DESIGNING PROCESSES

FABRICA

DESIGNING PROCESSES
RATHER THAN ART

Edited by Omar Vulpinari

A Fabrica Workshops project
directed by Bruce Sterling

FABRICA

FOREWORD

by Bruce Sterling

A zealot with rigid, abstract, unswerving principles will find that life becomes surreal. Generative art is quite like this. Generative art is a twenty-first century effort using networked tools to make images and objects that the twentieth century could not imagine.

Generative artists are sociable. They are eager to share their code, to swap tips about hardware, and to validate each other's other worldly efforts. Their beloved computer language, *Processing*, crafted specifically by and for computer artists, is open-source software — with all the dense, web-based sociality that breed of software implies.

Furthermore, Web 2.0-style participatory sites such as FlickR and Vimeo have become the global galleries for generative art.

Yet the machinery is not central to the effort. The core of generative art is the artistic ability to see and shape 'processuality' — the code of form.

Processuality is a modern change in artistic perception, inspired by the craft of software. Our world is rich with processuality — the growth of plants, boiling liquid, the cracks in mud — processuality is all around us. A rather similar ruckus struck the visual arts in the early 1900s, when the machineries of cinema revealed hidden realities of motion, time, and space.

This Fabrica workshop carried 'computational aesthetics' outside the computer. We methodically experimented with processuality, crafting tightly-written instructions to generate images, objects, and situations in the real world. By taking that step into 'dynamic abstraction,' by forfeiting some human control, artists and designers can coax radically strange results from even the meagerest resources.

The teams were given tiny graphic scraps the size of postage stamps. The rest was left to their rigor, imagination, discipline, and insight.

I'm proud to say that everything you see in this booklet was generated — through processes they built themselves.

INTERVIEW

Bruce Sterling interviewed by Andy Cameron

Why Generative art?

I got interested in generative art in 2007 when I saw that people were doing generative work with computer fabricators. I've been very interested in fabricators for a long time; any kind of method of moving digital plans into physical actuality makes little bells go off for me.

Then I saw these guys were using fabricators with generative processes instead of simply executing plans. They were writing this kind of mobile code that causes these fabricators to output things that were not pre-planned. I immediately thought, "ok this is like some kind of the equivalent of an acoustic guitar undergoing electric feedback." They are actually getting shapes and volumes and forms out of this approach that are humanly impossible.

How do you know if it's any good or not? You turn this stuff out but isn't most of it junk?

Yes, but in my line of work, science fiction, author Theodore Sturgeon coined the law that says, "90 percent of everything, is junk or crap." In any case generative art since it's so easy to generate it's more like 99.9999 percent of it is junk.

How do you deal with this absence of intentionality considering that normally with artistic works, we have this idea that it's the person who is expressing something to his or her audience? Humans who are expressing their meaning, their feeling, their position and their point of view, all of that goes out of the window with generative art. So, in a sense, it becomes something that is no longer part of inter-human discourse, but it becomes almost like a natural fact.

I think it does go out of the window but it kind of creeps back into the basement, the attic.

What do you mean?

