

Chapter 12

Possibility of Fractal Aesthetics

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ABSTRACT

Fast development of computer networking contributes to the global spreading and popularizing of the notion of fractals and complex patterns in their use in computer-aided design and computer art. This chapter looks for answers to the following questions: How are fractals perceived? Are fractals predominantly man-made or natural objects? How do fractals relate to the overall visual art experience of mankind? What are the main problems in using fractals in arts? What are the experiences from the visual art-history? Do Nature and artists use the same algorithm? What fractal experts can do to help artists?

1. INTRODUCTION

There is a geometry in the humming of the strings
-Pythagoras

Inspired by Alex Raymond's and Dan Barry's *Flash Gordon*, this author, in his teenage years, tried to produce his own SF cartoon. Supplied by the modest knowledge of Euclidean geometric forms, a small bottle of black China ink of acceptable quality and a sheet of *hammer* paper, he started making up his pictorial story. The main characters had been invented; the space ships had been already designed, when a major problem arose. How to draw starry skies, this unavoidable

scenery of space adventures? After many trials based on leaving white dots and blackening all the rest, the solution appeared by itself. Another bottle of China ink had to be provided, this time a white one. It turned out that the new technique was worth every penny. Not only the stars themselves but the whole Milky Way was very authentic! The author was captured by the beauty of chaotic scattered white dots all over the black background. Step by step, the author's attitude towards geometrically irregular forms was changing. Moreover, he became aware of importance of such forms in art expression. And soon, an unexpected feeling of the beauty of irregular and amorphous started to be a new reality. No wonder when, about twenty years later, looking at the newly published Barnsley's book (Barnsley, 1988), the old feeling resurrected.

DOI: 10.4018/978-1-4666-2077-3.ch012

Now, after nearly twenty years, this author is still fascinated by the effects chaotic patterns may cause on our senses, and continues looking for the answer why it is so.

Anticipation of chaos and fractals as “portraits of chaos” occurs many years before the first computing machine was ever built. But not earlier than the mid 60-es, with the help of the first computers with graphical capabilities, did the new exciting forms of chaotic patterns and fractal constructions started appearing. Still, broad science-oriented public becomes aware of the new, waste world of hyper-complex forms and colors upon Mandelbrot’s publishing his famous books (Mandelbrot, 1975), (Mandelbrot, 1982). Many classic problems, once put away due their cumbersome mathematics, were revisited and solved using new techniques of Chaos theory and Fractals. It turns that the simple pendulum may be a source of practically endless, fantastic patterns. Geometrically very complicated shapes reveal a strict order in apparently disordered blueprint. Visually curious, these shapes look even more attractive due to their inner logic stemming in iron laws that govern the behavior of deterministic chaos. The new geometry based on a peculiar mathematical background, took the experts of different fields by storm. If the first reason was its high scientific interest and all-embracing nature, the second for sure was its *beauty*. Not long after, this non-scientific contested term, *beauty* will appear more and more frequently by the name of fractals, usually without any explanation. An especially strong connection has been established between fractals and Computer Graphics, but also between fractals and Computer Science in general. The aesthetic value of fractals has rarely been disputed. Instead, many authors began investigating of participation of fractal patterns and chaotic configurations in art. Let us remind of some fractal-oriented titles involving visual arts, music, poetry or architecture as well: (Emmer, 1993), (Peitgen & Richter, 1986), (Pollard-Gott, 1986), (Mandelbrot, 1989), (Hsti & Hsti, 1990),

(Prusinkiewicz, Lindenmayer, 1990), (Musgrave & Mandelbrot, 1991), (Gardner, 1992), (Shearer, 1992), (Peak & Frame, 1994), (Shearer, 1995), (Pickover, 1995), (Kocić, 2002), (Kocić, 2003), (Kocić, Stefanovska, 2005), (Kappraff, 2007), (Fulton, 1999), (Burkle-Elizondo et al., 2007), etc.

Many books on Chaos theory contain chapters devoted to aesthetic moment of different graphs concerning complex or chaotic dynamics. Orbits in phase space, strange attractors, basins of attractions, bifurcation diagrams etc, are compared with colored patterns of butterfly wings, with figures made by polar light, textile designs, plans of cities and so on. See (Schroeder, 1991), (Moon, 1992), (Zaslavsky et al. 1991). In the next section there is an analysis of how we perceive fractal images.

2. PERCEPTION OF FRACTALS

Since perception precedes any aesthetical judgment, it will be the first subject of our concern. We will restrict ourselves to *visual* component of perception only due to understandable reasons. But, before any discussion about how we perceive fractals, one needs to know as clearly as possible what *fractal* is. And here is the first problem. *Fractal* seems to be as fundamental concept as *space*, *life*, *truth*, *number* etc, and fails to undergo any strict and concise definition. According to Falconer (Falconer, 1990) (see also (Fisher, 1995)) only a descriptive definition is possible (we combine Falconer’s and Fisher’s version):

Definition 1: (Descriptive) The set A is a *fractal* if:

- (i) A has detail at every scale. (ii) A is exactly, approximately or statistically *self-similar*.
- (iii) Usually, the *fractal dimension* (properly defined) of A is greater than its topological dimension. (iv) There is a simple *algorithmic description* of A (possible recursively).

What in this definition is of interest concerning our perception? From (i) we may understand that

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