

Fractal Beings

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Abstract

Fractals have always existed since the beginning of time. We have known them since the work of Benoit Mandelbrot [1]. They were first used to create beautiful images and especially to serve as a good tool to simulate nature.

In physical cosmology fractal cosmology is a set of minority cosmological theories which state that the distribution of matter in the Universe, or the structure of the universe itself, is a fractal across a wide range of scales. More generally, it relates to the usage or appearance of fractals in the study of the universe and matter [2].

Fractals thus appear to be present at all scales of the universe, both for galaxies and black holes, but also at the microscopic level. They are well compatible with the theories of relativity and those of quantum physics.

In this publication, we postulate the hypothesis that fractals are still much more than that, and that they are also directly related to any form of life, plant, animal, human and certainly others.

The Fractal Beings are the continuation of the series of creative artificial beings, begun in 2005 with the Painting Beings, and in which we meet over the years Cinema Beings, Sculpt Beings, Quantum Beings, etc. [3] [4].

The Fractal Beings are thus an artistic representation of virtual beings, which are in line with the works of Mandelbrot, Nassim Hameiri [5], Karen French [6], and many other scientific authors.

Art Beings

The series of Art Beings was initiated in 2002, on the simple principle of considering populations to be artificial as organic matter of a digital work. It is all along the series, to create evolutionary ecosystems, based on the use of genetic algorithms.

These evolve populations of virtual entities, which can be pixels (2D), vertices (3D), animation frames (4D), and so on.

This work of Research and Creation aims to explore new ways of creation, by mixing the principles of artificial life, with those of digital creation.

These sets of creations are based on a number of fundamental concepts, including that of symmetry, present on many scales in nature [7], [8], [9].

Many "artist and researchers" have been studying this type of track for some time, such as Den Heijer who is interested in the aesthetic measurement of such creations

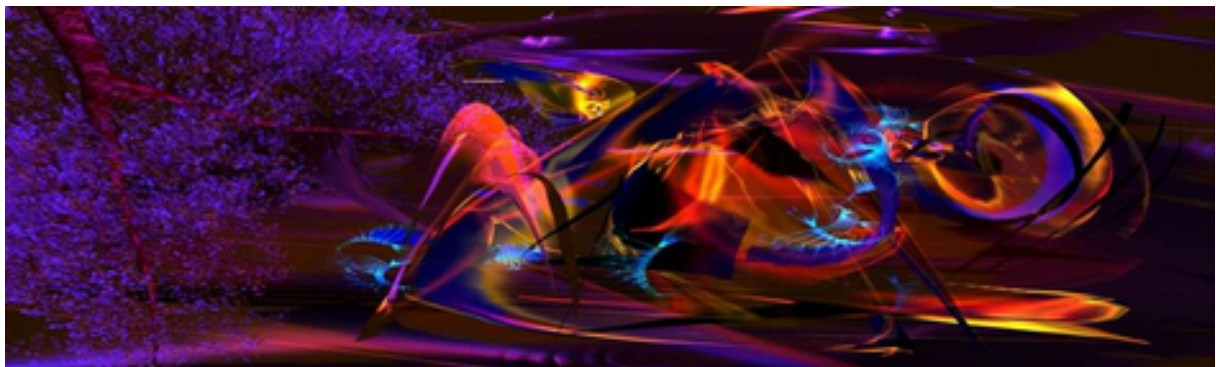
[10], or Di Paola [11], who tries to see how these processes Algorithms can be related to human creativity.

The use of evolutionary algorithms in creation is very well described by Philip Galanter [12], one of the world's leading specialists in Generative Art, as well as by Matthew Lewis [13], author of a founding paper on this topic .

Plant & Light Beings

The first creations were articulated around the light and the plants, as it can seem natural, in a creation of world.

Plant Beings and Light Beings are based on the evolution of L-Systems, which are algorithms particularly well suited to the digital world of plants. [14].



Light & Plant Beings. © Alain Lioret . 2004

Painting Beings

The following series was much more evolved, with the appearance in 2005 of Painting Beings. These beings are simply sets of self-organized pixels that make up painting in a 3D space. It is about dynamic painting, in movement, whose principle rests on a genetic algorithm which makes evolve the various populations of pixels, constituents of the created images. [15].