Well you know, writing is an expression of thought but software is an expression of will. So if you look at the software that you use to generate all these forms, images, whatever, I mean the software has a kind of clarity and intentionality that's very, very intentional even more intentional than some kind of direct declaration by an author, because in fact that's a series of deliberate commands, "do this, do that, if this then do that" so it's a kind of a huge reservoir of sort of raw intentionality in the code and then somebody has to frame the output and they also have to sort of
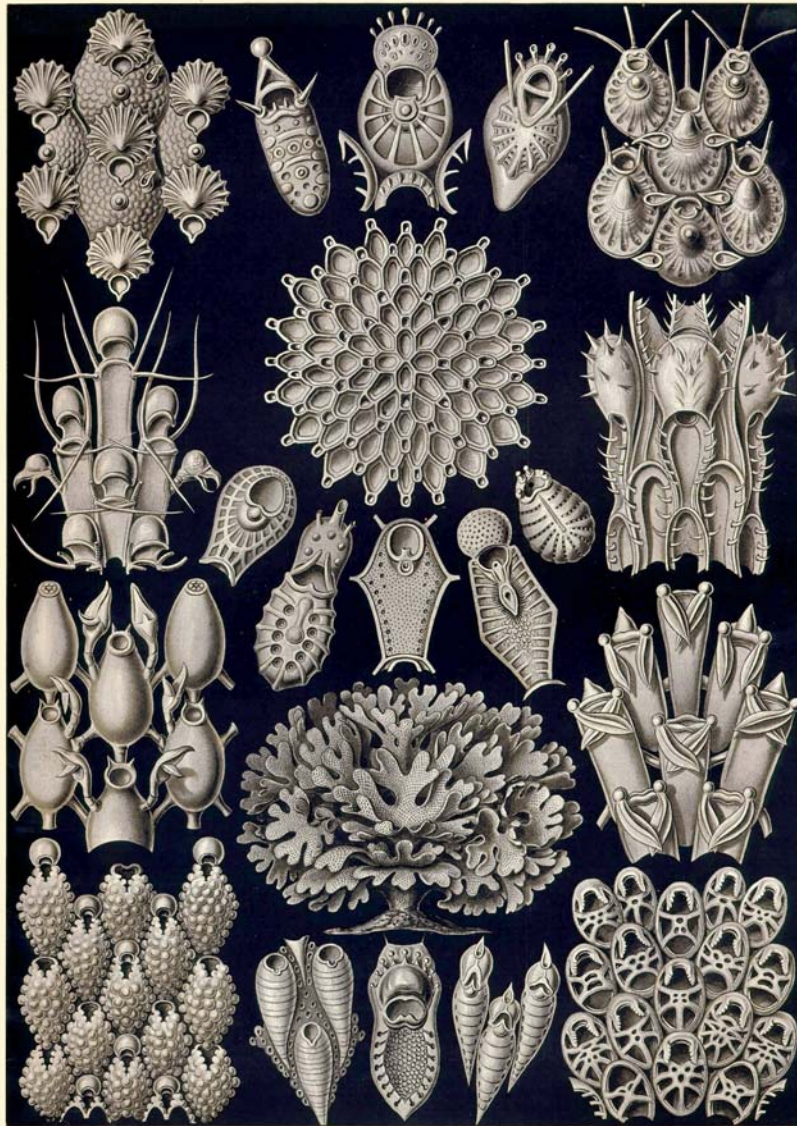
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ESSAY

By Marco Mancuso

This essay was written as a response to "Designing processes rather than art" a Fabrica Workshops project (November 2008) directed by Bruce Sterling.

GENERATIVE NATURE
Aesthetics, repetitiveness, selection and adaptation

In his De Rerum Natura, Lucretius denies any kind of creation, providence and original bliss and maintains that people freed themselves from their condition of need thanks to the production of techniques, which are transpositions of nature. A god and some gods exist, but they did not create the universe, nor do they deal with people's actions. Lucretius maintains that the rational knowledge of nature shows us an infinite universe that is made up of complex forms and constituted by atoms; it follows natural laws, it is indifferent to people's needs and can be explained without gods.

*When an artist uses a conceptual form of art, it means that all of the planning and decisions are made beforehand and the execution is a perfunctory affair. The idea becomes a machine that makes the art.
– Sol Le Witt*

Modern ecology began with Charles Darwin's studies. In his "theory of evolution" published in 1859 in *On the Origin of Species*, he underlined the adaptation of the different organisms to the various kinds of environment, which are subjected to the age-long examination of natural selection. However, the word was coined by Ernst Heinrich Haeckel in 1869 and comes from the Greek óikos meaning "house" and logos meaning "discourse". It is therefore a biological science that studies environment and the relationships that the different living organisms establish between each other and with the environment itself. For some time, Haeckel was a strong supporter and popularizer of Darwin's theories, but he soon became one of his most bitter enemies; he firmly refuted the process of natural selection as the basis of the evolutionary mechanism, in favor of a thought that was more focused on the environment as a direct agent on natural organisms, which is able to produce new species and generate diversity.

