

# Beauty, Art, Nature and Chaos

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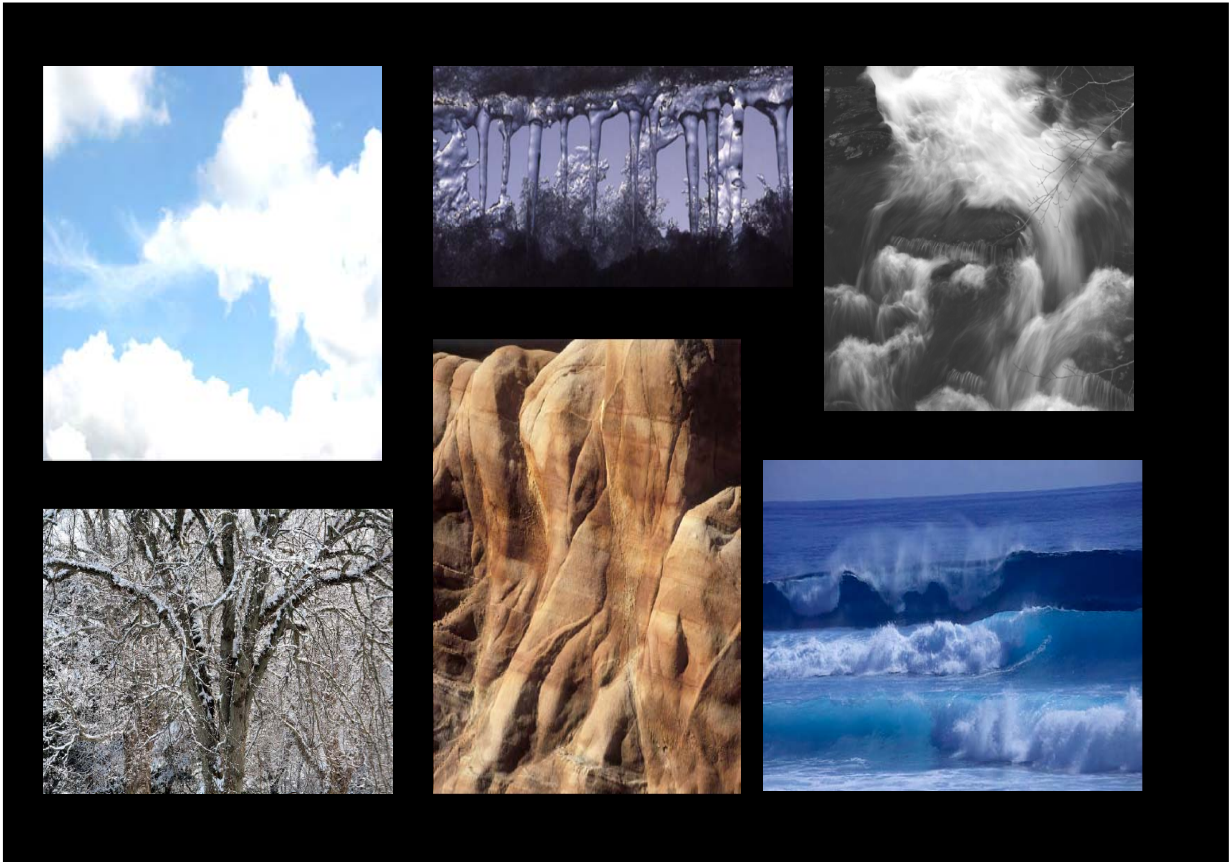
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A Paper Delivered at the Université de Genève

May 19, 2008

I'd like to show you a small sample of what I think of as the "ordinary beauty" of nature and natural processes. These little scenes are ordinary in the sense that they are the kinds of scenes found all around us though we may have ceased or failed to pay attention to them.