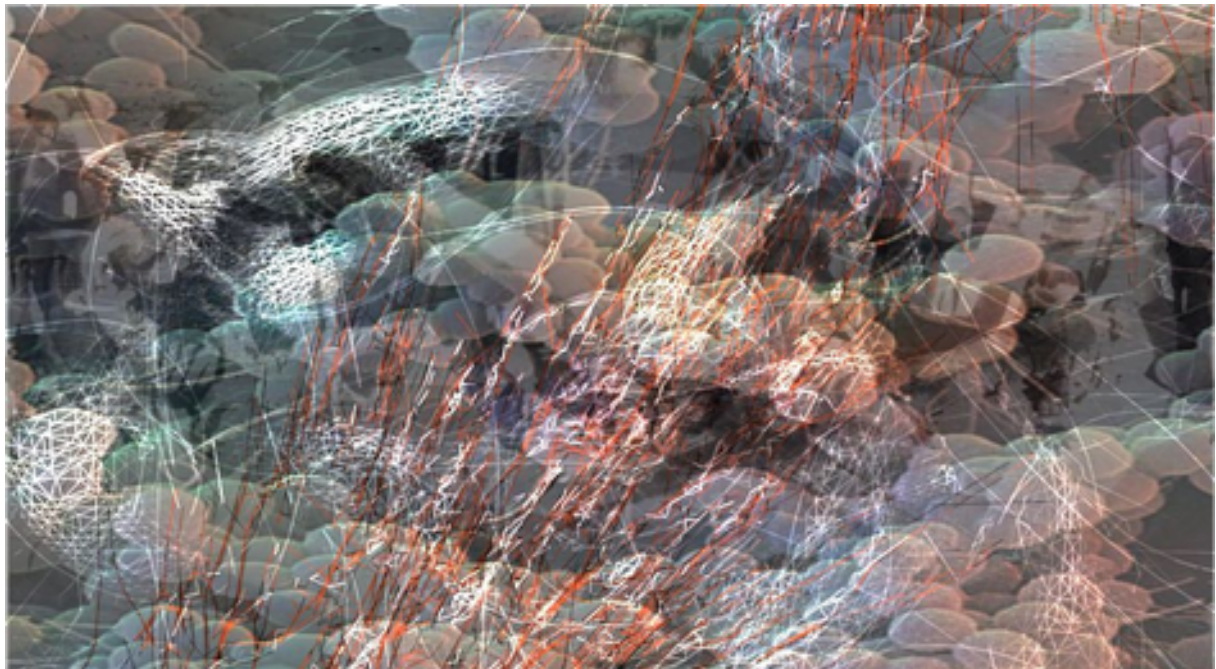


Painting Beings. © Alain Lioret . 2006

Cinema Beings

The following series follow the same pattern, but extend the concepts to other spaces of creation: the Sculpt Beings, for the modeling of Mesh in 3D, the Cinema Beings which form a more complex ecosystem, combining various types of Beings, like the Cut Beings for editing (according to the principles of Eisenstein in particular), Painting Beings for 2D images, Sculpt Beings for 3D creations, Sound Beings for sounds, etc. [16]

The different Beings (creator beings) that make up the virtual universe of what is called here the "Cinema Beings" can be considered as the equivalent of particles of the work of art (as would be the point on a drawing, the grain in a sculpture, the image in a film, etc.) [17] [18]. One can imagine that these are the living particles of the work of art thus created.