Ernst Heinrich Haeckel's thought and work represent the starting point of this critical reflection. First of all, because it was the theoretical and practical cue suggested by Bruce Sterling during his workshop for

Fabrica, to which the text refers. Secondly; because it allows me a philosophical and critical reflection, aspiring to find a possible point of contact between nature, theories of evolution and programmatic and generative art. Is it impossible? Well, I would say no, on the contrary. Above all if we try to compare and amalgamate, like the colors on a canvas, the German biologist's research on one side with some works of conceptual and minimalist artist Sol Le Witt and the possible relationship between mathematics and nature on the other, and what is known today as art and generative design.

Nature as an art

"Kunstformen der Natur" literally means "artistic forms of nature": this is the title of biologist Ernst Haeckel's 1898 most important text, his most complex and fascinating research. Moreover, this is the text from which Bruce Sterling took, for those participating in his workshop, some primary images that could be the graphic material and starting point for an aesthetic and methodological reflection on the practices of generative repetitiveness. By watching the richly decorated plates in Haeckel's text, it is undeniable that nature is able not only to create spontaneously real 'art forms', but also to produce a direct correspondence between a certain generative aesthetics, starting from a fundamental unit/nucleus to come to a complex entity, and a consequent

adaptive and evolutionary practice.

In other words, if the stages of the embryological development of a species actually trace the evolution phases that led it to its position in the natural order, the survival of each species basically depends on its interaction with the environment. According to Haeckel, the mechanism thanks to which new species and a new diversity have origin is that of a gradual addition of a certain development trajectory starting from an initial unit, which is determined by imposed external (environmental) parameters, which are able to influence the gradual direction of the trajectory itself.

At this point, a first important reference to the theoretic and methodological bases of Generative Art seems evident, as one of the pioneers of this discipline, Italian architect Celestino Soddu, suggests, "Generative Art is the idea realized as genetic code of artificial events, as construction of dynamic complex systems able to generate endless variations. Each Generative Project is a concept-software that works producing unique and non-repeatable events, as possible and manifold expressions of the generating idea strongly recognizable as a vision belonging to an artist/designer/musician/architect/mathematician. This generative Idea/human-creative-act makes an unpredictable, amazing and endless expansion of human creativity.

Computers are simply the tools for its storage in memory and execution. This approach opens a new era in Art, Design and Communication: the challenge of a new naturalness of the artificial event as a mirror of Nature. Once more man emulates Nature, as in the act of making Art [...]."

Although, over the centuries, biologists and morphologists have widely denied a so close correspondence between ontogenesis and phylogeny, and so between unity and complexity, the germ of thought is interesting and I think it is worth continuing to nourish it...

Forms, colors, lines and instructions

As everybody knows, US conceptual and minimalist artist Sol Le Witt, who died not long ago, is one of the spiritual fathers of modern artists and generative designers. By reducing art to a series of instructions thanks to which everybody is able to draw forms, colors and lines in the two-dimensional and three-dimensional space, creating geometric elements that are repeated and modulated according to standard space proportions, Le Witt loved reminding that "all the people are able to participate in the creative process, to become artists themselves". It is well-known that the artist tended to separate the planning stage from the realization of the work; he devoted himself to the former, whereas his assistants devoted themselves to the latter: if the artistic process thus

lies in the conceptual planning of the work, the (basic, elementary and geometric) execution can be carried out by everybody, thanks to a series of detailed instructions that are suggested by a thinking unit with a procedural approach. He also claimed, "There are several ways of constructing a work of art. One is by making decisions at each step, another by making a system to make decisions."

