



NEWSLETTER

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Artists Using Science and Technology



Artists Working With Ideas and Philosophy

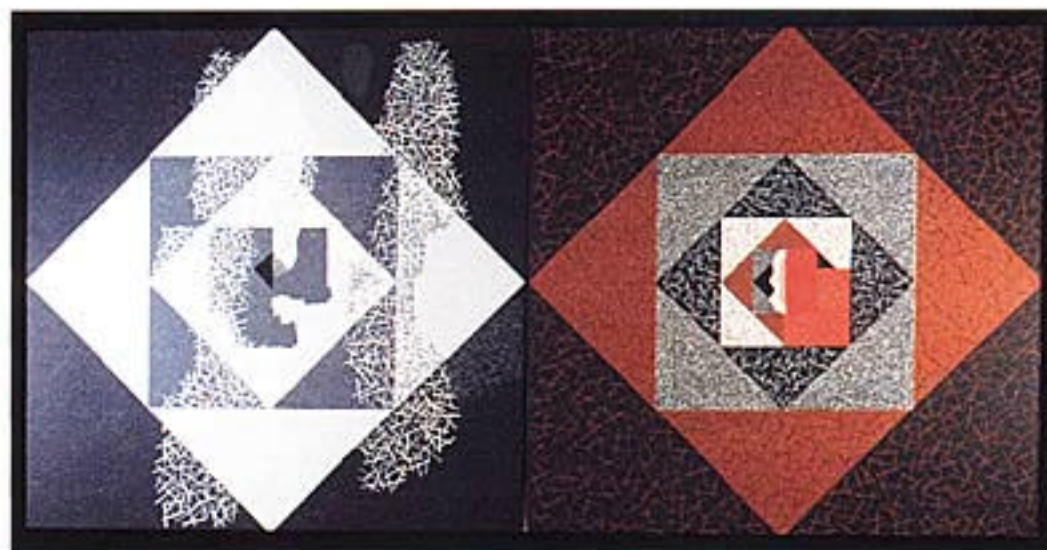
NB: This color insert appears in the Gallery section in the original issue



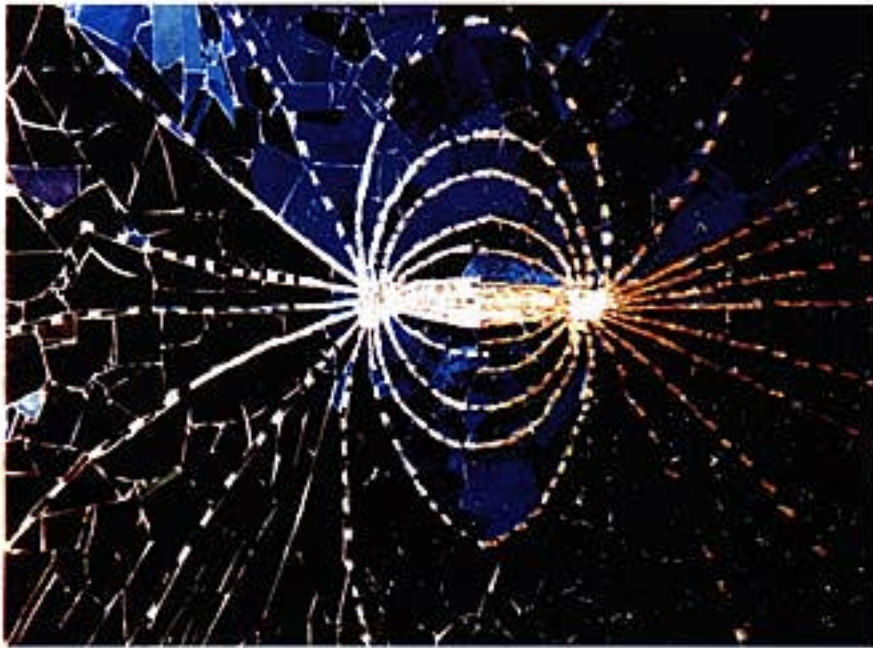
Bettina Brendel, figure 2, *Crystal 1 & 2*, acrylic painting, 40" X 80"



Bettina Brendel, figure 4,
Dissolution of Symmetry, computer art, 28" square



Bettina Brendel, figure 3, *Symmetry & Asymmetry*, acrylic painting 60" X 120"



Zoe Adomo, figure 1, Truth Table, mosaic, 24" X 36"



Trudy Myrrh Reagan, figure 2, Quest, watercolor with incised lines, 28" square

Artists Working With Ideas and Philosophy

Zoe Adorno

The three of us are visual artists. Zoe works with glass, fusing it in a kiln in her studio and then hand forming the glass while soft into three dimensional sculptures. Bettina is a painter who uses the computer to visualize scientific concepts and to create her art. Trudy also is a painter who is an active participant in making the world a better place as seen by her efforts on behalf of the refugees in Central America. We are keenly interested in many areas of science including theoretical physics, symmetry, chaos and mathematics. These in turn lead to philosophical ideas that find their way into their writings and their abstract art. Although diverse in their artistic expression it is hoped the reader will enjoy the variety they offer here.

Zoe Adorno's article, *A Myth for the 21st Century; An Artist's View of Reality*¹, offers the artist's idea of what Truth is and proceeds to develop this in a way that she hopes may be useful to individuals in this 21st Century world we share.

Bettina Brendel writes about her article, *Symmetry - Structure and Symbol and Art as a Metaphor*,

When Zoe Adorno asked me if I would like to participate in a future issue of the Ylem Newsletter and write something about Symmetry, she reminded me that we had met years ago in 1958 in Whittier, California where I had a small solo show at the local art gallery. At that time I also showed slides of my nonobjective and abstract art, which was not yet widely accepted in Southern California. Since then my interest in abstract art and poetry has let me to study theoretical physics in New York and to explore the role of visual imagery in the field of physics and physical optics. I have written articles on that theme and given slide shows in this country and in Europe. My work with the computer started in 1988. I use it as a tool to create art and continue to visualize scientific concepts as chaos, symmetry, order or entropy for example.