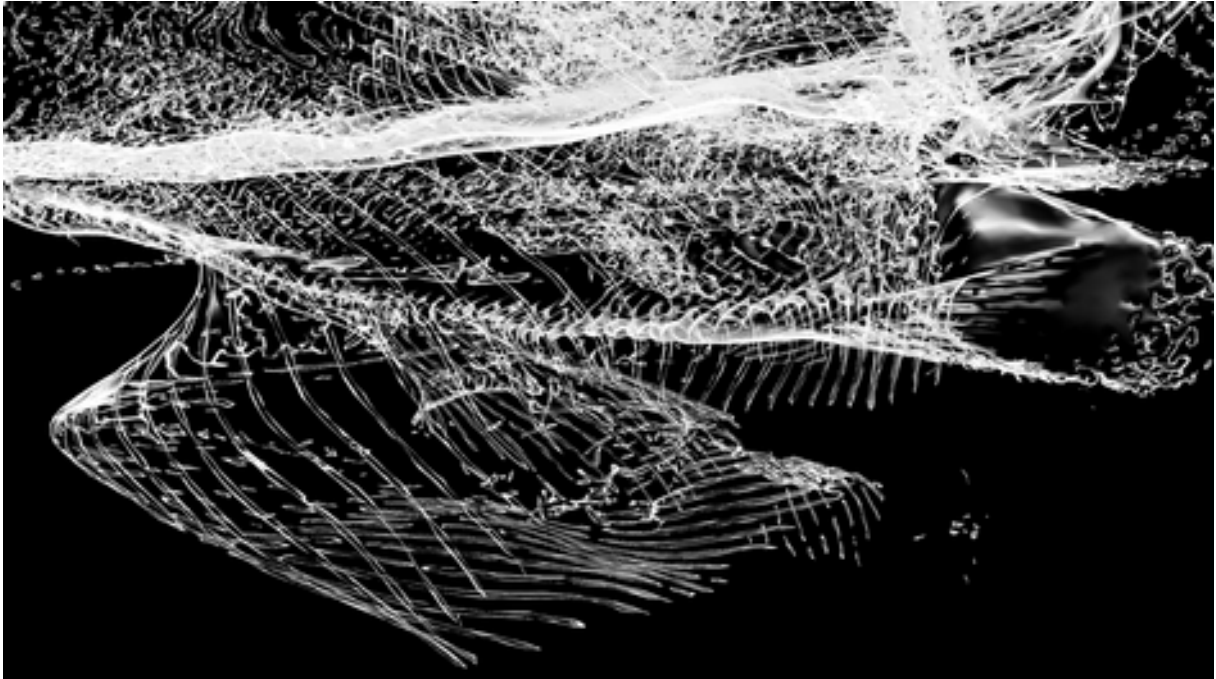
Cinema Beings. © Alain Lioret . 2011

Quantum Beings

It is therefore a natural logic that led this work towards the exploration of two new types of Beings, more related to the physical world around us, and which have their place in this series of evolutionary works: the Quantum Beings and the Fractal Beings.

The Quantum Beings (also called the Time Beings), behave like quantum particles, with most of the characteristics of this type of particles (which are also waves), and in particular the gift of ubiquity, the quantum entanglement, teleportation, etc.

The use of quantum algorithms, while the quantum computer does not yet exist, is particularly interesting. This allows you to explore even a little further new worlds of creation. [19], [20], [21].



Quantum Beings. © Alain Lioret . 2014

Fractal Beings

The Fractal Beings, the last born of the series, (and there, we loop in a certain way on the beginning of the series, at the beginning, created with L-Systems), are created starting from the evolution of fractal creations (therefore recursive and with levels of self similarity).

It is important to note here the importance of some recent works that show that fractals have a primordial place in the universe.

We have here two important tracks, which revolve around fractal cosmology and the first recently discovered fractal beings. Many scientific writers have postulated that the universe as a whole was fractal in structure. Luciano Pietronero [2] who was one of the first to do so, but also Andrei Linde [25], Laurent Nottale [26], and the excellent work of the French mathematician Alain Connes [27] and authors like Yuriy Baryshev and Pekka Teerikorpi [28]

A recent discovery by Cuthill and Morris mentions some strange living organisms: it is the Rangeomorphs [29]. Rangeomorph fronds characterize the late Ediacaran Period (575–541 Ma), representing some of the earliest large organisms. However, their extraordinary branching morphology differs from all other organisms and has proved highly enigmatic. This reveals an adaptive radiation of fractal morphologies which maximized body surface area, consistent with diffusive nutrient uptake (osmotrophy). Rangeomorphs were adaptively optimal for the low-competition, high-nutrient conditions of Ediacaran oceans. With the Cambrian explosion in animal diversity (from 541 Ma), fundamental changes in ecological and geochemical conditions led to their extinction.