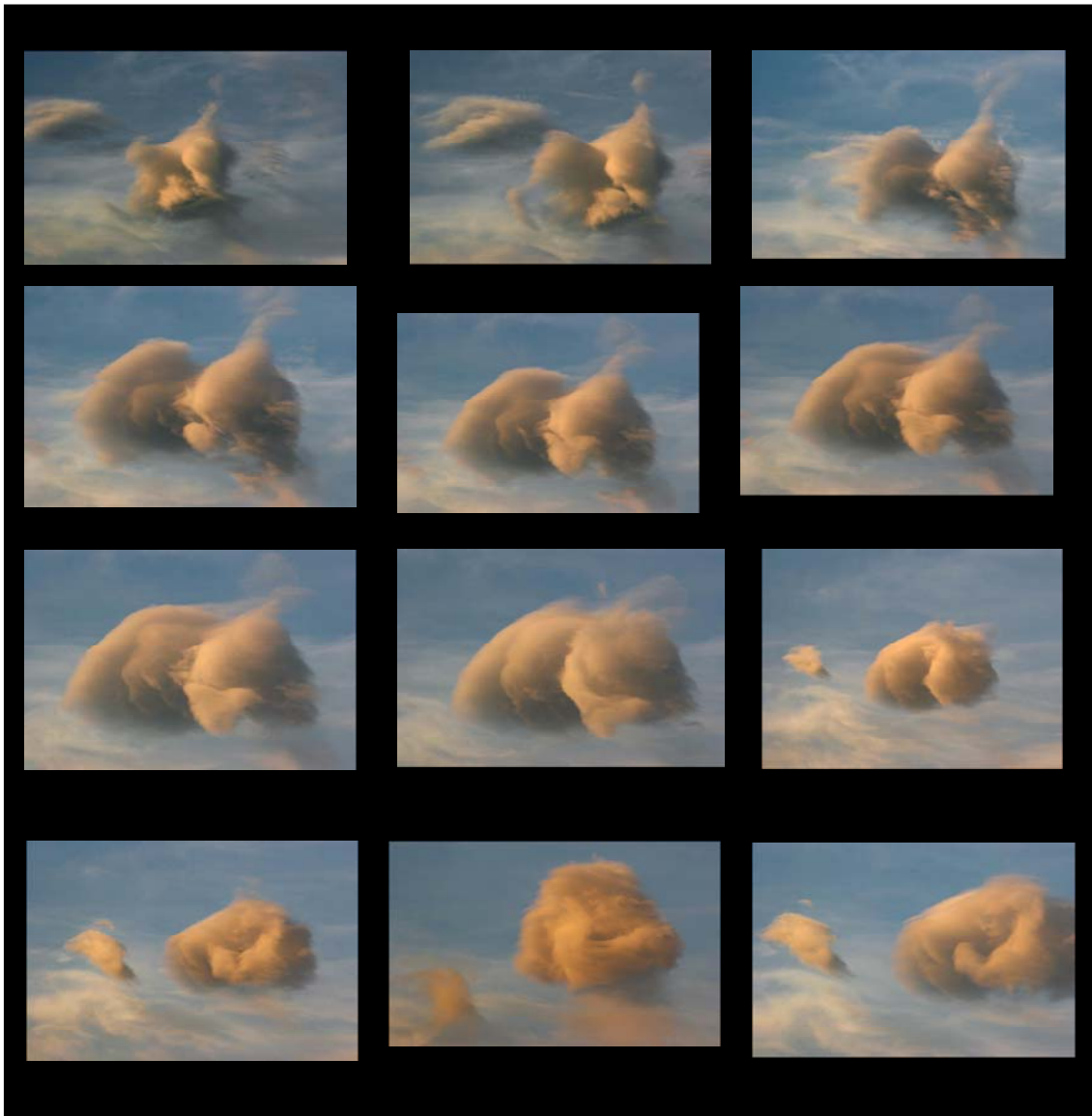


I catch many of the clouds in shopping mall parking lots. Clouds and trees, stains on walls, clusters of vegetation, melting ice, ocean waves, the stochastic scattering of stones on a shore or stars in the heavens. Such phenomena have acquired a scientific name: fractals.

The word fractal refers to a form with an irregular shape, a shape that has a certain chaos and unpredictability built into it.

Everyone knows what a cloud is—and scientists understand how clouds are formed and the physical forces that act on them. So no one can predict what a particular cloud will look like at any given moment in time. I might offer this unpredictability as a hidden characteristic of the apparent oxymoron, "ordinary beauty": a phenomenon's familiarity—its ordinariness--combined with its element of constant surprise and change. If you have ever seen a photo sequence (what we used to call a "contact sheet") of a friend's face, you realize that the apparently familiar face contains many surprising faces we have failed to notice. Here's a photo sequence of a cloud I made very close to sundown near Mount

Ventoux in southern France. The single cloud reveals itself as a continuum of many surprising clouds. The one is the many and the many the one, as the Taoists would say.



Despite the unpredictability and apparent non-geometricity of fractal shapes, we feel that they have order. It's only in the last 40 years or so that scientists have developed a way of talking about that order as the order of Chaos.

Fractal forms such as the one I have shown you are the signs and the marks--the traces--of the activity of chaos.

