effect[72] never received the recognition for his work on the Special theory of relativity which was not accepted until well over a decade after he published it. Subjecting an idea to ridicule is a devise which seeks to belittle the message, but perhaps this is only hiding the discomfort we may feel at ideas which challenge our deeply engrained belief structures.

The use of quantum physics as inspiration is increasingly generating works from creative disciplines from all fields, subtly creating a climate which encourages the population to take notice and contemplate on what this may mean to them.

---

[71] http://www.artofeurope.com/blake/bla3.htm 20.11.09
[72] http://www.newton.dep.anl.gov/askasci/phy99/phy99078.htm 12.10.09

The objective of making this work is to try to have the viewer reflect on the interconnected nature of our reality. A big thing to ask, but by the nature of the works titles to guide a thought process and the interconnected and vibrational nature of the work will hopefully inspire a closer look not only at the work but the larger system of things. Ultimately the creation of the work has been for myself; a gradual peeling away of the layers allowing me, through the research to see reality in a different light. The process of working on the series has allowed time to percolate the information gathered and given space for a new personal paradigm to evolve.

10. Bibliography

Schlain, Leonard,
Art and Physics; Parallel visions in space time and light
(New York: Morrow c1991), 136.

Capra, Fritjof,
The Turning Point; Science society and the rising culture.
(New York: Bantam Books 1988) 77.

McTaggart , Lynne,
The Field
(London, Harper Collins, 2002)

McTaggart , Lynne,
The Intention experiment
(London, Harper Collins, 2006)

Radin, Dean Ph.D,
Entangled Minds,
(New York, Pocket Books, 2006)

Crouch, Catherine H.,
Quantum mechanics & the Creator,
(The Lutheran, August 2002) accessed 25/08/08

Tacha, Athena,
Chaos and Form: A Sculptor's Sources in Science
MIT Press (Leonardo, Vol. 35, No. 3, 2002) 239 – 245

Brendel, Bettina,
The Painter and the new Physics
Art Journal, Vol. 31, No.1 (Autumn, 1971) 41-44

Levrier, Guy,
A painter's Thesis: Quantum Physics as an inspiration for art
Leonardo, (Vol. 30 No. 4 1997) 268 - 269

Stewart, Susan,
The Sculptor as first finder
London, Hayward Gallery, catalogue 2007

Laszlo, Ervin,
Science and the Akashic Field
(Vermont: Inner Traditions 2007) 30.

Carroll, Lewis,
Through the Looking glass; and what Alice found there,
(Macmillan, London, 1927)

Hawking, Stephen,
Cosmos Images from here to the universe
(London, Duncan Baird Publishers, 2008)

Koestler, Arthur,
The Sleepwalkers,
(London, Hutchinson, 1959)

Shlain, Leonard.
Art and Physics, Parallel visions in space time and light
(New York, Harper Collins, 2001)

Women's Art Journal, Vol. 9, No.2 (Autumn,1988 – Winter, 1989) 38-44

Marshall, Ian and Zohar, Danah,
Who's afraid of Schrödinger's cat?
(New York: Quill, William Morrow, 1997)

The Galileo Project
http://galileo.rice.edu/chr/inquisition.html
29.0.09

www.whitecube.com/artists/gormley/texts/94 8/09/08

Leader, Darian, Antony Gormley at White Cube,

www.whitecube.com/artists/gormley/texts/94 18/03/08

http://www.spaceandmotion.com/albert-einstein-god-religion-theology.htm

Capra, Fritjof, The Tao of Physics,
(Shambhala Publications, Boston, 1999)

Laslo, Ervin, The connectivity hypothesis, foundations of an integral science of quantum, cosmos life and consciousness, (State University of New York press, Albany, 2003)

Taylor, Richard , Micolich, Adam P. and Jonas, David,
Can Science Be Used To Further Our Understanding Of Art?
http://www.phys.unsw.edu.au/phys_about/PHYSICS!/FRACTAL_EXPRESSIONISM/fractal_taylor.html

Jackson Pollock
http://thinkexist.com/quotation/when_i_am_in_a_painting-i-m_not_aware_of_what_i-m/304368.html

http://discovermagazine.com/2001/nov/featpollock

http://arts.ucsc.edu/faculty/lieberman/zen.html

http://www.kheper.net/topics/intelligence/MacLean.htm

Nagler, Michael,
Spirit and science in Vedanta
Tikkan; Jan/Feb2008, Vol. 23 Issue 1, 61-63

Durant, Will and Ariel,
The Age of Reason
(Simon & Schuster, New York, 1961)

http://arts.ucsc.edu/faculty/lieberman/zen.html

Quantum Approaches to Consciousness http://plato.stanford.edu/entries/qt-consciousness/#1

Suzuki, D.T., On Indian Mahayana Buddhism, (Schocken Books, New York, 1963),

Domenico, Argentieri, Leonardo Da Vinci, (Reynal & Company/William Morrow, New York)

http://theobservereffect.wordpress.com/schrodingers-cat/

Donley, Carol C., Friedman, Alan J., Einstein as myth and muse, (Cambridge University Press, Cambridge, 1985)

Durant, Will and Ariel, The Age of Reason
(Simon & Schuster, New York, 1961)

Buddha, http://www.all-famous-quotes.com/Buddha_quotes.html

http://plato.stanford.edu/entries/baudrillard/

http://www.essortment.com/all/jeanbaudrillard_rbhi.htm

Baudrillard, Jean, Integral reality, http://www.egs.edu/faculty/baudrillard/baudrillard-integral-reality.html , 21.10.09

http://www.newton.dep.anl.gov/askasci/phy99/phy99078.htm

http://theplaceofdeadroads.blogspot.com/2005/05/einstein-optical-delusion-of.html

http://www.perceptions.couk.com/perceptions.html#use

Talbot, Michael, The holographic universe, (Harper Collins, New York, 1991)

http://www.superstringtheory.com/index.html

http://www.albertchihwang.com/circle.html

http://arts.ucsc.edu/faculty/lieberman/zen.html

http://www.123opticalillusions.com/pages/Ponzo_illusion.php

http://science.howstuffworks.com/hologram.htm

Rosemblum, Bruce, and Kuttner, Fred, Quantum enigma, Oxford University press, New York, 2006

http://www.phys.unsw.edu.au/~jw/thesis.html

Related Fiction

Rose M.J.
The Memorist,
(Mira Books, Chatswood, N.S.W. 2008)

Goonan Kathleen Ann,
Light Music,
(Orian Publishing Group, London, 2002)

Alper, Mark,
Final Theory,
(Simon and Schuster, Pymble, N.S.W., 2008)

Harding, Traci,
The Ancient Future, The Dark Age,
(Harper Collins Publishers, Australia)

Harding, Traci,
An Echo in time, Atlantis,
(Harper Collins Publishers, Australia)

Harding, Traci,
Masters of Reality, the gathering,
(Harper Collins Publishers, Australia)

Harding, Traci,
Chronicle of Ages
(Harper Collins Publishers, Australia, 2000)

Harding, Traci,
Tablet of destinies,
(Harper Collins Publishers, Australia)

Harding, Traci,
Cosmic Logos,
(Harper Collins Publishers, Australia, 2002)

Gregory, Jill and Tintori, Karen,
The Book of Names,
(Snowbooks Ltd., London, 2007)

Images

http://www.nikonsmallworld.com/gallery.php?grouping=year&year=2005&imagepos=36,

http://plato.stanford.edu/entries/qt-consciousness/#1,

http://theobservereffect.wordpress.com/the-most-beautiful-experiment/