About *An unwitting Pythagorean*, Trudy Myrrh Reagan writes,

We're all using philosophy whether we know it or not. For instance, Americans have internalized John Locke's philosophy of individualism to the point that they don't recognize the times when they are operating on assumptions that differ from their friends from Confucian cultures. Because members of my family have been involved in science for four generations - physiology, geology, chemistry, physics, molecular biology - I've carried around in my head a large view of ourselves in the scheme of things, from the micro to the macrocosmos. It incorporates

attitudes about how one finds things out and verifies them, and the strange, creative interplay between theory (often mathematical) and data. I have been fascinated by the tension between what is certainly known and what gives reason for skepticism - because some paradigms have shifted even in my lifetime. Paradoxes and unexplored terrains abound. Travelling in the art world, I have felt that many who borrow technology and science buzzwords are just scratching the surface. In general, they don't share these basic assumptions and mental habits. For this reason, it has been an interesting project to incorporate my take on science into art and to associate with artists sharing my interests. As you will see, I have used the material I found to artistically further my personal spiritual quest as well. Art gave me a handle to think about these issues. Some aspects of science make me recoil: Some scientists' readiness to justify continued work on weapons, or to irretrievably modify the gene pool and environment. But, I would like to think that the good parts of the scientific world view will seep into the culture like compost tea and nourish the civilization, just as Hubble Telescope pictures are doing. ~~xxxx~~

Notes:

1. For the 1997 unabridged version on the Internet, see Ylem, Art on the Edge, at <<http://www.ylem.org>>

Forums and Members News

Forum:

November 15: On the Edge of Not Being Seen: Science imaging and what we can (or can't) know.

Please visit <http://www.ylem.org/NewSite/news/Forums.html> for further information.

Members included in important group shows include **Patricia Tavenner** in Northern California Women's Caucus for Art's recent sculpture exhibition at the Atrium in San Francisco, and **Loren Means** in "The Digital Dimension" at Nexus Gallery in New York.

Members News:

A new museum in formation, The Silicon Valley Art Museum, has launched itself as a beautiful website, www.svam.org. Its online gallery features **Helen Golden**, whose work combines digital techniques, traditional fine arts and photography.

Corinne Whitaker's piece, *Upper Cut - The Vanishing Human* will be part of the Eighth New York Digital Salon, opening Nov.. 6 through Dec.. 9 at the Visual Arts Museum in New York City and then travelling internationally throughout the spring and summer of 2001. The catalog will be a special edition of Leonardo.

Ivars Peterson has written an article for the online edition of Science News about **Bob Brill's** math art with Poincare recurrence. Several of his algorithmic images are reproduced there.

<http://www.sciencenews.org/20000826/mathtrek.asp>

Bob Brill also gave a paper at the ISAMA Art and Mathematics conference organised by Nat Friedman at SUNY-Albany. Possibly other Ylem members spoke. **Trudy Myrrh Reagan**, who spoke at a similar conference in Seattle, Mosaic 2000, reports that **Carlo Sequin** was one of the organisers, and other Ylem members who presented were **Larry Cuba**, **Rona Gurwitz**, **Craig Harris**, **Robert Krawczyk** and **Stephanie Strickland**, with **Helaman Ferguson** giving the keynote address.

Lucia Grossberger Morales has moved to 29 Palms. She is working with a Costa Rican performance artist, Elia Arce, on a piece called *First Woman on the Moon* to be shown in Highways in Santa Monica. She continues her work on her interactive work, *Sangre Boliviana*, and will go to where she was born in Bolivia late this fall to do research for it.

Robert Grimm in his retirement from engineering oversaw all the new exhibits at The Tech Museum in San Jose. For this and his many other endeavors, he is one of Palo Alto's year 2000 "Lifetime of Achievement" honorees.

Larry Cuba's computer animation classic, Two Space, was shown at the Oskar Fischinger Film Festival at Pacific Film Archive in Berkeley.

A Myth for the 21st Century: An Artist's View of Reality

Zoe Adorno

The following is a work in progress which began in the 1960's with an insight into the relationship between "man and the world" and developed along what I would describe as the meaning of "the without and the within" for each human individual. The idea for the myth is based on a theory, or hypothesis, as to what Truth is.

In the early 60's while thinking about this without/within idea, what I'm calling a theory suggested itself as "Truth is the Inseparability of the Opposites, and, at the same Time, Their Very Oppositeness," i.e. that the laws governing what I was then calling consciousness in the individual correspond to, or find their counterpart in, the laws of the physical universe.

Believing the theory to be not provable, and yet thinking along the lines of, if true then what would it mean, I was pleased to read what Richard Feynman said in one of his lectures, "..... It is 'Scientific' only to say what's more likely and less likely and not to be proving all the time whether something is possible or impossible."

Going on from there, I began thinking of how the Chinese had it right with the Yin/Yang idea of the active and passive elements and the dual nature of everything, not only in science as it was being discovered and developed, but also in everyday life experiences. I wanted to find ideas that could show this kind of polarity in opposites especially where scientists had already done the work to establish certain laws of physics. By reading about these I could find ways to illustrate the ideas graphically. The only place I could do this was through my art. I was a mosaic artist from around 1955 to 1985 and so I began to express my ideas in glass mosaics.

One mosaic which I made around 1966 is called *Truth Type* (Figure 1) and suggests the relationship of the opposites as inseparable, using the pattern created by the force field of a bar magnet. It is a graphic design directly from nature that everyone is familiar with. This picture was in several art exhibits with the title *Truth Type* and if anyone thought I was thinking in terms of something more than making metaphors with my mosaics, no one asked.

Being an artist and not a scientist I started thinking of other ways the theory has meaning for the individual. It is both comforting and sobering to think of Truth as the inseparability of opposites. It also gives him hope for the future, for if there has been injustice in the past, the theory hints at a kind of equity in events, or what you could call a kind of moral law of

averages. The theory also affirms the brotherhood of all men as possessing by their very being this same relatedness to the world and to each other.

There is Truth which has to do with our existence, such as our without/within. Then there is Truth as it relates to events or occurrences that are happenings in time as are our actions and choices. Truth of this kind isn't usually of opposites occurring simultaneously... Time is the variable.

In thinking about our choices or acts as vector quantities having both magnitude and direction (toward good or evil), several acts of small magnitude in the same direction can equal one act of large magnitude, (force + force) and graphically illustrates the importance of one's conduct in that each act counts, a kind of "all thy deeds written in a book" idea. I think this thought could have an empowering influence on an individual, to know that by his or her conduct it's possible to make a difference. I also wonder if this can be the mechanism by which consciousness expands.

