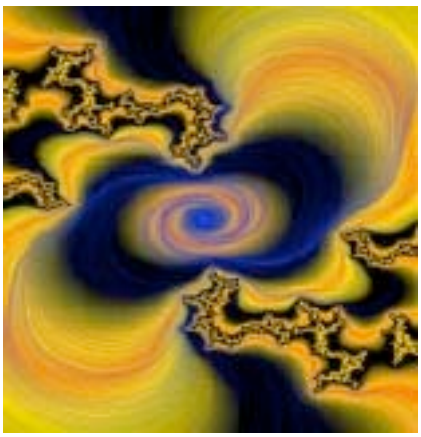
The Frontiers Where Chaos & Order Meet



François MIGLIO

will present the
FRACTAL SYNCRETISM
in his paintings, at the occasion of the exhibit of
his work at the International House
University of California, Berkeley
(April 12 & 17, 2003)
with an introduction by Bernard Metais, Ph.D.,
Président de l'Alliance Française de Berkeley,
Ingénieur des Arts et Manufactures
on the historical aspects of
FRACTAL GEOMETRY.

The most appropriate way to explore the infinite complexity of nature is its approach by fractal representation.

EXTRACTS FROM THE PRESENTATION
by
François MIGLIO & Bernard METAIS

The Frontiers Where Chaos and Order Meet

INTRODUCTION

Trees, spirals (logarithmic spirals, coastlines, mountains, galaxies, clouds, rivers, weather pattern, brains, lungs, turbulence, heartbeats. What do all these natural wonders have in common? They are dynamic systems that can be best explained by fractal geometry. If we look closer at these dynamic systems, we can distinguish two groups:

a) Stable systems : trees, shells, mountains, blood vessels

b) Chaotic systems : clouds, turbulent flows
Recognizing and identifying the transition from stability to chaos and vice versa has always been intellectually and experimentally challenging. The recent contribution of fractal geometry has brought some insight into this phenomenon.

In our presentation we will, briefly, try to describe how "Science" (mainly an analytic approach) and "Art" (mainly an intuitive approach) experience this natural fractal world.

1. THE SCIENTIFIC POINT OF VIEW by BERNARD METAIS

A) Stable systems

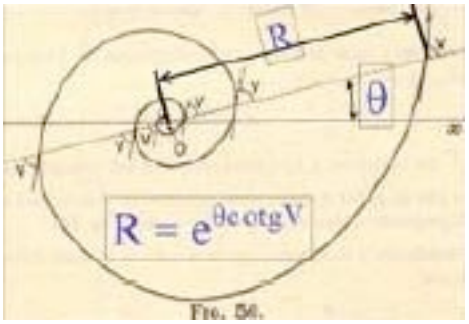


Fig. 56.

A fractal object can be defined as a geometric figure in which an identical motif repeats itself on an ever diminishing (or increasing) scale. A typical & simple example of a fractal figure is this logarithmic spiral. Magnifying (or rotating) a logarithmic spiral always reproduces the same self-similar figure. Because of its fractal quality this spiral is common in nature (see the ammonite of the previous figure).

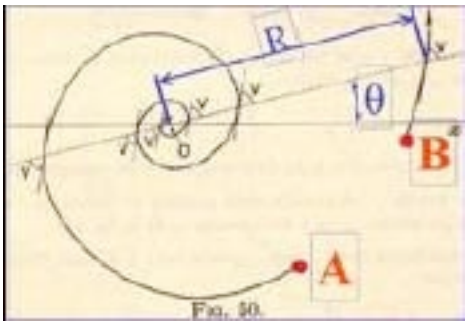
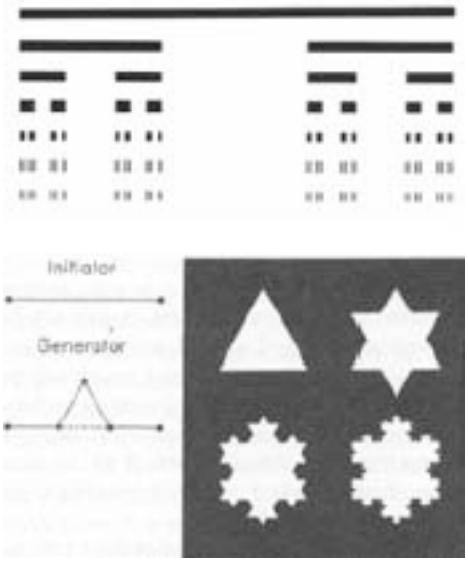


