

particles+waves

Essay by Adam Brown

We are inescapably involved in bringing about that which appears to be happening.

-John Wheeler

American theoretical physicist, a collaborator with Einstein in the advancement of relativity, and coiner of the term “black hole”.

PARTICLES + WAVES presents a varied group of twelve artists whose work resonates with quantum theory, the perplexities of the subatomic world, and various interpretations of the “observer-dependent universe” through visual metaphors presenting the paradox of particle/wave duality as a modern day parable.

How it is that each of us see things in similarity and arrive at a common description is *the profound mystery we so intimately know as our immediate world*. As theory has reordered contemporary notions of “reality”, and how we measure and interpret phenomena, this exhibition looks to artists whose work provides insight.

Particles and waves, points and lines, singularities and infinitudes are complementarities that circumscribe a lexicon in the search for a theory of everything. Of profound interest to both the physicist and the philosopher is a foundational question of quantum theory: how and why does our familiar experience of a “classical” Newtonian world emerge from a limitless set of possible possibilities? Einstein's world-shaking paradigm of Relativity would forever alter the narrative of twentieth century physics while simultaneously declaring the *primacy of perspective*. His insights led to proverbial thought experiments like the “twins paradox” showing us the importance of the position of the observer by postulating diverging experiences of time for two individuals, one stationary here on earth, and one traveling at speeds approaching that of light. A decade later, addressing a similar query from the quantum perspective, Werner von Heisenberg put forward his now ubiquitous “uncertainty principle”. Heisenberg showed us that the more we know about the position of a particle, the less we know about its momentum (and vice versa), and that probabilities are all we can ever truly know about a quantum object's location or direction. Not long afterwards, Edwin Schrödinger would present his famous “Schrödinger's cat” problem addressing the mind-bending proposition of quantum superposition. A quantum

*What we see as
'reality'
is actually a
discontinuity.*

theoretical version of “does a tree fall in the woods”, a cat is imagined to be placed in a sealed chamber with a vial of poison in an experimental arrangement where it is given a 50/50 chance of survival. Schrödinger's cat is understood to exist simultaneously in both a dead and alive state before the box is opened to observe an actual outcome.

If “why do things appear the way they are?” is the question, then much has come down to the frame of reference imposed by the simple act of observation, and nowhere does the matter of position, momentum, and perception come more to the fore than in the world of the very, very small and the paradox of particle/wave duality.

By definition, a quantum “is the minimum amount of any physical entity involved in an interaction”. Both light (photons) and matter (electrons) are comprised of quanta, and as such, each contain particle-like and wave-like properties of manifestation in their essential nature. The standard interpretation of quantum theory regards particle/wave duality as a fundamental property of the universe. Put simply, it states more or less, that sometimes particles behave like particles, and sometimes particles behave like waves. Both descriptions are equally valid. However, for the observer, phenomena can be viewed in one way, or the another, but not both ways at once. This is the conundrum. Quantum theory addresses this perplexing dilemma, calling it a condition peculiar to human circumstance. As all manifest phenomena are understood to coexist in simultaneity with their wave aspect, what we see as “reality” is actually a discontinuity - a fragment of an entirety. Like a single frame of a motion picture taken out of sequence, a fractal in a cascading chain of interdependent structures, or an obtuse Buddhist koan proffering formulaic descriptions of emptiness, indeterminism or impermanence; *phenomena are ascribed form*. Caught in time by the very act of perception, the moment of cognition becomes the reduction of all possibilities to a single outcome. Quantum theory elegantly refers to this as the “collapse of the wave function”. Likewise, because of a phenomenon called quantum entanglement, the very atoms of the human eye are seen to interact with the particle/wave duality of light - like any other object - and the simple comingling of photons with the atoms of our sense apparatus serve to collapse the wave function through their intercourse. It is here at vision's fulcrum that creation can be seen to take place in the eye of the beholder, and the broken symmetry of light manifests as our own space/time continuum.

*Technology
has become a
placeholder
for man's measure.*

In the field of Cosmology and Astrophysics, the anthropic principle is a philosophical argument that states that observers are needed to bring the universe into manifestation. Simply put, the tautology addresses the necessity of things being as they are; *if life were impossible, then no one would know it*. Likewise, in quantum theory, a physical reality comprised of objects - independent of our measurement of them - is a thing difficult to uphold.