My focus this morning is this: Chaos Theory and its offspring, Complexity Theory, are holistic theories. I'd like to suggest that the holism of Chaos in nature has important implications for the meaning—or at least **one** meaning—of ordinary beauty and what I see as the holism in works of art.



In appreciating the beauty of a fractal (such as this cloud), we are also at some level appreciating the beauty of the whole. So let's explore Chaos and then we'll come back to fractals.



The study of Chaos is a study of complex dynamical systems, which is to say systems containing many (perhaps even literally "countless") interacting "parts." Chaotic dynamical systems are everywhere and constitute much of what we think of as our everyday reality. They include local, regional and global ecologies, networks on the internet, neurons in the brain, turbulent flows in the ocean or rivers, growth of snow crystals in the atmosphere and of individual trees in a forest, the beating of our own hearts (which require a certain level of chaos to be healthy) the systems of erosion, wave action and geological uplifting that creates coastlines and mountain ranges. In chaotic dynamical systems all of the "parts" of the system are linked together through feedback loops which are, in turn, linked to each other through a process sometimes called "phase locking."

The interwoven feedbacks in a holistic system include:

negative feedbacks which "regulate" or hold parts of the system within specific ranges the way the feedback loop of a thermostat regulates the furnace to keep the temperature within a certain range.

And there are also explosive, system-changing positive feedbacks. These can "blow up" an interaction because the output of a cycle becomes the starting point rather than the limiting point for the new cycle. The result is that each cycle builds up in a certain direction, an amplifying exponential results. The screech that comes out of a speaker when the microphone is placed too close For example, the positive feedback which creates new cells in our bodies amplifies small copying errors and eventually they do us in. The screech of a microphone placed to near a speaker results from a positive feedback loop, a fast amplification of small crackles of sound. The basic equation which yields the stunning images of the well-known mathematical fractal called The Mandelbrot Set, is a positive feedback equation which is applied one by one to a matrix of numbers on the complex number plane.

In chaotic dynamical systems everything (every part) is connected to everything else (every other part) through feedbacks. "Everything affects everything else." That is the chaos adage. That is the meaning of Chaos as an holistic theory. In fact, Chaos is a relatively new and productive way to

conceptualize what is meant by the otherwise vague concept "the whole": here whole means *not* a collection of parts but rather a dynamic of interactions in which any identified "part" is only a handy and relative term where we may glimpse the whole as something constantly changing: unfolding and enfolding--sometimes staying pretty regular, familiar and ordinary, but sometimes getting pretty wild.

Virtually every system in the universe—from the systems that give birth to stars to the calls of insects in a jungle night to the jiggling bumper-car behavior of paramecia in a drop of pond water—involves holistic dynamical chaos in some way. These are "relative wholes," of course, nested within the ultimately greatest whole, the whole universe itself.

One physicist has noted that from the perspective of Chaos, the Newtonian ball we'd assumed was rolling mechanically across the Newtonian billiard table was actually being affected by an electron on the other side of the universe. (citation) The effect is negligible from our point of view and we can probably ignore it when playing billiards, but it's there. Sometimes we can't ignore it.

The best known illustration of the curious holistic relationship of the small to the large in the chaotic system is the weather—the famous butterfly effect of Edward Lorenz, who died earlier this month. Briefly, because everything affects everything else in the global climate, then air currents, weather fronts, high and low pressure cells, temperature gradients, high altitude wind speeds, sea surface temperatures, fluctuations of solar output--all that and much more can be found interacting fluidly. The microscopic breeze from a butterfly flapping its wings in Brazil interacts with other movements taking place in the system. In the right place at the right time, this insignificant activity may be magnified by feedback, so that the small wind cascades to change the weather in New York.