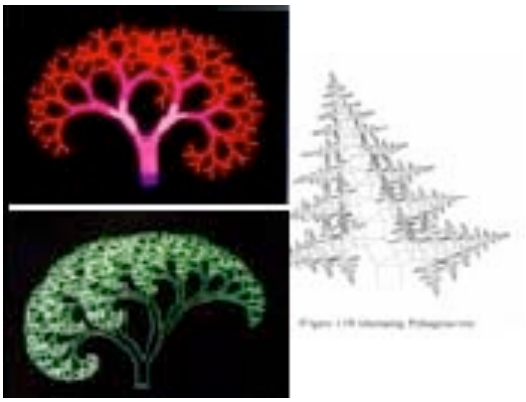
Fig. 30.

Because a spider constructs its web according to the law of self-similarity of a logarithmic spiral, it can easily repair any broken segment (A<B) of the web by keeping the same angle? between the radius and the tangent to the web during the spinning.



Self-similar geometrical figures of great complexity can be obtained by repeating simple geometric transformations. Around 1880, Georg Cantor created one, " the Cantor's comb", by removing the middle third of a linear segment, then repeating the same operation on the remaining two segments and so onŠ.Another one, "the snowflake of Koch", can be created by adding a scaled down (by 1/3) equilateral triangle to each side of a equilateral triangle and so on.

These "monster figures" with ever increasing perimeters scared away some of the greatest mathematicians, such as Henri Poincaré (early 1900), who, otherwise, contributed greatly to the field of systems instability, by being the first one to demonstrate that an enclosed non-linear system could show instability

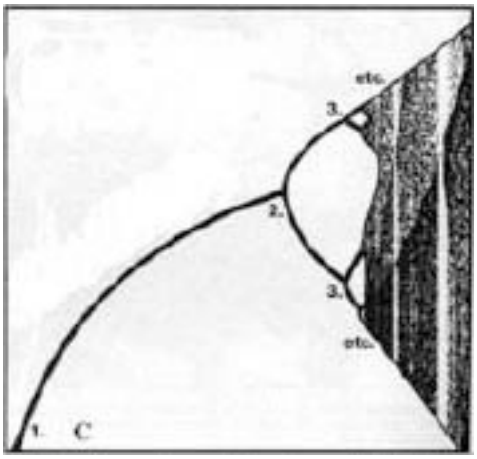


Today we can generate beautiful complex self-similar fractal figures with the help of computers. They can, for instance, simulate the growth of trees or a cauliflowers

B) From simplicity to complexity: Chaotic systems

Verhulst equation
$$X_{n+1}=CX_n(1-X_n)$$

The study of chaotic systems started in the 1840s, when Pierre François Verhulst refined the negative feedback model of growth of the population of a species.
If Xn is the number of flies in the year n and C is the reproduction rate of the flies during the year n, the number of flies in the year (n+1) will be Xn+1=CXn(1-Xn).
The factor (1-Xn) takes into account the realistic fact that the number of flies cannot grow indefinitely.
This equation has been extensively studied, especially since the advent of the computer:



The growth of Xn depends on its initial value X0 and on its growth rate C.
It was found that:

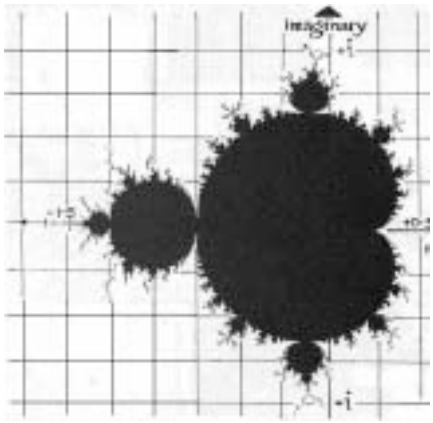
· If C is smaller than 3.0 (point 2), the growth is regular
· When C reaches 3.0 there is a bifurcation point (pt 2): depending on the starting point, Xn can take either one of two values located on two different curves.
· When C reaches 3.45 (pt 3) there is again a doubling of the possible values for Xn (4 cycles)
· When C reaches 3.54, there are again bifurcations (8 cycles)
· When C reaches 4.0, there is complete chaos
A small change in the value of C can tremendously impact the behavior of X. This is called the "butterfly effect" from the article by Edward Lorenz "*Predictability: does the flap of a butterfly's wings in Brazil set off a tornado in Texas*" (1979)