Thinking about the paradox of free will and pre-determination man's freedom of choice only affects the time it takes for the foreseen to be realized, so each injustice in the world causes justice to "well up as the waters" in a degree of the same magnitude but opposite in kind. You might ask if good or justice can well up to balance out injustice and evil, but do you really think that we will ever run out of injustices done to individuals in the past history of the world or collectively to people, as in war, any Eon soon?

By studying space-time, quantum mechanics, gravitation, and string theories, physicists are discovering wonderful things about the way the universe works. Edward Witten, a theoretical physicist at Princeton University, writes about the appearance of Symmetry in his work in the field of Superstring Theory. Roger Penrose, in his book, *The Emperor's New Mind, Concerning Computers, Minds and the Laws of Physics*, writes in his chapter entitled Where Lies the Physics of Mind?, Chapter 10, p. 431:

I have concentrated on my suggestion that there is an essential non-algorithmic aspect to the role of

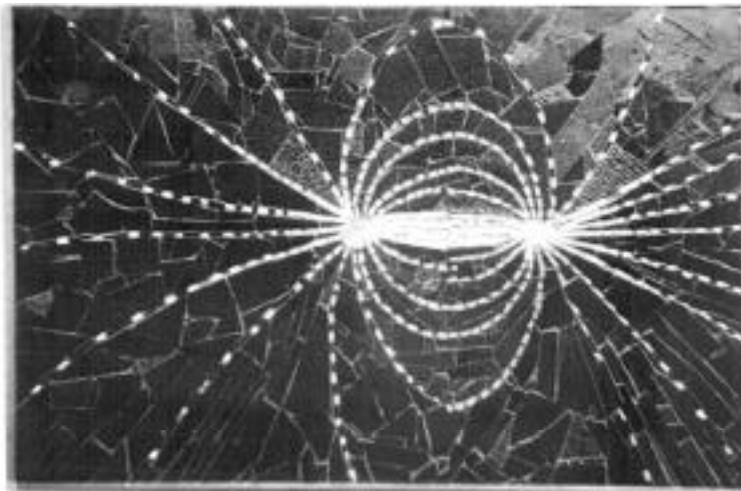


Figure 1: Zoe Adorno. *Truth Type*. 1966. Glass mosaic. 24"x36."

(Continued on page 10)

An Unwitting Pythagorean

Trudy Myrrh Reagan

I recently heard a lecture on Pythagoras that cast a new light on the art work I have been engaged in since 1970.

Most of us are acquainted with the Pythagorean Theorem on the right triangle as well as his discovery that the musical intervals on stringed instruments have numerical relationships. In this lecture it was revealed that his big idea was that abstract number relationships underlay all the sensory world, not simply atoms or some other "thing." This set science in the West on the distinctive course of math-based investigation that has been so fruitful.

He sought to understand the universe in a large way, thinking that this study would help him approach the divine. Whether I have always recognized it or not, the fascination I have with this theme is the religious awe I often encounter working in this sphere. I have found a kindred spirit who lived 2,500 years ago!

The picture I get from people who try to piece his life together is one of a remarkable adventurer, a polymath, a real character. If geography is destiny, he was well-placed: He was born about 570 b.c.e. into a trading family. His father was Phoenician who sometimes took him on business trips. His home was Samos, an island off the Anatolian coast (today's Turkey). Anatolia was the home of the Greek philosophers who debated about the ultimate constituents of matter. One was Anaximander, who became his teacher, and urged him on to Egypt to study mathematics. While there, he delved into its numerous religious cults. When Egypt was invaded by Persia, he became captive in another math mecca, Babylon. There he encountered Zoroastrianism.

When he returned to Samos, he tried teaching. But he failed to interest his students in the very abstract teachings that he had acquired. So, he struck out for Italy, where he had visited when younger, and near the toe of the boot in Croton he began a school, nay his very own religion.

The cult included both men and women. He had become convinced that somehow the basic stuff that everything possessed was the abstract quality of number. Showing that number, ratio and geometry related all phenomena, he declared, "All nature is kin." He was the first to use the word "philosophy" in the sense we use it today, the love of abstract knowledge.

Besides the Pythagorean theorem, he and his school are credited with:

Proving that the sum of angles of a triangle is always equal

to two right triangles.

A kind of geometrical algebra whereby they could solve equations such as $(a-x) = x^2$ by construction figures.

The discovery of irrational numbers. This must have vexed Pythagoras, who believed that all things were composed of whole integers.

The five regular polyhedra, though Pythagoras himself may not have known how to construct more than three of them.

Pythagoras taught that the earth was a sphere (though he visualized a geocentric system), that the orbit of the Moon was inclined to the equator of the earth, and that the evening "star" and the morning "star" were both Venus.

These were devotees of Apollo, the God of reason, cosmos, i.e. order and limits in the world - "Nothing too much." By contrast, chaos represented the unlimited and evil. From the Zoroastrians he adopted dualism, a philosophy that the world is a mixture of opposites. From the Egyptians he borrowed curious beliefs about diet, and also the necessity for extreme secrecy.

For this reason, no original documents by him exist. That we know about him at all is a fluke: Novices in his cult (of whom there were both men and women) lived in silent study of mathematics for seven years before being initiated into the highest secrets. A rowdy nobleman, Cylon (one story goes), was enraged at being excluded from the society, so incited the townspeople against this cult. They were already unhappy, for it had taken over the governance of their town. The Pythagoreans had to flee for their lives. Some disciples gravitated to Athens and became teachers of Socrates and Plato, who in turn influenced Aristotle. What we principally know of his

teachings are critiques of them. However, Socrates declared that the investigation of natural phenomena will always lead to the abstract, and that abstractions such as numbers can generate reality. This is straight Pythagoras!

His beliefs lived on in the early Christian era in the Neoplatonists, together with the Greek belief in inherent order in the universe (Cosmos, also Logos) as opposed to disorder, absence of limits, evil (Chaos). After the revival of learning in the high Middle Ages, the tradition continued and has inspired



Figure 1: Trudy Myrrh Reagan. *Science is System Searching for System*. 1971.