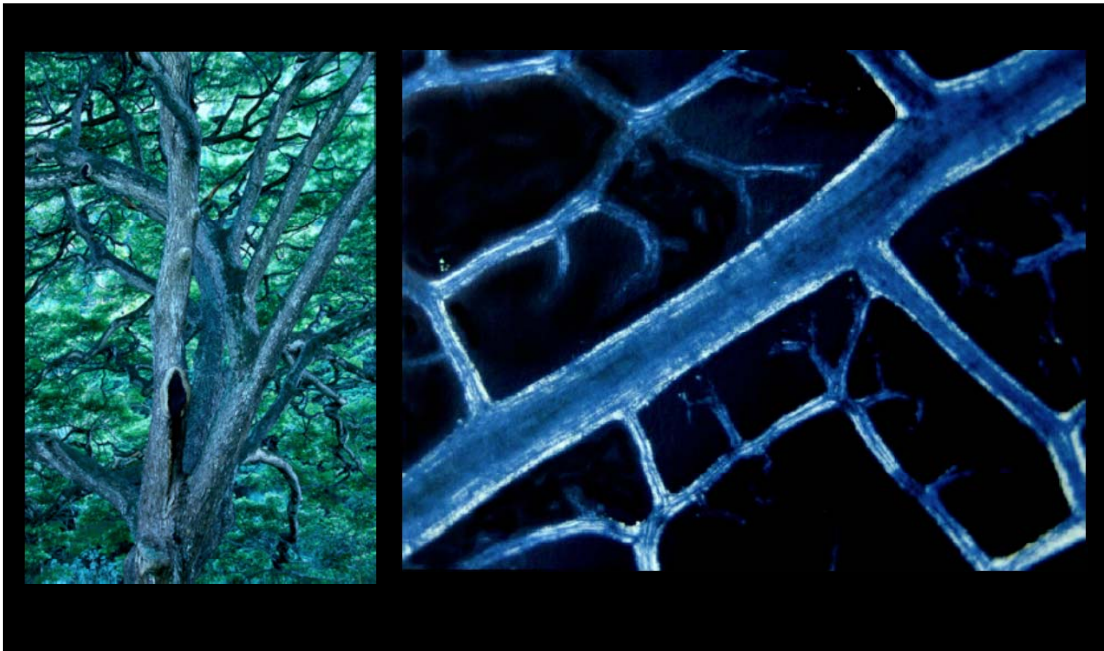
Of course, the butterfly, in turn, is affected in the wavering pattern of its flight by air currents generated from across the world. Consider: It's not just the patterns on the surface of the butterfly's wings—patterns produced by chaotic processes operating through evolution (complexity theory applies here)--it's the butterfly's pattern of flight, too, that we find beautiful and mysterious—ordinary and yet extraordinary. The butterfly provides an image of a new way of thinking about the relationship of the part to the whole, and of the order involved in an instance of ordinary beauty.

The shape of almost everything is intertwined with chaotic processes. So even though a system may have embedded rules for unfolding—the rules that govern the growth of crystals, or the DNA codes that dictate the general branch and twig pattern of a particular species of tree—the actual unfolding takes place within a chaotic dynamical context. So no two snow crystals are identical even if they travel through the atmosphere side by side. Here even the six sides of a single snowflake are not identical, despite the crystal forming rules.

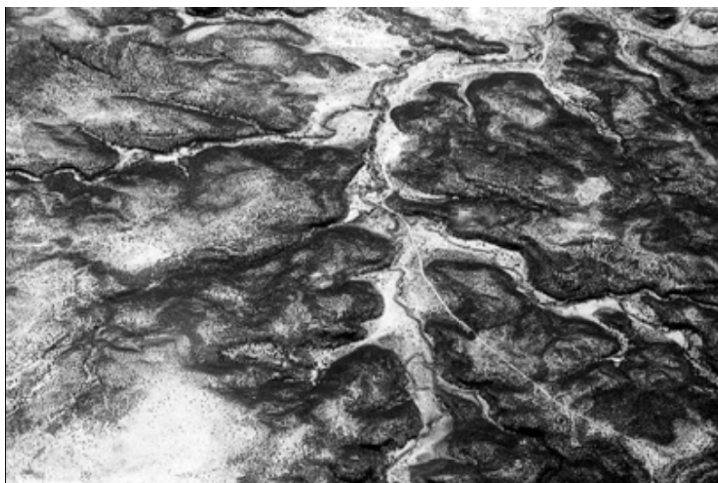


Two trees of the same species standing right next to each other are individual and not identical because the ever shifting forces acting on them, including the effect each has on the other.

One of the great discoveries of Chaos Theory--and the Fractal Geometry that describes chaotic forms--is that fractal shapes are "self-similar at different scales." Thus we realized that we can actually "see" the order in chaos and "see" that apparently irregular shapes have an order that we didn't have a name for. Some self similarity is obvious. The dendritic shape of the tree at large scale repeats itself at the branch scale and, of course, the leaf scale.



Here's another dendritic self similar form I photographed from an airplane window over Texas.





If you go down to the ground level, the canyon's branching erosion pattern repeats itself at smaller scales.

But even where fractal scaling is not involved, or at least not apparent, there is still the fact that in the natural world, the part that we're looking at--the fragment or assembly of fragment before us--one catches a glimpse of whole--or more precisely, the *movement* of the whole.

For example, in this instance of rocky debris deposited by the processes of erosion and geological change one can glimpse the whole chaotic dynamism of the landscape of which we are inextricably a part.