Feigenbaum's number
F = 4.6692016…

In 1977, Mitchell Feigenbaum found out that the value of C atconsecutive bifurcations points decreases by about the same factor F = 4.669Š. This is a universal number to be found each time there is a repeated period doubling (i.e. phase transition). It has been said that: "*Seemingly pure mathematical research, computer experiments, and physical reality are in fact intimately related*".

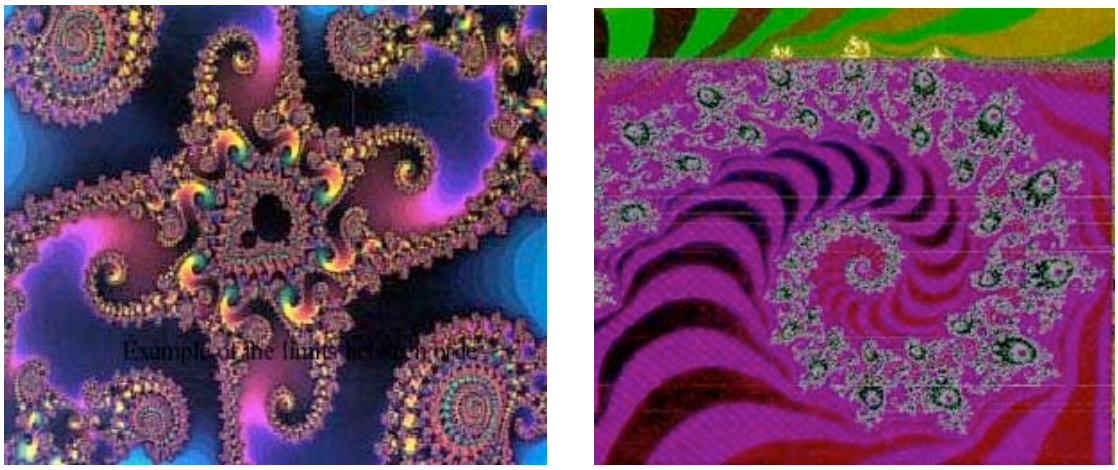
The JULIA set

Already in the 1960s, Benoit Mandelbrot was evaluating the fractal dimension of coastlines (the value of the a coastline depends on the length of the yardstick) and was studying the fractal figures mentioned above, especially the ones from the Julia set, which corresponds to a simple geometric transformation. The set had been developed by Gaston Julia in early 1900, but could not be thoroughly analyzed until Benoit Mandelbrot was able to use the new computer techniques of the 1960s.



B. Mandelbrot used complex numbers for the values of Z and C in the Julia set and tried to find out why some values of the constant C resulted in "connected" figures in the mapping of Z while some other values resulted in dust-like or dendrite-like figures. He had the idea to plot the values of C for which the orbit of Z did not go to infinity, a characteristic of the connected figures of the Julia set. The plotting of these values showed acardioid-like figure called the Mandelbrot set, which could be construed as defining the limit between stable phenomenon and chaos. The Mandelbrot set is a semi self-similar figure as was illustrated by a short movie sequence, projected during the presentation.

By assigning various colors to the speeds of convergence of Z and plotting Z (Julia set as well as C (Mandelbrot set) one can obtain sumptuous selfsimilar colorful figures, such as the ones shown during the presentation. I would like to point out that "fractal sets" were used to create the mountains in the movie "Star wars". This is a good example that shows that a simple equation can generate complicated nature-like images. Fractal geometry represents the nature better than Euclidian geometry.