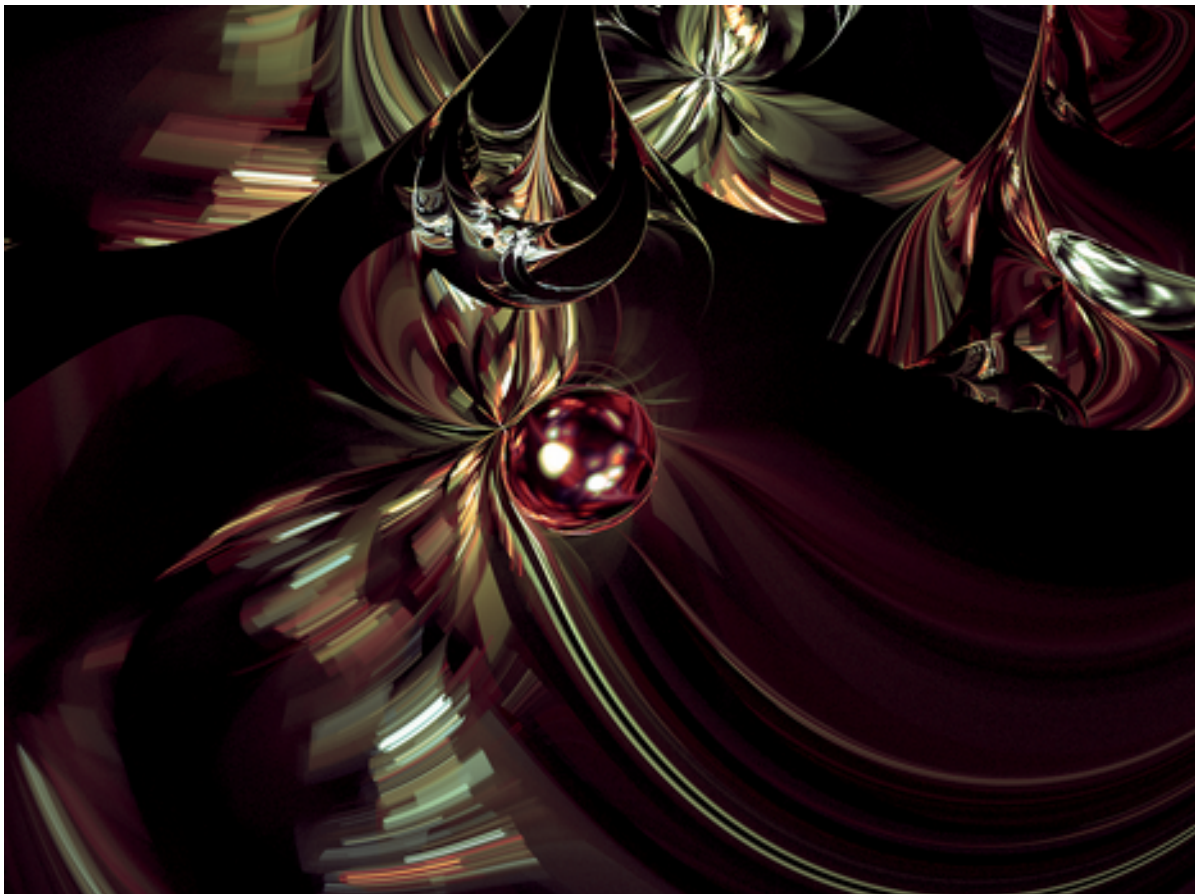
Another major work is proposed by Tim Palmer [30]. He propose a new hypothesis

about the nature of physical reality at its most primitive level. The hypothesis is framed in terms of invariance, a concept that forms the very bedrock of physics. Specifically, the Invariant Set Hypothesis proposes that states of physical reality are precisely those belonging to a non-computable fractal subset of state space, invariant under the action of some subordinate deterministic causal dynamics. The Invariant Set Hypothesis provides a geometric framework for a new perspective on quantum physics.

The work around Fractal Beings is made following these research. The evolution capacities of Fractal Beings are variable (see all the articles described in reference for more details). Each time, these abilities are based on rules or artistic references (which can be images, objects, films, the golden ratio, the Fibonacci series, etc.).

The images created for this work are based on Fractal Beings. Models are created using 3D objects. The genetic algorithm thus seeks to explore the infinite world of fractals to create images (in a 3D space), which try to appear according to innovative methods and new ways of creation (use of genetic algorithms). [22].