In this kind of approach the work of the last years of some of the most important generative artists and designers in the world (Casey Reas, Ben Fry, Jared Tarbell, Theodore Watson, Lia, Toxi, Andreas Schlegel, Marius Watz, Robert Hodgin, to mention only some of them) is reflected: if the human being identifies himself/herself with the author of a series of mathematical instructions that can be suggested to a computer, the resulting work of art will be the sum of the operations that the computer has carried out autonomously. Therefore, as for Sol Le Witt the emotional elements of the authors, their joy at a moment, their frustration, their apathy were constituent elements of a free interpretation of the instructions that had been suggested to them and so of the resulting work of art, in the universe of digital software as well (from Processing to VVVV to Open Frameworks, to mention the most widespread) we can hazard the thought that the instructions given by the artist/designer can be freely

interpreted by a kind of 'emotiveness' of the 'thinking' computer.

Le Witt's conceptual indifference to any kind of aesthetic judgement, the aversion to prearranged aesthetic conventions that are assimilated by the public, a general indifference to any kind of distinction between old and new are perfectly reflected in the words of one of the most important generative artists in Italy, Fabio Franchino, "In the evening I give some instructions to the computer, which processes data and autonomously generates lines, forms and colours during the night; in the morning, when I wake up, I judge the results. If I like the product I will keep it, if it is not satisfying I will throw it."

Well, I do not know what these things suggest to you: I think that also in this case we can make a comparison with the natural universe. If we assimilate the environment, nature in its widest meaning, as the entity that is able to cause a series of changes, evolutions and dynamics, then the organisms living in contact with it (again, the concept of 'ecology') are able to interpret these vital codes, to assimilate them, in order to react to them and autonomously generate a series of forms, colors and systems that can be seen as the result of their evolutionary process, which comes to a complex final system from a starting unit. The difference maybe lies in the 'spontaneity' with which this process

begins: if an artist/designer decides, in advance, a series of instructions that will be given to the computer, it is difficult not to think that nature operates by following only its evolutionary spontaneity. At the same time, it is fascinating even to think that as the artist/designer does not know the final effects of the instructions, giving the computer the freedom to interpret them, similarly nature does not care about the effects it produces on the organisms living in it, giving them evolutionary freedom of forms and elements that we, human beings, only afterwards could maybe consider as 'works of art.'

Numbers in evolution

Today, one of the most fascinating mathematical theories is undoubtedly that of fractals: according to the definition of their discoverer, Polish mathematician Benoît Mandelbrot, they are geometric shapes, characterized by the endless repetition of the same pattern at ever smaller scales. This is the most intuitive definition that can be given to shapes that exist in nature in an impressive number but do not still have a precise mathematical definition. The natural universe is rich in forms that are very similar to fractals, forms that do not follow the norms of the Euclidean geometry: a stretch of coast, the branches or the roots of a tree, a cloud, the snowflakes, the ramifications of a lightning and the dentation of a leaf are example of fractal forms originating spontaneously in

nature. Among these, the fractal form par excellence is the spiral, the constituent element of the shell of many annelids and conches, which is one of the main objects of study of Ernst Heinrich Haeckel's theories and one of the most beautiful and fascinating geometric forms.

If we shift the field of analysis to mathematics, to numbers, to equations and algorithms, the level of intersection between science, technology, art and nature does not change. And if the procedural and generative method is what we have chosen as the guiding element of this treatise, it is not surprising to think that the construction of fractals follows a reiterated process, that is, the repetition of a starting element for a theoretically infinite number of times until, after a while, the human eye cannot distinguish the changes in the starting element any longer. We must not forget the fact that, as it is acknowledged, fractals are influenced by certain controlled casualness. There is thus again the element of casualness, of spontaneity, as the distinctive (or unifying) element between computer and nature, according to which evolutionary mechanisms cannot be predicted from their constituent elements and it is often impossible to reconstruct them, starting from their visible manifestations.
At this point of the text, the procedural, generative, iterative and evolutionary element may be considered as the pillar