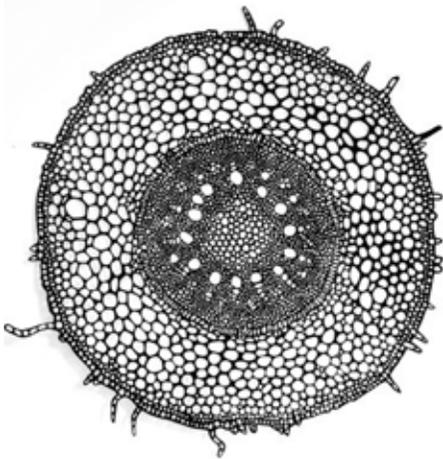
Simple truths seem to evade our reasoning. Our predominant Newtonian paradigm of inquiry strives to maintain a hegemony crafted in its own image by proclaiming ours is but an incremental, transactional “world of measurements”. In our realm of particulars, we rigidly maintain preconceptions and perceptual biases like the apparent separability of

events, the division between subject and object, and the wide gulf we maintain between the observer and that which is observed. A line in the sand appears to have been drawn. A contest has arisen between inclusion and separation, between finite and infinite, between particle and wave. To paraphrase the immortal words of John Wheeler, *we inevitably see what we expect to find*.

Defining the particle at the expense of the wave evokes a vision of collateral damage. In **Cair Crawford**'s confrontational *War Zones* series, we are reminded of long-held, deeply rooted cultural biases imbedded in either/or decision making, prefigured in the cultural imperative of sacrifice. In *Blood Sport* the depiction of human presence in theatre of battle is articulated as patches of flesh-toned camouflage interspersed with a diagrammatic sequence of moving particles. In *The Core is Very Hot* a map of Iraq is juxtaposed with scorched earth, and an ancient solar icon correlates both a visual target and the radiating shock waves of bunker busting "smart bombs".

Technology has become a placeholder for man's measure. Armed with a vast array of perceptual tools, our devices have at once expanded and predicated our field of vision. Dividing the world into disparate or concomitant parts through our investigation, we must reassemble it through acts of imagination, replaying events frame by frame in the narrative we call consciousness by filling in the lacunas of interconnectedness with our own measure of pattern and meaning. **Nefeli Massia**'s luminous and gem-like laser etched crystalline avatars of cloned neural dendrites and axons, in truth, are an amalgam of dozens of sacrificed cells. Both "neuron" and "not neuron", images of individual cells are stacked together in 2-D immuno-fluorescent layers to lend three-dimensional breadth of vision to what previously was only visible to the mind's eye. Destroyed on site in a violence of measurement, birthed in death on fluorescent medium, these imaginary creatures are make-believe wholes, gleaned through science's yardstick and finally vindicated by artistic process.

*Simple truths
seem to evade our
reasoning.*



At a very basic level, quantum theory shows us that the world is less the arena of causes and effects than it is one of choices and outcomes. Biology provides us an analogy in the immortal stem cell. **Kari Lindstrom**'s fascination with cellae and transformation is expressed in her series of sublimely elegant relief sculptures. Her *Root Apical Meristem* series portrays what for her is an especially potent region of a plant. Meristems are tissues comprised of stem cells which morph and transfigure into the various parts and organs of a plant. In the "quiescent center" of the root meristem, highly plastic, undifferentiated progenitor cells perfectly reproduce a reservoir of available prototypes through cell division. Unlike differentiated "daughter cells" that are born to take their various forms and die, meristematic cells hold in germ the organism's age-defying mean. A virtual fountain of youth, these stem cells provide a biological cipher for a plant's continuous growth. Both part and whole at once, in guise, they are superposed with their mortal twins like a proverbial "cat in the box". Meristem progenitors give rise to generations of normal cells and new stem cells in their unbroken continuous performance.