Two examples of pictures generated by computer from the Julia set (from reference 2)

Paintings by Pollock:

Where are the limits between order and chaos? It is difficult to say which ones are fractal. (Although a method exists to evaluate the degree of "fractalisation" (degree of irregularity to a scale from 0 to 4) of an object: for the cantor comb it is 0.6, for the sphere 1, for the brain between 2.73 and 2.79.

2. THE ARTISTIC POINT OF VIEW by FRANÇOIS MIGLIO

As shown by Bernard Metais fractal representations are present throughout nature. It was discovered, through the progress of science, that, both, the infinitely small and the indefinitely large represent the same thing. Furthermore, we are also aware that the brain itself is a fractal construction and that thought as well as dreams emerging from that brain are organized in a similar fashion. As such, this can enlighten our own perception of the world and its representation. With this knowledge, the exploration of the fractal world helps us understand the secrets and forces that govern energy, as well as inanimate and living matter.

A - The first fractal's representations

From the beginning of the history of humanity, man has explored his territory and his environment. The fractal forms embedded in it have always been represented through drawings, paintings, engravings and sculpture, as well as interpretations through music, song and dance. The iterative language used in these various forms of expression is present throughout the world since the dawn of history. I believe this intuitive approach could be the birth of art.

B - Fractal world and artists

Through the centuries, artistic fractal representations have evolved. From primal art to contemporary art, artists have questioned themselves on these seemingly artificial forms emerging from nature. In the world of painting:

Australian aborigenes, through their art, tens of thousands of years old, utilized repetitive dots and symbols in order to represent their territory and cosmogony.

During the renaissance, Leonard De VINCI, observed the turbulences and swirls which are the subject of much scientific research.

Similarly to Hokusai, many paintings have represented the auto-similarity present in nature.

In contemporary painting, Jackson Pollock, with his 'dripping' technique, introduced the notion of guided randomness, creating a coherent form of art.

In the world of music and dance, we can establish a correlation between primitive repetitive dances, music and songs. Gregorian chants, which have inspired Eric Satie, one of the originators of serial music and a significant influence upon John Cage. Currently, rave parties and techno music borrow from this repetitive theme.

C) Fractal world: Art and Science

We have noted the interaction between art and science, the parallel between these two forms of explorations, their enrichment and convergence. Art, with its intuitive approach, can, at times, open the way for science. The scientific approach has included valuable insight into the nature of the fractal world.

D) Fractal world: Art and Sacred

The various representations of the fractal world have long been rendered sacred by rites and religions:

· Pictorial symbolism of the spiral
· Arabesques, mandalas or rose windows of Cathedrals
· Gregorian chants
· Dances of the whirling Dervish.

Through a new perception of the fractal world and our environment, our spirituality has been modified. Representations of the Sacred have also constantly evolved.

E) Fractal Syncretism

Fractal Syncretism has three main lines : artistic, spiritual and scientific which in sum, are one and the same quest or exploration of the unknown world, in spite of their different criteria of truth.
This is a new approach to Art , based on contemplation and resulting in reflexion on the process of creation, notably through the symbol of the spiral and the poetic approach to the fractal world.

HOLISTIC VISION

I have chosen this double spiral that is omnipresent in my paintings because it becomes a sphere when contracted onto itself. Thus, the same symbol can evoke several dimensions.

GEMMATION

The majority of my paintings, specifically my theoretical paintings, are geometrically built with this double spiral or spiraled cones In this painting, I introduce the concept of parallel worlds, which in this instance are apparently unaware of each other, yet submit to the same laws to carry out cycles emerging and returning from chaos.

UNION OF MATRICES

Here as well, the geometrical construction is comprised of conical spindle spirals (lavender and clouds) emerging from the point of creation and fitting into a sphere.This painting is made up of only one half of this sphere.
In this geometrical composition, I introduce the reality of a landscape, and the integration of the landscape becomes apparent.