of the thought underpinning a modern 'computational ecology': between Turing's revolutionary theories on *morphogenesis* (every living organism is able to develop complex bodies, starting from extremely simple elements and basing on processes of self-assembly, without the aid of a guide following a prearranged plan) and the most recent studies that have been carried out on *genetic algorithms* (a particular class of evolutionary algorithms using techniques of mutation, selection and recombination, so that a certain population of abstract representations of possible solutions to an optimization problem evolves into better solutions) almost fifty years of studies, analyses and research passed; they aimed at underlining the nearly computational properties of Mother Nature on one side, and the ability of digital machines to simulate and repeat complex natural phenomena. Frankly, I do not wonder any longer what is the most fascinating form of art or the most difficult process…

Moreover, I think that the most interesting answers to these themes can be found in the studies and theories of Karl Sims, the famous artist and researcher from Mit Media Lab; in particular, we can find them in his 1993 work, *Genetic Images*, which drew inspiration from his paper *Artificial Evolution of Computer Graphics,* where he described the application of the *genetic algorithms* for the generation of 2D abstract images, starting from complex mathematical

formulas. Therefore according to Sims, Darwin's evolutionary theories can be simulated by means of a generative software or appropriate mathematical algorithms; in this way, "populations of virtual entities specified by coded descriptions in the computer can be evolved by applying these same natural rules of variation and selection. The definition of fitness can even be altered as the programmer desires." I think that what is interesting in *Genetic Images* is the fact that this work was presented as an interactive installation: in other words, it was the public who could choose and select the most interesting images and forms from an aesthetic point of view, among those generated by a computer simulating a process of artificial evolution. The selected images were then recombined by the computer to create new ones, basing on alteration and mutation methods, similar to those of natural species during their evolutionary process. Karl Sims thus wonders whether these interactive evolutions can be considered a creative process. If yes, is it the public who develop an independent creative attitude or is the presence of a designer making the computer follow precise creative paths necessary? Or is it maybe the computer that develops autonomous creative tendencies?

In his treatise, Sims duly mentions biologist Richard Dawkins who, in his book *The Blind Watchmaker*, talks about the ability

of natural evolutionary processes to create complex forms without the external presence of any designer or programmer: "It is thus possible that these generative techniques challenge an important aspect of our anthropocentric tendencies, according to which it is difficult for us to believe that we are planned not by a God but by casualness showing through the codes of a natural evolution," concludes Sims. Maybe true art lies exactly in all these things.