*The world is less the arena of
causes and effects,
than it is one of choices and outcomes.*

mentarity is a whole that is also the sum of its parts. For example, emptiness and fullness represent mutually exclusive *complementary principles*, while together, they are a *complementarity*: an entirety whose parts both suggest themselves and define each other through their relationship of contrasting values. In the case of emptiness and fullness, it is a part defining the other, at the expense of itself. A complementarity is a marvelous thing. A complementarity references itself by both encompassing and representing a totality. Being both a sign for a thing and the thing itself, it is *both* all possible possibilities, and a “set” representing all possible possibilities *at one time*. In other words, it is a self-referencing system.

However, the funny thing about complementarities is that they are mercurial. As if deftly hiding their true identities in our macroscopic world of appearances, they readily disguise themselves as binaries, as either/ors, particularly when framed in an operational matrix that elicits yes/no, this/that responses as the desired output of a system's program. It is the subtle and intelligent work of **Taney Roniger** that arises from her preoccupation with computer languages, information-based systems, and the digital and analog realms. Says Roniger, “the apparent incongruity between the discrete and continuous” in both virtual and real time systems for her is the comparative domain for examining both artificial intelligence and the arena of human consciousness. In Roniger's *Stone Series*, imagery is formulated through a binary interplay of circumscribed and evacuated spaces, graphically portraying convergent and interpenetrating opposites which harmoniously arise from a unified ground-field milieu - suggestive of some initial base-line condition. At the core of each painting is a series of pinholes; a method of drawing by elimination. On her canvas, vacuity becomes her anti-node positing an essential point of departure from which her forms emerge.

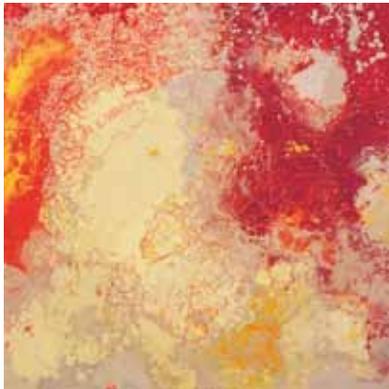
Discontinuity is a fundamental component of a quantum system. Another placeholder of sorts when construed from any system's point of view, a discontinuity represents a break in what previously was a continual flow of information. From inside the continuum of a system's standpoint, a discontinuity is completely opaque. From outside, we can say that a discontinuity is an interval that represents the *absence of value*.

At the turn of the 20th century, a bold idea with discontinuity at its core allowed Max Planck to clear a conceptual hurdle that bogged down the science of his day while providing a conceptual framework for a new physics. In the year 1900, lacking a classical description for why radiant bodies emit discrete amounts of high frequency ultra-violet radiation (or put another way, why we get a tan from the sun and not from sitting in front of our fireplaces), science confronted a baffling problem known to history as the “ultra-violet catastrophe”. Classical mechanics had predicted that the fire's ember and the sun's radiation should be continuously rich in higher frequency ultra-violet emissions, on an up an energy ladder – an

*If life were
impossible,
no one would know it.*

incongruity that was clearly not the case. However sacrosanct, Newton's yardstick could not explain what was happening making predictions that were not consistent with what was being observed. Without an existing science to explain how higher and higher energy configurations transformed from this state to that, Planck found his solution by taking an intuitive leap, imagining that in and along the energy spectrum, from burning coals to stellar masses, electrons both absorb and radiate energy only in discontinuous, discrete, "quantized" allotments comprised of minimal amounts which he termed "quanta". Planck's new quantum description was able to account for the varying magnitudes of observed phenomena in the universe. Quanta are discrete because, as elementary particles, they represent both an increment and the smallest physical entity that can be involved in an interaction. Quanta are discontinuous because in and between energized configurations, Planck found that once a particular energy threshold is reached, there is a non-continuous transition that occurs between states. From atoms to stars, the electron is simply here at one moment in one configuration, and then we find it somewhere else in another – in discontinuous quantum fashion. From the prior perspective of Newtonian mechanics, non-continuous transition was unanticipated and quite out of the ordinary as there are no connecting steps between the transposition of one energized state to another. Planck filled this lacuna by describing a peculiar change in an electron's orbit or position, a change in state that *was not mediated by any signals or "in-between" steps*. ...and voilà, we have the "quantum jump". In one fell swoop, Planck cut the Gordian knot of Newton's physics and opened a window to a new paradigm. Quantized energy transformations give rise to the scale and complexity that we see in the universe. Quantum jumps are discontinuities... interruptions....signal-less transmissions. Quantum jumps are things that by their very nature transcend Einstein's local limit set by the speed of light.