Let me put this simply and hopefully not simplistically. To me this is an exciting idea: *It is through the fractal piece (if we know how to look) that we can glimpse the whole, or rather the dynamics of the whole.*

Knowing how to look is the act that transforms something "ordinary" into "beauty." Recognition of beauty in this formulation is synonymous with a recognition of the dynamics of the whole, the dynamics of change, the dynamics of unity in diversity and diversity in unity. So, now I'll turn to art and make three points connecting the seemingly ordinary, haphazard, holistic beauty of the natural world with the beauty of works of art.

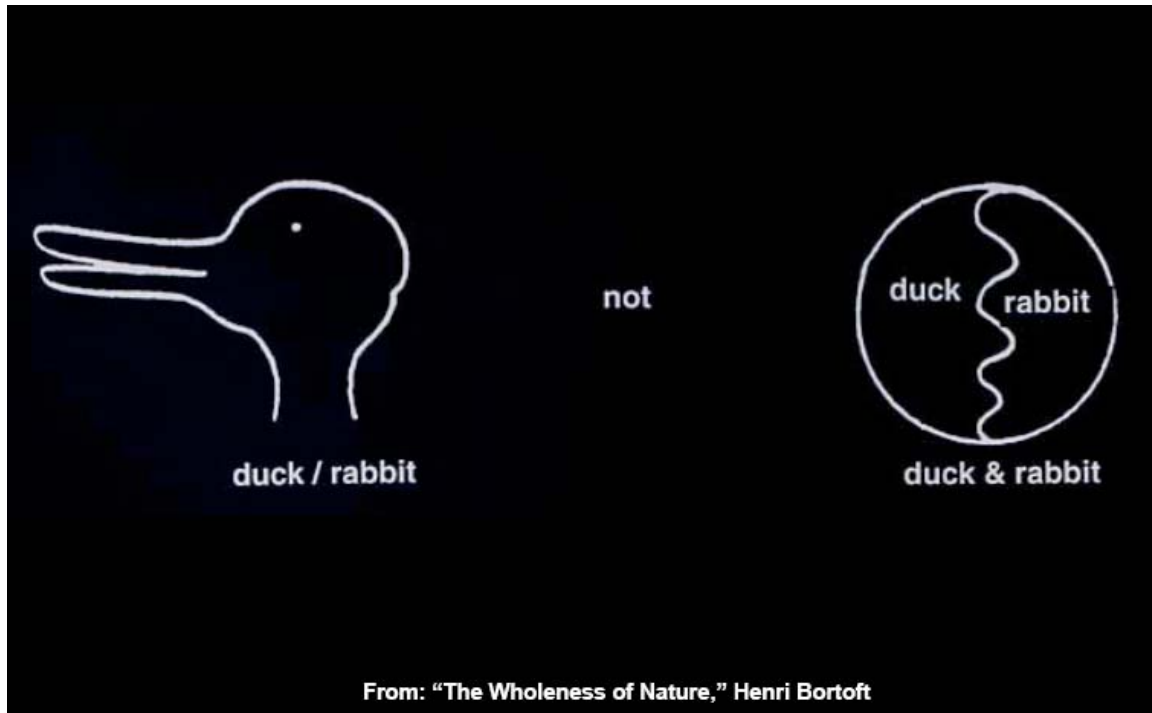
First point: Goethe.

Wolfgang von Goethe, incomparable scientist as well as incomparable artist, opposed Isaac Newton's conceptualization of the natural world. Newtonian science aims at unifying phenomena by means of universal equation. It looks to strip away individual differences, as between apples falling from trees and planets orbiting the sun, and come to a collection of abstractions or unifying "laws" of nature. In current parlance, Newtonian holism is a reductionist holism that attempts to confine free ranging nature in a mathematical cage. We can see this approach at work in the effort to create the single equation of the Grand Unification Theory or the network equations of String Theory, the effort in biology to tie virtually every human trait to the barcode of DNA, and the effort in consciousness studies theorists to crack the so-called "hard problem" by locating the site or mechanism of conscious awareness in the brain organ or mechanism.

Goethe's approach was quite different from the mathematical reductionism of Newton's science (which is by and large still our science). He imagined nature in terms of the holism he was familiar with as an artist. Rather than looking to reduce all variety to unity as a conclusion, he **started** with unity. Let's assume that nature **is** whole, he argued, and then let us look at each part as a **metamorphosis** of that whole into particulars. For example, Goethe proposed that the different species of plants, and the different parts of each plant are the metamorphosed expressions of **a single plant**, as he said, "becoming other in order to remain itself"(qtd in Bortoft 7).