The idea is quite simple: we explore the world of fractals (and especially those based on the formulas of MandelBulb and IFS systems). These formulas now classic in the world of fractals, are here coupled with the use of a genetic algorithm that allows to play with the various parameters, and to explore original creations.



Fractal Beings. © Alain Lioret . 2017

Infinite Artistic Explorations

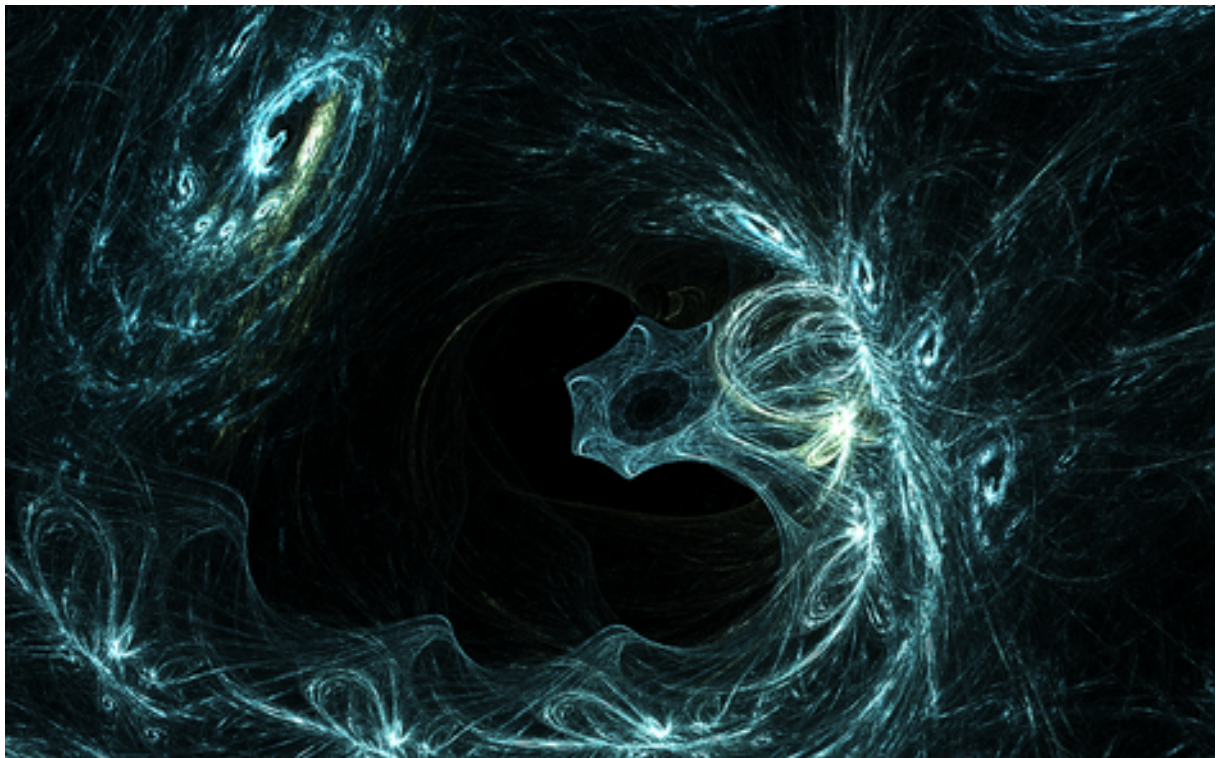
The use of fractals is overall very surprising. It would seem that the fractals, discovered in 1975 by Benoît Mandelbrot, are still far from having delivered all their secrets.

Thus, we know that fractals can very well model mountains, clouds, trees, plants, pulmonary systems or blood vessels, etc.

Almost everything that exists in nature, everything that is not built by man. They are therefore an interesting model of the visible aspects of Nature.

What about the invisible? What are the other fractals? What are today considered just as beautiful and abstract? Questions that remain open and require many other experiments.

Recent research on fractals joins some older ones, and all converge on an Art of Nature, on the edge of the Arts and Sciences axis. [23], [24]. A particularly rich field for the artist interested in the advances of science.



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