(Continued on page 11)

The concept of symmetry is reassuring. One form, shape, color or image repeated validates itself. It convinces us that it has significance. Bilateral symmetry shares its axes: the image is validated by repetition. The slightest deviation on one side will create an imbalance, a dissonance in the eye of the observer, a conflict.

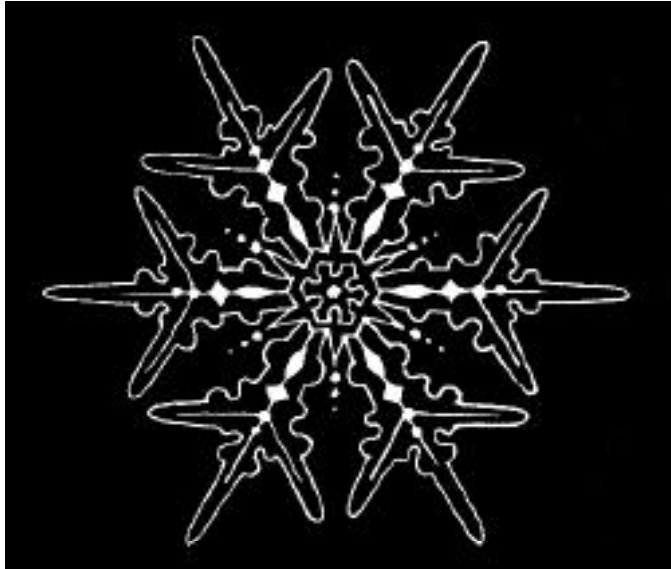


Figure 1: Bilateral Symmetry, a snowflake.

Bilateral symmetry, which is the symmetry to the left and right, is especially that of the human body and other living and growing organisms, (Fig. 1 above). It appears in the earliest descriptions of humans, sometimes strictly geometric, on cave drawings and pottery. It appears in early depictions of rotation and reflection, on decorations and in the architecture of early civilisations. Symmetry was observed and studied by philosophers and mathematicians like Plato and Kepler. The German philosophers Leibniz, Kant and Helmholtz in the 17th, 18th, and 19th centuries considered its importance and its relevance to the understanding of the world in which we live.

In his book, *Symmetry*, Hermann Weyl discusses the history of symmetry in art, architecture and in the modern sciences, especially chemistry and crystallography. Even modern physics deals with the concept of symmetry in its measurements of electrons and their permutations. The chemists Istvan and Magdolna Hargittai augment their book, *Symmetry Through The Eyes of a Chemist*, with varied and wide ranging visual images from the field of art, architecture, biology and chemistry. The pictures included range from Egyptian sculptures of 2700 B.C. to M.C. Escher's periodic drawings, and from molecular structures observed with the microscope to the hexagonal symmetry of snowflakes. M.C. Escher stated once that "in order to represent symmetry on a flat surface, one must take into account the fundamental principles of crystallography which are: translation, rotation and reflection"³.

The German physicist, Werner Heisenberg, mentioned in his book, *The Order of Reality*, the kaleidoscope "reveals a simple mathematical symmetry in its incidental mirroring of hexagonal patterns and it could become an inspiration to the artist."⁴

The visual concept of bilateral symmetry appears in several of my paintings and computer works. In the two paintings, *Crystal 1 and 2*, I placed two circular shapes in the center of each canvas and by highlighting the geometric forms inside the circles in different ways, a different pattern appears in each circle. The resulting asymmetry is more interesting and the crystals seem to be seen with different light reflections. (fig. 2 color page) The two paintings, *Symmetry and Asymmetry*, each show the same upended squares in the center, each painting being an example of basic bilateral symmetry, but in each one the pattern has been broken by a deviation or by the addition of a net-like pattern suggesting its dissolution. (fig. 3 color page) The same dissolution of symmetry can be seen in a series of computer images, entitled, *Dissolution of Symmetry*. These images are part of a series that I am able to show in consecutive order on my computer, thanks to an animated File-Show program. (fig. 4 color page) There are endless variations possible on the theme of Asymmetry which express a more modern spirit of dissonance.

Symmetry as structure is a basic form in nature. As symbol, the principle of Symmetry in the arts has inspired many centuries of civilisation.

Bibliography and Footnotes:

1. Hermann Weyl, *Symmetry*. Princeton, N.J.: Princeton University Press, 1952.
2. Istvan Hargittai and Magdolna Hargittai, *Symmetry Through The Eyes of a Chemist*. New York: VCH Publishers, Inc., 1987.
3. M. C. Escher. *The Graphic Work of M.C. Escher*, N.Y.: Meredith Press, 1967. Page 9.
4. Werner Heisenberg, *The Order of Reality, (Ordnung Der Wirklichkeit)*. Munich: R. Piper, GMBH & Co., 1989. Page 141.

Art as Metaphor

Abstract

This paper which was presented at the Creativity and Cognition Conference at Loughborough University in the United Kingdom, October 10 – 13, 1999, discusses the artist's interest in modern physics, especially quantum physics. The metaphor of the line is introduced as an important component of visualisation of space and movement. Computer technology and its software enable the artist to explore mathematical imagery such as chaos and fractals.

Statement

If I should describe my work as an artist, I would say that it centers around a dialogue of ideas that link art with physics.

The title of a recent Retrospective of my work that I had at the Long Beach Museum of Art in California was *Particles and Waves* (figure 5), and this aptly describes the thematic content of my paintings and computer art. In that exhibition I showed large acrylic canvasses and also my digital 'Gicle' prints. I have been involved with themes from physics for thirty years I think I was the first artist who ever exhibited an abstract painting of a laser beam, in 1963.

My paintings evolve from an intense process of visualisation of concepts, discoveries and assumptions in the field of quantum physics, particle physics and the study of light. The events that I visualise, for example, are: the path of a single electron or photon, interactions of many particles within an ionized gas, also called "plasma" and chaos and symmetry on the nuclear level. These processes are not visible to the human eye, and many are not measurable by the most advanced technology. These are events in pure thought. The abstract world of particles and fields is available to us through thought. The visual language of art requires that we transform thoughts and feelings into metaphors of form and color. To me, art is cognition and metaphor [see footnotes 1 and 2]. I am using the metaphor of the straight, thin, short line to represent something like a

fundamental constant in nature: the diameter and lifetime of a particle, be it electron or photon. I have filled many large-size canvasses with the celebration of vibrant interacting lines, laboriously repeating a basic pattern.