*With his "quantum jump",
Max Planck cut the Gordian knot
of Newton's physics.*



To quote **Rhonda Smith**, "the straight line from point A to B is singularly efficient. The actual traverse is fraught with possibilities". Her paintings and drawings of minutiae, what she calls the "mapping of mercurial movements of daily life and natural phenomena" appear as an intricate weaving of marked events. "Behind every simple surface is a structure and system operating on a different scale and by complex rules, these parallel, dynamic worlds". Her enigmatic surfaces are motivated by what lies beyond or perhaps within our means of observation, just as human acts of reinvention or renewal create new lenses, ever re-focusing the ongoing examination of our daily lives. Discontinuities loom large in the conceptual framework of Smith's work, harbingers of "fickle" and "harrowing instability" creating tensions or balance in otherwise stable structures. In her own words "a new layer of life and disruption....systems can face small or grand interruptions and by pattern or intelligence recover their nature....or not."

But it would be incorrect to think that Isaac Newton got it wrong. If the world of the very small is an indeterminate realm of probabilities and uncertainties, *ours is certainly a world of scale and statistical outcomes*. For almost a century now, science has struggled to reconcile the strangeness of the subatomic world of elementary particles with the agglomerations and ensembles of macro objects encountered in everyday life. Recognizing a growing rift in the field of theoretical

physicists of his day, Niels Bohr, the father of the Bohr atom and framer of the quantum complementarity principle, found a way to address this apparent lack of fit between what we encounter at the quantum level and what we measure at our own. Bohr's *correspondence principle* put forward the proposition that under certain limiting conditions (such as those satisfied by most macro-scale bodies under ordinary circumstances), quantum mechanics predicts the same motion as classical Newtonian physics. Another bold act of imagination that saw connection and complementarity where before there was none, Bohr said the relationship of a classical system to the quantum is a relationship of a part to a whole.

“*The path of the electron comes into existence only when we observe it*”

-Heisenberg

To what was Bohr alluding by these “limiting conditions”—just what hidden variables are implied by “certain circumstances” when he so eloquently put forth his intimations of correspondence? *Forces of nature* are at the very core of **Alice Hope's** intriguing and tactile installations. Hope's work evidences invisible structures that can influence and determine the shape of a system's outcome. In her words, “magnetism is a generator of experience through its force and field”.



Built on steel substrates and tiled in a matrix of magnetic disks, gravity and magnetism become the medium from which her fabric-like carpets of woven particulates take form. In Hope's *Magnetpolis* the artist imagines entire cityscapes shaped through an internal logic and motive of their own — induced apparitions mediated by invisible force-lines in direct correspondence to their manifest form. In her *Do Not Touch* series, plush fields of colored filings produce sumptuous textures in magnetic webs of labyrinthine design.

The deeper we look, the more involved we become in the process - the more we seem to exist in an observer-dependent universe. Heisenberg said, “The path of the electron comes into existence only when we observe it”. Somehow, with or without our noticing, the “waviness” of the wave aspect of the particle becomes filtered out from our immediate experience of the world. Interference patterns can help us understand a beguiling phenomena by providing a familiar example from nature. Two pebbles dropped in a pond put in motion sets of waves in water and make a pattern. When the waves from the two stones encounter each other, if the wavelengths converge in sequence, they are mutually reinforced and the wave is strengthened. However, if the timing of one or the other is inopportune, the waves from each of the pebbles can cancel each other out. Between the extremes of augmentation on one hand, and the annihilation of mutual destruction on the other, there exists a range of possibilities. This range of possibilities can be understood as the wave's *amplitude*. In such a way the interplay of two particles (or two pebbles) in an interference pattern provide both shape and scale to the amplitude of waves in an interactive system .