To get a rudimentary sense of the relationship of unity to individuality as it appears in Goethian science, look at this famous visual paradox (Bortoft)

In *The Wholeness of Nature*, Henri Bortoft says on this point: "We could say that the whole world is multiperspectival, where each perspective is wholly the world, as each perspective of the duck/rabbit figure is wholly the figure, and not only part of it. Yet just as any one perspective does not exhaust the figure, so no one mode of disclosure exhausts the world." (352)



The figure is **both** a rabbit and a duck. Therefore, underlying it a unity from which each perspective emerges. Goethe's approach recalls Neils Bohr's famous idea of the "**Complementarity**" of quantum wholeness which can't be described in language without resorting to paradoxes such as saying that each separate discontinuous particle is simultaneously a continuous wave. Underneath such paradoxes lie the unity from which the paradoxical perspectives emerge.

To me, as an artist, it seems important that in Goethe's understanding of nature, individuality is not to be discarded as it was in Newton's understanding, where individuality vanishes into the unity of an abstract equation. Rather each form in reality (each tree, each stone, each wave crumbling into to the shore) reveals the whole from which it has metamorphosed (again, if we know how to look and aren't trapped by our "ordinary" concepts of what we're looking at). Each such glimpse gives us a subtle **vibration** of the whole, a glimpse into it, but does not leave us with the illusion that we have grasped the whole thing. Recreating those holistic vibrations is, of course, the domain of the artist. As Ernest Hemingway said, fiction writing, "any part you make will represent the whole if it is made truly." At some level, all artists know this.

A second connection between the seemingly ordinary, haphazard, holistic beauty of the natural world and the beauty of works of art involves what I call—for purposes of discourse-- **the Primal Paradox**. The paradox is this: the human being--and perhaps everything in reality, but especially humanity--is embedded in a self-contradictory state



in which we are each individual, unique, isolated and separate (my consciousness, my death), but at the same time—and here's where the paradox comes in—we are also each of us *indivisible*, inseparable and utterly merged with the whole. We are both particle and wave. For example, the thoughts that pass through our individual heads are ours alone, in one sense, but in another sense are a shared activity that fuses us as an ensemble in language, knowledge, nurture and much else. The thoughts I'm expressing now are both mine and are a metamorphosis in the Goethian sense, from the whole of consciousness. If we shift our gestalt, we can see that this unity is real, not an abstraction.

I say I'm *observing* the Primal Paradox because I didn't invent it or discover it. The paradox that shows up at some important point in every system of thought I'm aware of. "Do unto others and you would have others do unto you" is a Biblical acknowledgement of the existence of the Primal Paradox. In Hinduism the paradox finds itself in the statement that "the Atman is the Brahman." Darwin's notion of mutations occurring with individuals as the mechanism of the survival of species, is a scientific form of the paradox. Quantum Mechanics is full of the paradox, from the particle-wave duality to the observer-observer conundrum. In our concepts of justice we try to balance individual rights against the rights of the whole society. Each system, of course, develops ways of **explaining** how the paradox isn't really a paradox.

There isn't time to quote even a sampling of the vast sacred and secular scriptures that agree that the Primal Paradox is basic to our existence. I wonder if it may be the only thing that humans have ever agreed on, though they have vehemently and often enough violently disagreed about how to explain it away, resolve it, what its origins are or what it really means.

The Primal Paradox is an holistic idea. The paradox implies that each part contains an impression of the whole and the whole implies each part, the macrocosm is the microcosm, the world is in each grain of sand. Physicist David Bohm argued that each photon of light, through its embedded interference pattern, contains the pattern of the whole universe. One might say that an "ordinary" grain of sand in our hand is beautiful in part when we are able to sense the universe lying there.

I believe that unlike other kinds of human thought and expression, works of art engage the Primal Paradox **as a paradox** without attempting to resolve it or explain it. For example, a novel might portray a situation in which an individual attempts to act the golden rule and in the process reveals himself to readers as having both an indissoluble connection to others and as being isolated from them, in conflict with them. *Don Quixote*, comes to mind.

Far from being mere social constructions, the act of engaging the ambivalence that surrounds the paradox is what I believe makes art a unique form of human expression and takes us back to the religious origins of art and its role in instantiating eternal mysteries.

Art is, I believe, a human "mirror" of nature in this regard. Nature conveys forms made of matter and energy. Art makes conveys forms made of human thought: In nature the individual fractal fragment records the movement of the whole. Similarly, in art the individual melody, painter's subject, fictional character's dilemma embodies both the whole even as it present the glory and the tragedy of individuation.