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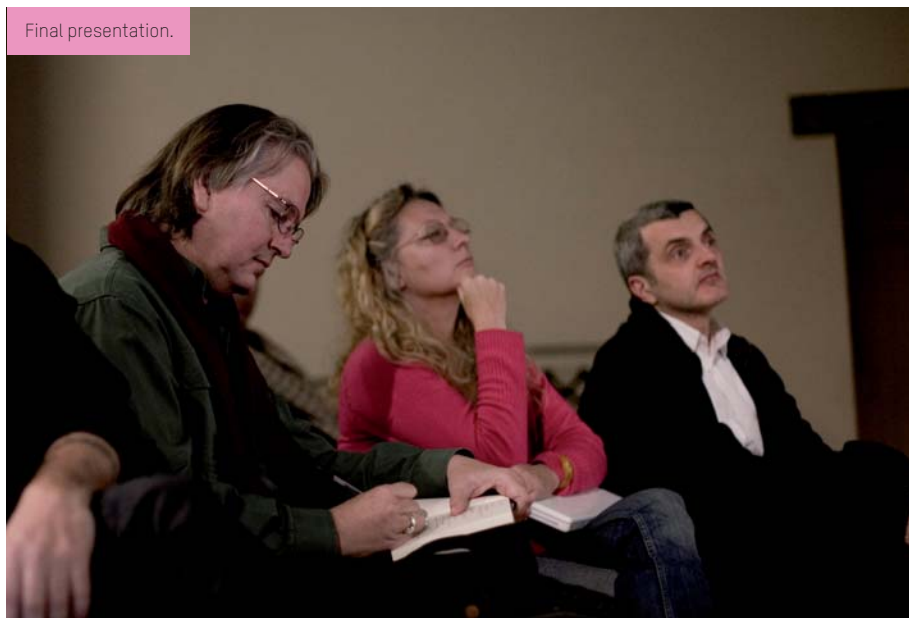
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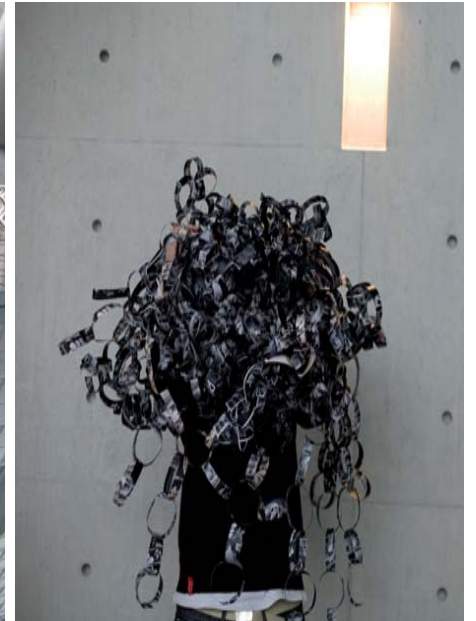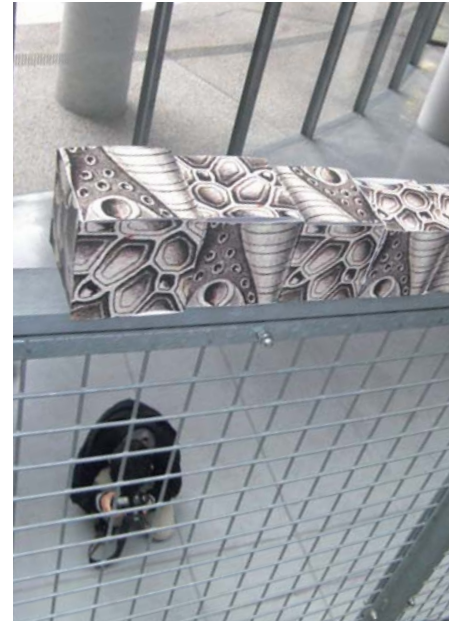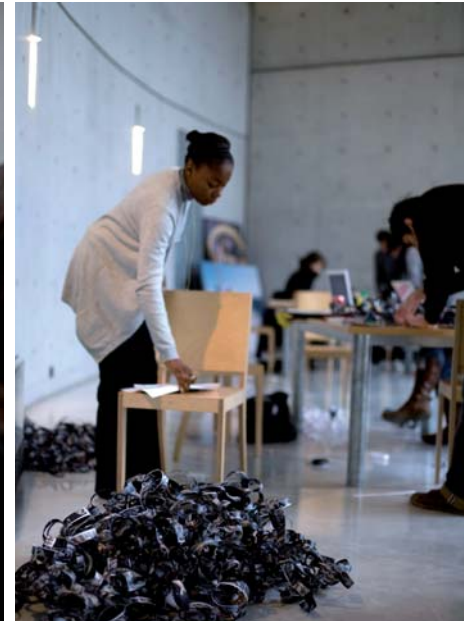
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Odd Shape?

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Designing Processes Rather Than Art

**A Fabrica Workshops project
directed by Bruce Sterling**

Guest commenter Marco Mancuso

November 25th - November 28th 2008

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Thanks to:
Laura Pollini, Sam Baron, Enrico Bossan,
Andy Cameron, Federico Mariotto, Babak Payami

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