Bear this in mind when considering Edwin Schrödinger's revolutionary wave description of matter. Schrödinger understood a particle's position in space and time in terms of the amplitude of a wave from which it is formed. Schrödinger was able to represent the ambiguity of a particle's specific locale by referring to it as a “wave packet” - a tiny bundle of possible possibilities. His formula describes locations of particles as probability distributions that can be represented in a bell shaped curves showing the amplitudes of waves over time. Where the amplitude of a wave is strong (i.e. high),

that is where one will most probably find a position for the particle. Where the amplitude of a wave is weak (i.e. low), that is where there will be a small, but *non-zero* chance for finding it. Schrödinger's formula is known to us today as the Wave Function Equation of quantum mechanics. Its applications have facilitated technologies from lasers to superconductors.

A poetic image for an enigma that eludes reason has been offered by philosopher/physicist Henry Morganeau in the vision of a firefly. Morganeau said, "watching electrons is like watching fireflies on a summer evening, you can see a flash here and another twinkle of light there, but you have no idea where the firefly is in between your observations. You can not define a trajectory for it with any confidence."¹ As elusive as it is poignant, the particle/wave nature of matter has been famously demonstrated in the well known "double-slit experiment", where a single electron is seen to split and interfere with itself in its own diffraction pattern. Particle beam diffraction photographs and experiments plotting repeated measurements of electrons in orbit, reveal their amorphous forms in fuzzy halos of indeterminate distributions and probability clouds of uncertainty. The haunting and contemplative work of **Norman Mooney** evokes just such an image. As a post-modern koan for the particle might read: *the wave usually collapses where the probability for finding it is high...* in the artist's words, "the work deals with the eternal dichotomy of the present, the immediate moment whereby we are both immanently becoming and eternally dying at precisely the same time". Emissions of carbon and acetylene torch are as calligrapher's ink to brush. Norman Mooney's zen carbon drawings on aluminum panel and paper reveal the confident marks of the practiced hand, while bearing witness to a delicate balance between competence and chaos.



As both ignorance and mastery have been called "states of bliss", a fine line can be drawn between conditioned response and the capable hand. Likewise, as attempts and failures are stock in trade for the novice, the creative accident, pregnant with possibility, is a cherished attainment of the master. In the words of **Svetlana Rabey**, "repetition is a daily exercise, a disciplined rehearsal of forms. The rigid structure allows for accidents and unconscious intuitive decisions to happen". Force of gravity is an essential element in Rabey's work. Grinding pigment to paints in her own certain measure, her arc-like strokes of shockingly brilliant color, yield to the downward pull of liquid's mass to a place where

order and entropy become gravity's rainbow. Says Rabey, "the repeating icons are painted in thin layers so that the shape emerges from within itself. Gravity controls the result in color, composition and mood". From artist's wand to the center of the earth, Rabey's paintings are elemental diffractions of spectral radiance. Each gesture, each layer is a response to a surface beneath and between, in a compelling metaphor for dance, and the intimate pirouette of moment and memory.

Like babes in the woods, *we are inescapably involved in bringing about that which appears to be happening*. Like some young Actaeon startled by the visage of the naked goddess,

*Both ignorance
and mastery are
states of bliss.*

¹Amit Goswami, Richard E. Reed, Maggie Goswami, *The Self-Aware Universe: How Consciousness Creates the Material World* (New York: Tarcher/Penguin, 1995), 42

our naive intrusion into the affairs of the wave decisively alters its symmetry giving rise to its fragmented feedback of varying forms. Along the way and in the process, we become inevitably entangled, as the photon of light we must appropriate to witness an event deflects the particle/wave at the quantum level to influence an outcome. Nowhere is such a vision more evident than when standing in the presence of the works of **Karen Gunderson**. Her captivating paintings of waves and stellar landscapes pay homage to the profound duality of matter and light. Says Gunderson, “there is no single or final reference point to the work.” Through her extensive palette of reflective black paint, “forms and phenomena seemingly emerge from darkness and void to become evident only when exposed to the light.... the illusion of volume is conveyed through the convergence and intersections of the many parallel or perpendicular strokes of the brush”. Observer-dependent worlds in and of themselves, the reflection of light and shifting perspective engages and perpetuates the attention of the viewer in a dance of the seven veils.