Novelist Joseph Conrad expresses this wonderfully when he describes the meaning of artistic truth, which he opposes clearly philosophic and scientific truth. Conrad calls artistic truth

"the latent feeling of fellowship with all creation...the subtle but invincible conviction of solidarity that knits together the loneliness of innumerable hearts." (20) Here Conrad has made an unequivocal statement that the truth of art is the presentation--absent rationalization or resolution--of the Primal Paradox. The two parts of the paradox he calls "loneliness" on one side and "solidarity" on the other. He goes on to say that this truth lies in a "passing phase of life" (the ordinary), and that the aim of art is "to hold up unquestioningly, without choice and without fear, the rescued fragment before all eyes." (21) Conrad's presents us with a sort of a fractal idea. Artistic truth, for him, is this solidarity "which binds men to each other and all mankind to the visible world." (21) Conrad, like Keats, seems to understand that when it comes to art, truth and beauty are the duck and rabbit of the same side of the coin.

The strategies by which the arts instantiate the Primal Paradox (what Conrad calls artistic "truth") then, is my third approach for connecting holism—in fact, something close to a fractal holism--and art.

Irony, literary metaphor and other allied strategies allow the Primal Paradox of individual loneliness and yet solidarity to appear in dynamic tension (without resolution) so that "all eyes" may see it.

Let's look one strategy, metaphor, very briefly.

Physicist Roger Jones has observed:

“There is an act of creation at the heart of metaphor which distinguishes it from simpler, more passive comparisons, and explains its essential value in the arts.... I define metaphor as an evocation of the inner connection among things... I think of metaphor in the larger context in which all things are related to one another through an underlying unity--some cosmic principle... Metaphor tantalizingly evokes this hidden synthesis through its dramatic juxtaposition of apparently unlike things. It is as if the poet, in using a metaphor, not only refers to a symbolic or ironic connection between two things, but hints at the very creative act itself which underlies all naming and evoking processes.” (4)

To this I would add that the metaphor in an artistic context importantly relies on our continuing active experience of the **difference** between the terms. American poet Mary Oliver's metaphoric description of starfish relies on a kind of negative feedback loop cycling between the terms of the comparison, keeping us continually within a range of tension and a lack of resolution of the metaphor. We can resolve the terms as finally similarity OR its difference: The narrator says that as she fought her fear of starfish and touched them underwater the starfish "bloomed through the water like flowers, like flecks an uncertain dream." (113)

All this is to say that literary metaphor (I won't speak of the other kinds, which are mostly dead or polemic) holds together the tension between similarity and difference and, more deeply, the paradox of the particular and the universal; it doesn't resolve them. Through a literary metaphor we experience the dynamic of both the whole and the separation from the whole. Of course, metaphor has become a degraded term, as has irony, which has been reduced by the Seinfeld generation of critics to sarcasm. Real

irony, not the tv kind, is another strategy of tension where the thing said doubles back on itself or goes in multiple directions:

Here is American novelist Cormac McCarthy creating convolutions of ironies that are hardly sarcasm. The feedbacks of the ironies here create an eloquent expression of the Primal Paradox. The passage comes at the conclusion of his book, *Cities of the Plain*:

Every man's death is standing in for every other. And since death comes to all there is no way to abate the fear of it except to love that man who stands for us. We are not waiting for his history to be written. He passed here long ago. That man who is all men and who stands in the dock for us until our own time come and we must stand for him. Do you love him, that man? Will you honor the path he has taken? Will you listen to his tale? (288-89)

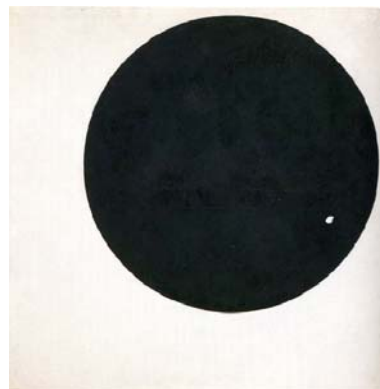
This statement, uttered by a stranger to one of the main characters of the novel, also creates a metaphoric comparison and contrast with the story that we have heard in the preceding 250 pages.

There isn't time to show that metaphor-like dynamics pervade the strategies used in all the arts to express the dynamics of the unresolved Primal Paradox. For example, "development of a theme" in classical music where an initial figure or melody is simultaneously compared and contrasted to variations of itself. The theme figure remains the same (remains universal) at the same time that it is, moment by moment, something particular and different, with each new moment coming as a little "surprise," what Leonard Bernstein called an "Expectation Violation."