Eleven years ago I was introduced to computer technology as part of the "Artist-in-Residence" program at the California Museum of Science and Industry in Los Angeles. I discovered the convenience of the electronic media which facilitates drawing, repetitions, magnifications and reductions, placements of patterns and overlays, etc.

As an example of my sources of imagery, I would like to talk about one specific project. In 1994 Scientific American published an article by Andrei Linde, a Russian physicist now teaching at Stanford University. The article was entitled *The Self-Reproducing Inflationary Universe*³. Linde suggested that the universe started in a fractal-like pattern that produced a chain reaction of expansion, a self-reproducing

inflationary universe [figure 3 color page]. Fractal geometry is a quantitative approach to describing complex shapes and patterns. The word 'fractal' was coined by Benoit B. Mandelbrot, and means irregular sets of similar triangular shapes [see footnotes 4 and 5]. The computer software offers the fractal function as a linear or filled pattern. This mathematical approach has been

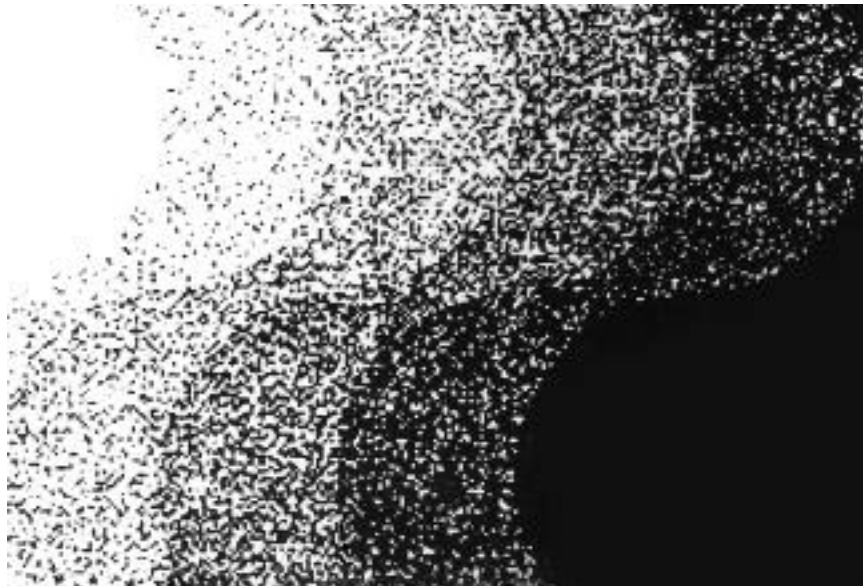


Figure 5: *Particles and Waves*

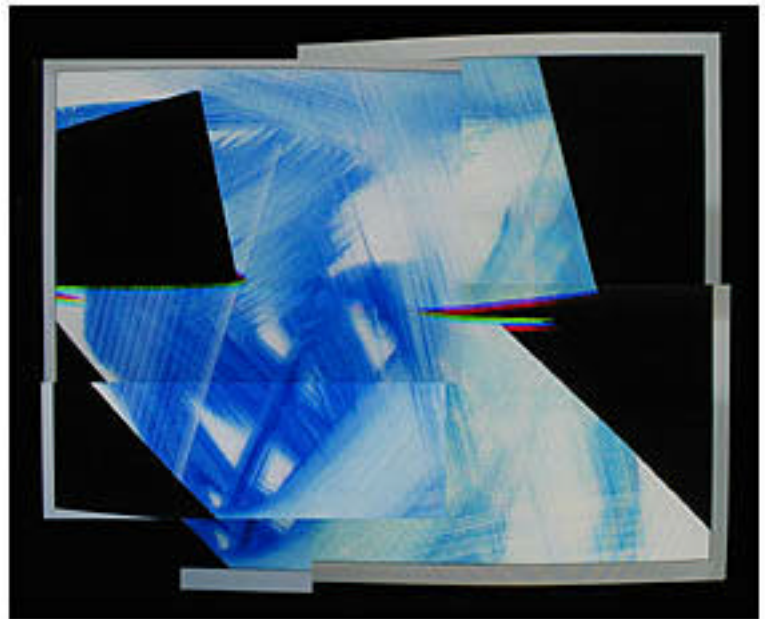
applied to the study of rock formations and is an easy way to recreate moon- or mars-like surfaces on the computer screen. My computer has a simple animation program, so that I can show the development of a fractal structure in motion in consecutive frames.

In recent years I have returned to the study of the nature of light and its representation in abstract terms. Light is proliferated by photons, but it is also part of a larger process that extends over space and distance. Quantum theory has combined the duality of particles and waves⁶. I tried to visualise this duality in several recent paintings and computer-generated images. The future of modern technology is based on mankind's desire to understand our world. As the computer has been invented to externalise our thought processes, we will go far if we understand the responsibility of such knowledge and its inherent power. XXXXX