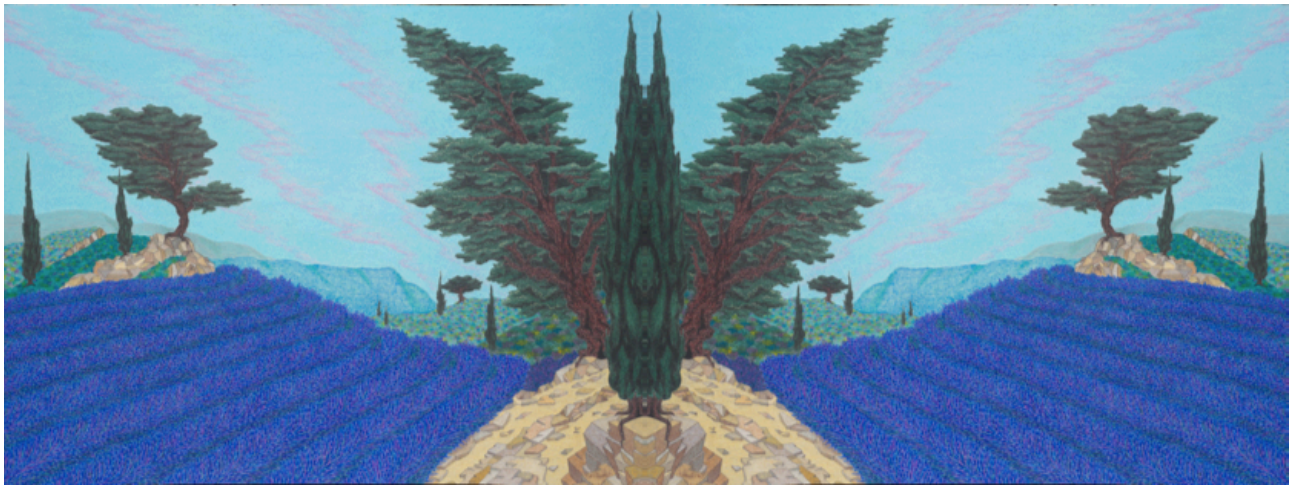
TRIPTYCH

My expressions 'point of creation' or 'conjunction' are perhaps best explained by the scientific term 'strange attractor'

BUTTERFLY EFFECT
One detail opens up into infinity
such a beat of the wing
Becomes a cyclone
Destructor of the establishment

Similar to Butterfly Effect, as described by Edward Lorenz, I question through this painting the creative strength of the work of art.

MIRRORED BUTTERFLY EFFECT



The complete "butterfly effect" is achieve by placing a mirror to the left of the previous painting. (see the description of the turbulent mirror by J.Briggs referring to the mirror in Lewis Carroll's 'Alice and Wonderland'. I believe this mirror could be the bridge between the visible and the invisible.

PASSAGE

This painting is a metaphor for the cycle of life, the link between the elements: Air, Water and Fire, the link between energy and matter.

This link is represented by the fractal symbol (the yellow double spiral). This double yellow spiral represents a fractal spiral that is a link between these different elements.

THE KISS OF LIGHT

Here too, through the waves (using solar colors), my intention is to establish this link between energy and matter. I represent turbulences where the order of waves returning to chaos, emerges.
I also demonstrate through the waves my concept of 'Fractal Syncretism'.
Through three different levels of interpretations of my paintings, I wish to establish the relationship between the three distinct languages, intuitive, rational, spiritual:

- Intuitive (Art) -

- The poetic representation of the wave is an artistic approach.

- Rational (Science) -

- The solar colors of the waves tend to provide a rational explanation for the transfer of solar energy to wind and then from wind to waves. This in turn will demonstrate the influence of solar energy upon matter.

- Spiritual (Sacred) -

- The engraved symbols throughout these paintings correlate to the repetitive language and the primary basis of my meditation.

CONSCIENTIA

I would like to end my presentation with this particular painting.
In this painting I am expressing that the universe appears real to us only because we are aware of it and because we can express it.

Here is a little poetic tale of a man contemplating the universe to which he belongs:

Ce Chaos étrange
Regardant
Une étrange immobilité
De ce regard,
Des particules de lumière
Se mirent à rêver
A jouer,
A créer.
Bientôt les hommes
Vinrent contempler
Ce monde a leur image.
Dans ce monde
Un monde encore plus étrange
Leur apparut
Fait de formes semblables
Qui jouaient ensemble.
Les hommes se mirent
A rêver, à jouer avec elles.
Ainsi l'homme
Ouvrit la porte
Sur un mystère insondable,
Celui de la Création.

GLOSSARY

Syncretism: the fusion of two or more originally different inflectional concepts

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