*We inevitably
see what we
expect to find.*

We are easily persuaded by appearances, as equally we are deceived. Poised between one and the other, the quantum description says somewhere we stand at the middle. We dwell at the crossroads of a liminal threshold, where planes of existence coincide and converge—the classical world and the quantum—with one foot in each. A peculiar commingling occurs in each one of us. We experience it as the vague nuanced sensation that from time to time communicates to us that all is not as it seems. The ground beneath our feet is plain as day, but as we gaze between the lines to discern some higher order, we are either stalemated, or become disoriented in our efforts to bring it to focus. We can explain the feeling away, but it confronts us time and time again. Our vertigo is a cognitive dissonance, a disequilibrium, like a swoon at the gate when confronting traverse at a boundary's threshold. **Cornelia Thomsen's** *Stripe* paintings provoke just this sensation. Both minimal as they are elegant, Thomsen's hypnotic works are born from a series of literal seascapes shifted on axis, turned perpendicular. Her deconstructions emerge as horizontal abstractions of lines smeared across canvas like waves stretched against an imaginary event horizon. Permeable boundaries of primary color diffract into hues, then to shades, yielding to saturations that scintillate upon canvas. Dizzying and dissonant while harmonious and tranquil, the static ambiance of *Stripes* present illusions that break down upon closer inspection.

By their very nature, illusions are compelling as they are beguiling. Like a veil before innocent eyes covering some naked truth, we at once find shelter in them while stand equally eclipsed in the light of a higher order. In so many ways, *this is our home*. As if not seeing the forest for the trees, **Ron Kingswood** relinquished his attachment to literal appearance in the natural world as an act of dispossession. Kingswood's energetic and capricious landscapes are synaptic fugues of color and motion. Like frenetic cacophonies of large hadron collisions (the Large Hadron Collider at CERN), denouements dissolve in decisive moment—then yield in surrender to live out their half lives in serenity and calm. The pulsing of life as vector and form, Kingswood's panoramas collapse incarnations of space and time to instants of quintessent immanence, erupting with possibility. In his words, “These visions of landscape have only to be unearthed by wandering and roaming familiar refuges. To realize a scene before oneself is not to replicate its exterior covering, but to allow the scene to immerse the observer. One can paint it truthfully without replicating it”.

*The universe
is one vast
description.*

If our subjective vision of the world can account for the differences between individuals, it does so while bastioning the self's creative potential in the premise that events, things, and persons, are all separable. As quantum theory has so elegantly stated, there are clearly opportunity costs associated with points of view. If observer-dependence is real, how *is* it that each of us see the world in self-similarity? Put a little differently, if the collapse of the wave function spontaneously creates a world in the eye of every beholder for various and sundry reasons—both known and unbeknownst to the observer—why do we all create the very same place? Nearly seventy years ago, mathematician John von Neumann proposed a compelling vision for systemic quantum entanglement. The first 20th century theorist to suggest that consciousness collapses the wave function, von Neumann saw a universe comprised of an infinite chain of quantum measurements, whereby each apparatus (from man to machine) that measures or observes a dichotomous quantum object, in turn becomes dichotomous itself... ad infinitum.

“*Man is the measure
of all things*”

-Protagoras

Dichotomous like Schrödinger's cat. Von Neumann chains are cascading fractal webs of dichotomous references and feedbacks that extend from the world of the very, very small to the world of the very large; an inclusive matrix of semblance and similarity in a vast quantum/universal circuit.

Perhaps we can here take a few steps back and simplify. In light of the thesis of observer-dependence, which describes the collapse of the wave function and the common appearance of the

world - when we speak about the workings of *the quantum realm*, we might just as easily be referring to the workings of *the human mind*. It is self-evident that consciousness is the agency by which the behavior of quantum objects are made sensible. Following in this line of reason and carried one step further, if one can say *as above so below*, it might equally be said that *correlation causes collapse*. Ontological correlations of the mind are part of the measurement apparatus of a conscious observer. As theoretical physicist Eugene Wigner (author of the well-known 'Wigner's friend thought experiment') proposed in his 1967 essay "Remarks on the Mind-Body Question", it is "the non-material mind", that is the only true measuring apparatus. To paraphrase Wigner, it is the transcendent mind that creates meaning, something we might call *the quantum mind*.