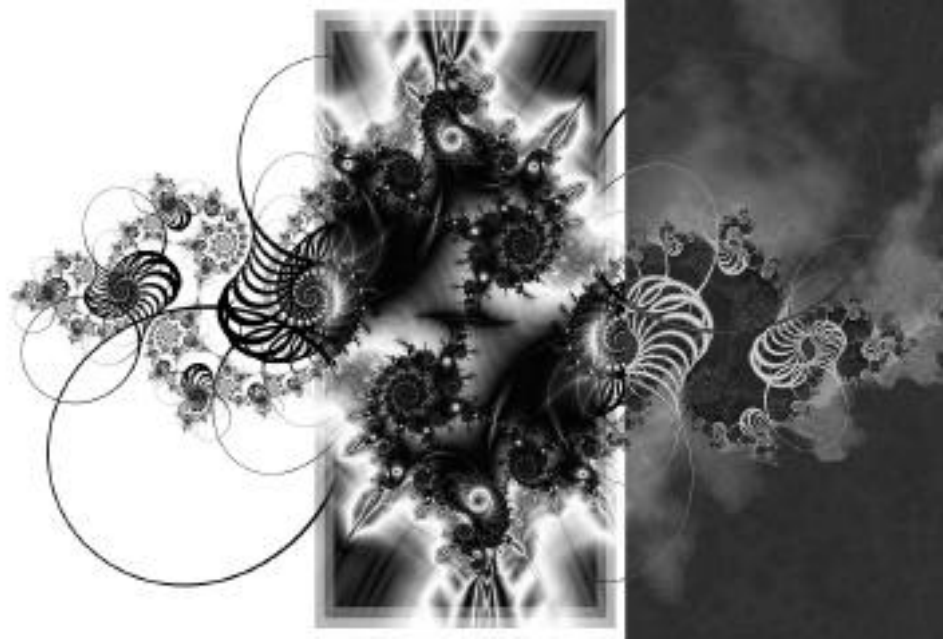
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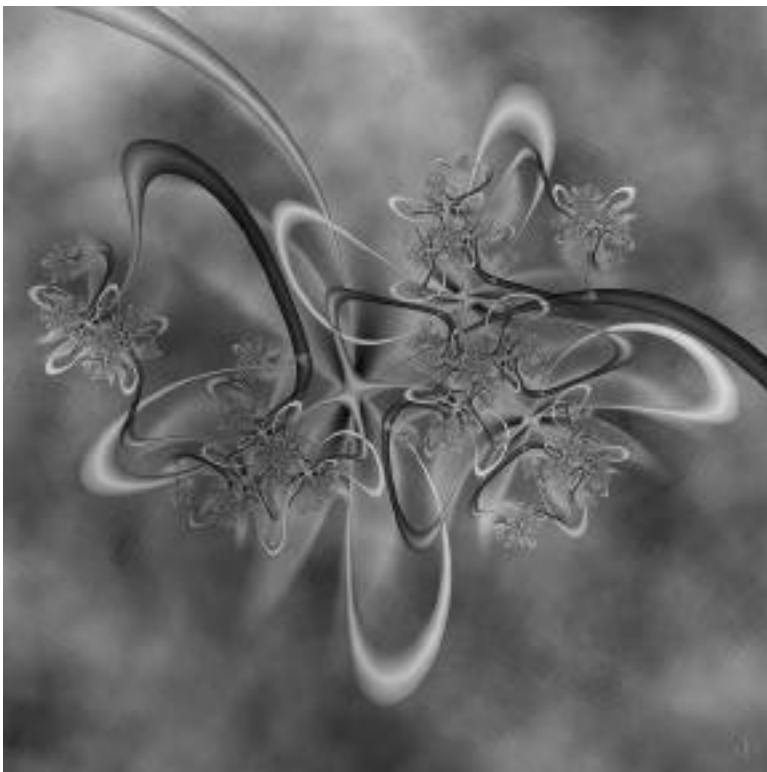
Marius Johnston. *Line*. 1994/2000. Found image, paint, scanner, digital camera, digital print. 19" x 14.3".



Marius Johnston. *Shard 10*. 2000. Scanner, digital camera, digital print. 15" x 18.5".



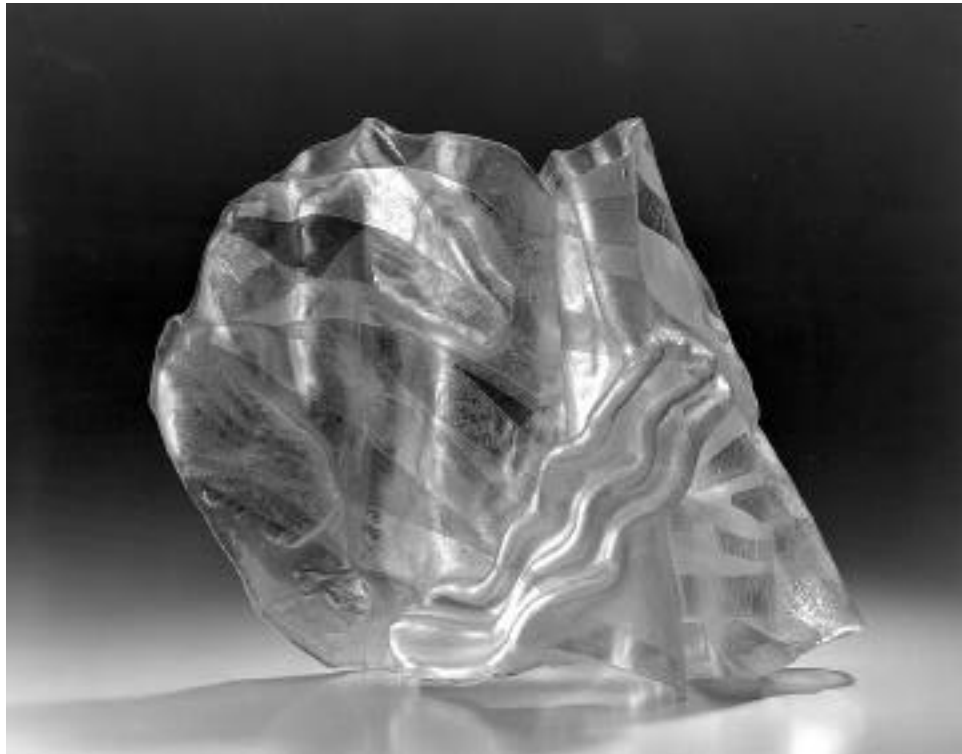
L. Kerry Mitchell (left panel), Damien M. Jones (middle panel), Janet Parke Preslar (right panel). *Kedaja*. 2000. Digital Lambda print. 30" x 30".



Janet Parke Preslar. *Quinomen*. 2000. Lambda digital print, 18" x 18".



Zoe Adorno. *River Voices*. 1998. Fused glass, hand formed. 17"H x 20"W x 8"D.



Zoe Adorno. *Wind Spirits*. 1998. Fused glass, hand formed. 13"H x 14"W x 8"D.

(continued From page 3)

conscious action. Normally, the issue of free will is discussed in relation to determinism in physics....

Recall that in most of our SUPERB theories there is a clear-cut determinism, in the sense that if the state of the system is known at any one time, then it is completely fixed at all later (or indeed earlier) times by the equations of the theory. In this way there seems to be no room for 'free will' since the future behavior of a system seems to be totally determined by the physical laws. Even the U part of quantum mechanics has this completely deterministic character. However, the R 'quantum jump' is not deterministic and produces a completely random element into the time-evolution....

My own point of view, although it is not very well formulated in this respect', would be that some new procedure, (CQG, cf. Chapter 8), takes over at the quantum —classical borderline which interpolates between U and R (each of which are now regarded as approximations), and that this new procedure would contain an essentially non-algorithmic element.