Each moment in the composition is, in effect, a fractal of the entire composition.

In the visual arts, many varieties of metaphor-like strategies dominate.

The philosophically famous "ordinary" shoes of Van Gogh are both individual (they were Van Gogh's though Heidegger thought they were a peasant woman's) and universal, part and whole. They are a metaphor and at the same time they are "a painting of an ordinary pair of shoes."

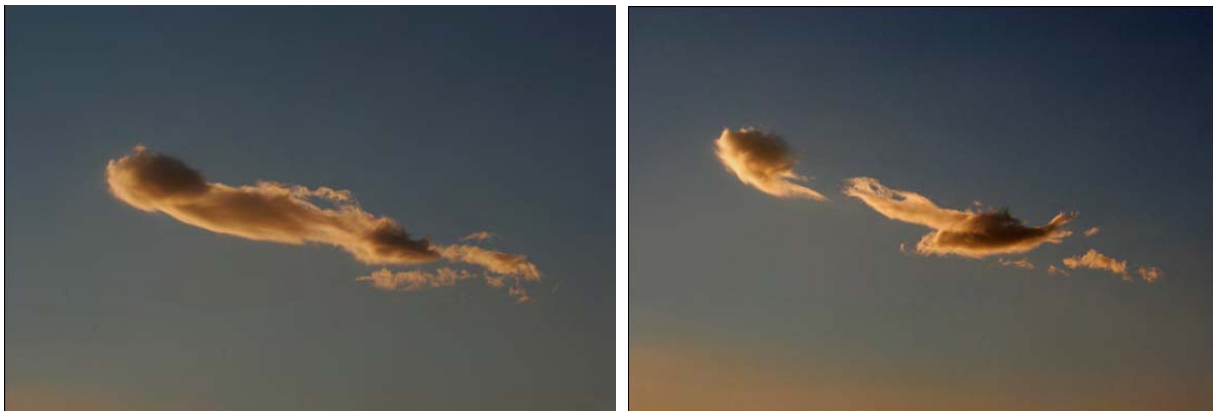


We can never resolve which is true. And that lack of resolution **is** the artistic truth that Conrad spoke of. And the work has beauty (at least in part) because it presents this truth.

Meanwhile, in this simple, abstract painting by Malevich painting there are all sorts of metaphoric juxtapositions and tensions. But, on the other hand, what could be more "ordinary" than this black disk with its little flaw inside a white square? Is this an artistic fractal of the whole, a fractal form made out of human thoughts?

I have tried to suggest that the ordinary beauty of a natural object contains within it the vibration of the dynamic and constantly interacting whole. We may not see that vibration because we are used to seeing the object as what Roger Fry calls our particular "labels" of it. (citation) But an artist may be struck by an object's "holistic vibe." that others might not immediately see it. The "object" referred to here may be a cloud, a few notes constituting a melody, a geometric shape, a story or anything within human imagination or perception. AT SOME LEVEL ARTIST IS RESPONDING TO THE HOLISTIC VIBE IN WHAT FOR OTHERS IS AN ORDINARY OR INCONSEQUENTIAL OR HABITUAL SCENE. VIBE IN THE FORM OF THE PRIMAL PARADOX. The artist moves make the vibration manifest and thereby to create a form which expresses what Piet Mondrian called the individual-universal equation. This equation joins and separates both the artist and her audience and the particular subject of the work from the universal context out of which it arises. Even the most ordinary thing, when it strikes us with this holistic "vibe," has that effect of connecting us with it's "beauty," a word which I hope you will agree means something very different from conventional prettiness, and which may include the fearsome and terrible, evoking "pity and fear," as Aristotle said. The artists work is to find a form (what Eliot called "the objective correlative") to recreate for others that holistic vibration he has felt in the particular. The result is an artifact which provokes a sense of otherness. Whatever is being represented—an old tale about a man who inadvertently kills his father and marries his mother, a hunting expedition for a white whale, a trip to the lighthouse, a block of red on a background of blue—is present to us but is also more than the particular subject.

Perhaps we all feel Mondrian's equation in force when we stop to watch the fractal shape of a cloud unfold.



This ordinary object delivers its extraordinary message. We, the distant observer, are, of course, in our own way, the cloud.



Metaphor degraded like irony which has been reduced by Seinfeld to sarcasm.

***Acknowledgement:** All the photos used in this article are original work from Prof. John Briggs and can be see also on his website.*