The universe is one vast description. *Information*. Data, correlated by the narrator we call mind in the unfolding saga of our lives. Once you get the hang of it, it can really be stated just as simply as that. When one description proves inadequate—doesn't tell enough of the story—we find new ones that meet our needs; and so it's been since the beginning of time. It was the Greek philosopher Protagoras in the controversy of his day who said "man is the measure of all things: of things which are, that they are, and of things which are not, that they are not". It is this capacity of the human mind to reflectively self-reference while envisioning ever new descriptions for itself and for the world which we inhabit, that is the story of mankind. In the day to day, this tale of high drama, danger, and adventure may seem to pass us by, but non-the-less, we encounter the mystery of the world every moment in the very, very small and in the familiar. By pattern or by design, the workings of nature can



On this page: Standing Wave, Andrea Zemel, 2011

be viewed as one and the same in a *quantum description of mind*. Dare we look down that corridor, dare we enter that sanctum sanctorum, we lock horns once more with the inevitability of the anthropic principle: that without an intelligence, there is no pattern to perceive. Effects that precede their causes: a tree *may* fall in the woods, but not if there's no one to see it. We are all, each of us balanced on the edge of a razor, inescapably involved in that which appears to be happening. Like Minotaurs trapped in the labyrinth, everywhere we look, all we see is ourself.

The luminous and allegorical works of **Andrea Zemel** imagine the play of world in terms of the tales which we choose to tell about ourselves. Drawn to “the timeless quality of a material that is so evidently made by hand”, her current body of work, “turns exclusively to the medium of mosaic as a method for creating visual narrative”. Through molding by hand, the firing of clay, and the cutting of tessera in archaic fashion, her symbolic landscapes “unearth metaphors that emerge from a deep interest in those foundational tales that reflect the sense of who we are and where we come from.” Fascinated with making the invisible visible, *Face of the Waters* is a literal homage to the wave. In her words, “emanation, movement, feeling, thought; I create imagery that attempts to reveal what is hidden beneath the ground, whirling in the air, or churning in the sea, suggesting a suffusive presence underlying phenomena that captivates and intoxicates the senses...” Zemel’s work shows concern for what now has come to be called the *numinous*. The term was coined by Walter F. Otto in his revolutionary and landmark work “The Idea of the Holy” in 1917. Derived from the classical Latin *numen*, a term which pertains to the notion of fate and divine providence, the numinous is that which refers to and implies a “feeling of awe in the presence of deity”. What is numinous is brimming with nuance, it is an overflowing of quality, a suffusing presence with an intimate personal dimension; to experience the numinous is to feel as if one is “in communion with a wholly other.” For archaic man, it was *the awe-inspiring mystery*. It was the *mysterium tremendum*. That ineffable power or quality of being which can reside in a thing - a force, that when confronted by its presence can both attract and compel, or provoke equally fear and trembling in its encounter. What is numinous evokes an image from the dawn of our experience as beings, and from the morning-time of man’s youth in antiquity.

As stark contrast to our post-modern existence, the idea of the numinous lives. It hides behind doors where it can startle us, it is couched in-between lines where it intrigues us, or is disguised in plain sight as to deceive us. But for most, what is numinous dwells nowadays as a category - as a position where its been placed; as a footnote in the annals of human experience. The word *pleroma* is a gnostic term, a relic from the inter-testamental period, it means *fullness* in Greek, signifying the totality of the divine principles and powers. In her *Pleroma*, Zemel resurrects the unnoticed in the image of a rose, the thorn, and the busy bee. The swirling ground of reflective glass bears witness to the presence of the invisible spectator; the onlooking eye of the conscious mind.

In so many ways, quantum theory has shown us that the universe is one vast description, held together by the connective thread of meaning. As conscious observers in an observer-dependent world, narrators of our own experience, we are the sum total of the stories which we use to tell about ourselves: no more, no less. Descriptions within descriptions, reflection upon reflection, everywhere we look, all we see is mirrors. We are all Minotaurs trapped in the labyrinth. As the “house of the double axe” it is the place that bears the name of the sword that *cuts both ways*.

John Wheeler said “we are inescapably involved in bringing about that which appears to be happening.” With our metaphors in hand, and allegories tucked firmly under our belts, we ask once more the question, why does anything appear to exist at all? In the end, it can be simply put; because we *mean* something to each other.

As if we needed to prove it.