This would imply that the future would not be computable from the present, even though it might be determined by it.

After reading this I wrote to Dr. Penrose and sent him my theory about the nature of Truth but, so far, he hasn't responded. Encouragement has come however, from Dr. John Archibald Wheeler, renowned physicist at Princeton University with whom I have been corresponding since January, 1994. In my letter of March 18, 1995, when I was inquiring further about his previous mention of the writings of Herman Weyl, Dr. Wheeler thanked me for sending him the photo of the mosaic *New Idea Meeting Resistance* (see cover) and he sent me this joke:

Question: What happens when an irresistible force meets an immovable object?

Answer: It goes through without leaving a hole behind it.

Neils Bohr the great Danish scientist, was fascinated by what he called "Complementarity" and predicted that some day all elementary school children will be taught about the complementary nature of science. In the book *Genius*, James Gleick, (Page 40), writes about Bohr who spoke about the unsettling problem of measuring anything in the new physics. Before a crowd of visitors at the 1933 Chicago World's Fair, A Century of Progress, he offered a principle that he called "Complementarity", a recognition of an inescapable duality at the heart of things. He claimed revolutionary import for this notion. Not just atomic particles, but all reality, he said, fell under its sway. "We have been forced to recognize that we must modify not only all our concepts of classical physics but even the ideas we use in everyday life", he said, adding 'We have to renounce a description of phenomena based on the concept of cause and effect.'"

This work then is being proposed as a "Myth for the 21st Century", one that hopefully will fit our knowledge of science as it unfolds and which also will add meaning to our lives. ~~XXXX~~

For the 1997 unabridged version of *A Myth For The 21st Century*, see <http://members.aol.com/myth21cent/index.html>

References:

1. Penrose, Roger. *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics*. New York: Oxford University Press, 1989.
2. Gleick, James. *Genius: The Life and Science of Richard Feynman*. New York: Vintage Books, 1993.

(Continued from page 4)

those who followed, like Kepler, Newton, Einstein and Stephen Hawking in physics and astronomy, among others.

So, it's not that I'm so bright that I rediscovered this. I simply had the good luck to marry a physicist forty years ago. To quote a recent fortune cookie, "Yesterday's philosophy is today's common sense."

One idea I heard debated among physicists in the 1960s was that the regularities we observe in the universe may simply be products of our imagination in the form of math constructs that simply happen to fit some observations. Worse, they may be misleading patterns we impose on data, like constellation diagrams on unrelated stars. This is the theme of my 1971 piece, *Science is System Searching for System* (figure 1 page 4). By 1973, I had personally become convinced otherwise. I had seen the scanning electron microscope photos of viruses (unseeable before 1965). The polio virus was a perfect icosahedron! Like so many forms in nature having a mathematical shape, it lurked there until we had instruments powerful enough to discern it. I did several versions of this. Version 2, a batik banner in 1975, I titled *In the Beginning was Logos*. The third version, 1987, was titled *Quest* (figure 2 color insert page). Seeing more and more is a voyage into the unknown—a voyage of scientists that struck me as similar in its intensity and dedication to the voyages of those in the arts or mysticism.

Now, I learn that Pythagoras taught "all knowledge is kin."

Doing this work was the most religious thing I undertook in the 1970s. The complete design and eclipse in the center of the batik banner represented the fact that no one person, nor discipline, nor creed, nor civilization, nor era could ever comprehend the whole pattern. To make the eclipse opaque meant satin stitching a 15" circle while leaving the white lines open. Hand-embroidering it, I could appreciate the patience and motivation of the cathedral craftsmen!

I spent much of the 1980s exploring natural patterns by analogues in crafts media, much the way programmers explore landscapes, plant forms with fractal equations. See *Mountains Swimming in Glaciers*, crumpled paper painting, (figure 3) and *The Kirlian Effect*, shibori sewn tie-dye technique, (figure 4). Wrinkling and dyeing (shibori) gave me convincing branching patterns, wrinkling paper yielded "aerial landscapes." Marbling paper gave fluid dynamics designs. All these can be described by mathematical formulae.

Douglas Hofstadter wrote an essay in 1982 called "The Music of Frédéric Chopin: Startling Aural Patterns that also Startle the Eye" in the *Scientific American*. He described the magic he found in a Chopin étude. When he finally saw the musical score, a wonderful pattern was visually revealed, one that accounted for his fascination. He said essentially that what we call magic is when we can sense an underlying pattern but we can't fathom exactly how it arises. Combing



Figure 3: Trudy Myrrh Reagan. *Mountains Swimming in Glaciers*. 1980s. crumpled paper painting.

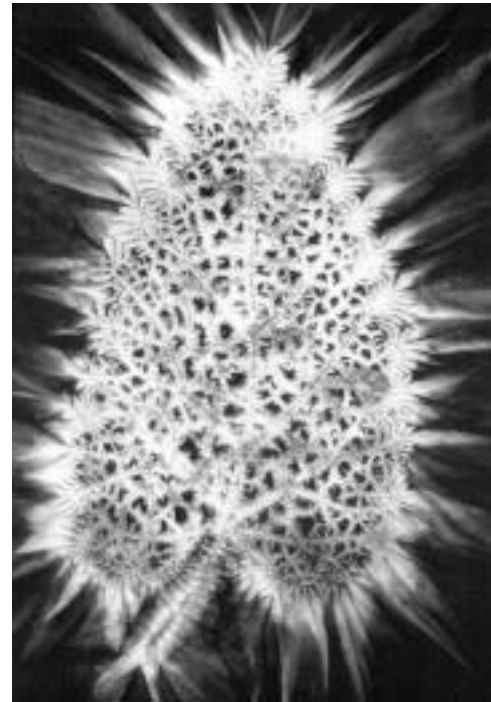


Figure 4: Trudy Myrrh Reagan. *The Kirlian Effect*. 1980s. shibori sewn tie-dye.

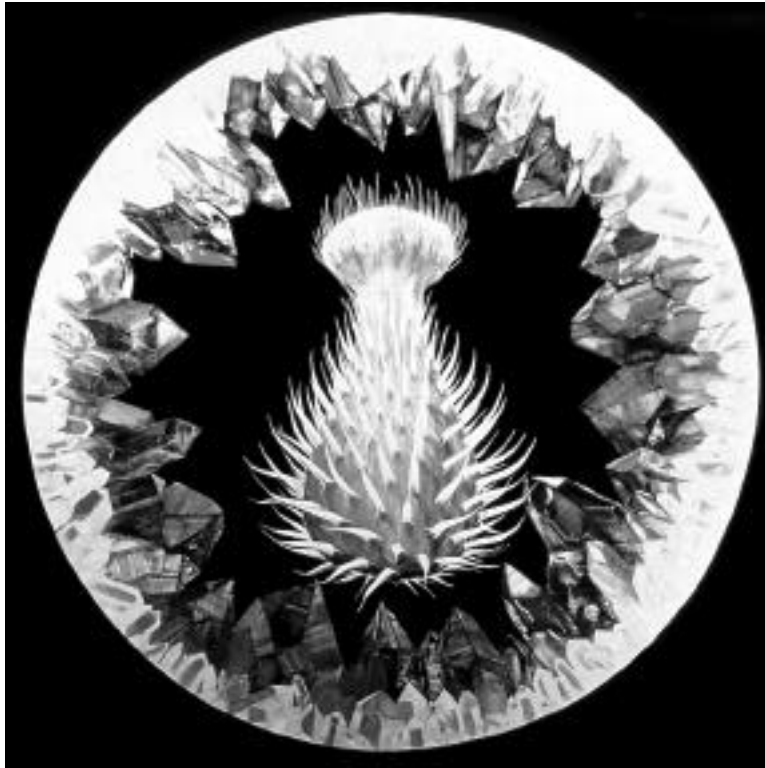


Figure 5: Trudy Myrrh Reagan. *An Essential Mystery that Number Governs Form*. 1994. Acrylic paint and incised lines on plexiglas disk, 45" diameter.

spots of paint to get patterns like laminar flow or pheasants' plumage was just such a revelation.

Since 1991, I have been painting on sheets of 1/8" Plexiglas cut into 45" diameter circles. Acrylic paint in glowing translucent colors contrasts with the stark opacity of black and the sparkling white of the exposed plastic. I achieve white by carving through the paint to the plastic with a small power tool. I call this series Essential Mysteries, for in it I explore issues that fascinate us all, are probed by science, but which remain fundamentally mysterious-sources of puzzlement and wonder.

One of these is *An Essential Mystery that Number Governs Form*, 1994 (figure 5 above). Pythagoras, here we go again! By now, we know that crystal shapes reflect the shapes of their constituent atoms, their arrangement and the forces between atoms. We know that there is an interplay of forces in developing creatures that can generate incredible patterns. We know more now, but is it any the less mysterious?

As I grow older, I am fascinated with the light and shadow, joy and sorrow in events as they unfold, which inspired the 1997 blockprint called *Deep Yin and Yang* (figure 6). The symbol for this interplay has been borrowed from China, but the subject was one of the themes of the Pythagoreans also.

So, on several points, some unexpected, the themes that have engrossed me were the preoccupation of a thinker much greater than I in antiquity. Not only does the Quest extend across disciplines and cultures today, but backwards in time, and, one hopes, forward into the future.

Finally, the idea of a cosmic pattern is across cultures, not exclusively Greek. Here is a wonderful quote from the 3rd century Chinese Philosopher, Chung Tzu that emphasizes the process of development, giving the concept of cosmos a modern, dynamic quality:

The harmonious cooperation
of all beings arose
not from the orders of
a superior authority
external to themselves,
but from the fact that
they were all parts
in a hierarchy of wholes
forming a cosmic pattern ,
and what they obeyed were
the internal dictates
of their own natures.

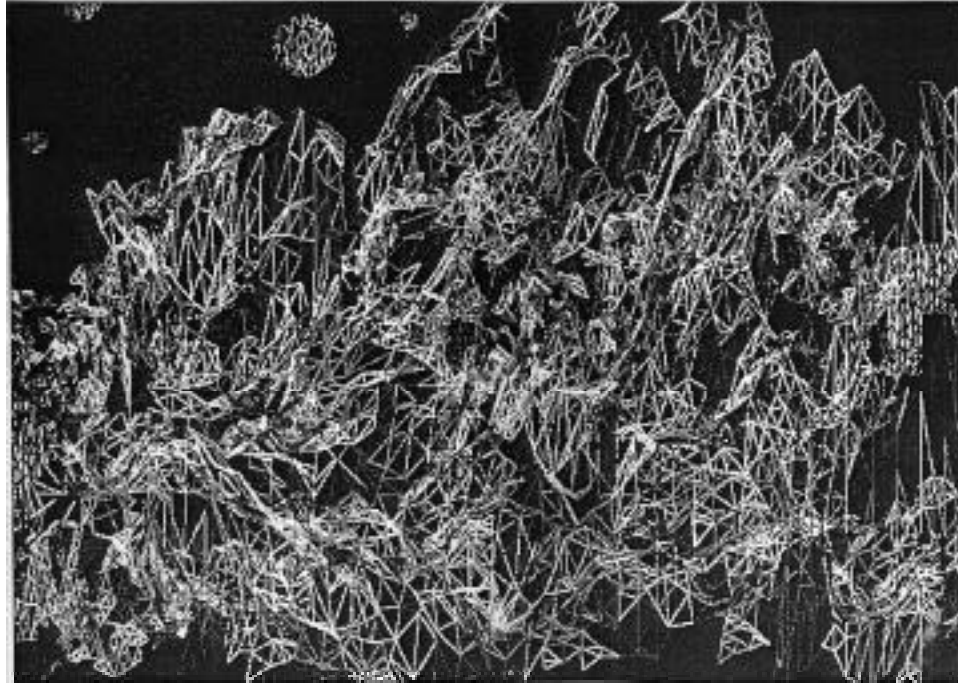
-Chung Tzu, 3rd century

(A more detailed and scholarly treatment of this material will appear in the Proceedings of Mosaic 2000, an art and mathematics conference held at the University of Washington in Seattle, August 20-25, 2000). xxxxx

(continued from page 6)

Footnotes

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Bettina Brendel. *A Fractal Universe, Multicolor computer print.*



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*n., pronounced eye-lum,
1. a Greek word for the
exploding mass from
which the universe
emerged.*

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