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bachelor in Fine Arts

Generative model of art

Dissertação para obtenção do Grau de Mestre em Arte e Ciência do Vidro

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ACKNOWLEDGEMENTS

My deep deep gratitude:

- to Professors Robert Wiley and Richard Meitner, who gave me the strength to find, recognize and express my inner artist by different languages;
- to Márcia Vilarigues for their help in resolving bureaucratic issues happy my training;
- to my co-coordinator, Prof. Elena Tereshina, who engaged me in the keenness to the structure of Nature;
- to auspicious history of Europe for the opportunity to touch the unbroken cultural tradition of hundreds previous generations;
- to the One I cannot refer;
- to myself whatever I am.

SUMÁRIO

Este trabalho é uma espécie de as notas que eu fiz no caminho de ser um experimento em si. Eu não sou um cientista. E, para o início do meu estudar em programa Art Glass e da Ciência, minha voz artística desejava manifestar-se, mas eu não sabia como encontrar a expressão certa para isso. Agora eu sinto que encontrei o caminho, e isso aconteceu porque aqui eu tive uma possibilidade para a arte e ciência de uma só vez.

Tive a sorte de encontrar um monte de analogias viáveis na ciência para o meu fazer artístico. Eu olhei Biologia, Morfogênese e geometria fractal e eu aprendi sobre como os objetos tomar forma na Natureza. Graças à ciência Eu tenho um solo rico de consciência, espécie de base forte, a partir do qual eu comecei a avançar rapidamente como um artista. Alguns dos fatos da ciência notei, já existe na minha tomada de arte, mas a consciência deles ainda me leva de alguma forma aos novos níveis de meu trabalho.

A ideia de "campos morfológicas" do biólogo evolucionista Rupert Sheldrake, é muito relacionado com o meu fazer artístico. O coração de sua idéia é que, se olharmos para a forma como as células se multiplicam, como se reproduzem-se ... se olharmos para a natureza e tentar quebrá-lo para baixo e para compreender e ler por que que as coisas acontecem, se tentarmos explicar por que parece que isto ou aquilo ... Por exemplo, fractais - por que é que aconteceu, por que as células organizar e repetindo o mesmo padrão em diferentes escalas ... Rupert disse, não é o suficiente para quebrá-lo e olhar para a informação - algo que está acontecendo fora de o que podemos ver. Nós não podemos ver a força que faz a tomar forma.

Como um artista, eu sei que força muito em breve. Eu só abrir a ele, eu apenas dar-lhe a usar minhas mãos, e não há nenhuma diferença entre nós.

Palavras-chave: caos, fractal, atrator estranho, natureza, biologia evolutiva, morfogênese

ABSTRACT

This work is a sort of set of notes I made while being both the experiment and the experimenter with the Master of Glass Art and Science. I'm not a scientist. At the beginning of my studying at Glass Art and Science program, my artistic voice longed to be made manifest, but I did not know how to find the right expression for it. Now I feel like I found the way, and it happened because here I had a possibility to be in art and science at once.

I was lucky to find a lot of workable analogies in science that I could apply to my art making. I've looked at Biology, Morphogenesis and Fractal geometry and I learned about how objects take form in Nature. Thanks to the science I've got a rich soil of awareness, kind of strong base, from which I began to advance rapidly like an artist. Some of the facts from science I noticed, already exists in my art making, but the awareness of them still leads me somehow to the new levels of my work.

The idea of "morphological fields" from evolutionary biologist Rupert Sheldrake's is very much related to my art making. The heart of his idea is that if we look at how the cells multiply, how they reproduce themselves... if we look at Nature and try to break it down and to understand and read how things happen, if we try to explain why it looks like this or that, we fail to find enough information to explain the final forms. Sheldrake argues that there is not enough information available when we deconstruct cellular information to explain how larger scale forms occur. Something or some process appears to be happening outside of what we can see. We cannot see the force that makes thing take shape.

As an artist, I understand that force very personally. I just open to it, I just give it to my hands, and there is no difference between me and the rest of natural processes.

Keywords: chaos, fractal, strange attractor, nature, evolutionary biology, morphogenesis

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INTRODUCTION

essential expression

“Those who kindled a passionate love of art, without further study of and with due diligence scientific part of it, more appropriate would be to compare with the sailors, who went out to sea on a ship without a rudder and compass, and therefore cannot hope ever to arrive at the desired port ”

Leonardo da Vinci

Encountering science led me to a critical point where I had a conflict, and now I've realized the reason. Science always works to be exact and always wants to prove the things. However, I've spent my whole life among the things which I can't prove, but sense strongly. And thus, there is going to be a limit how the science is going to serve my work as an artist.

It was like an extension of my conflict with the occidental idea from Judaic Christian that a man is distinct from Nature. According to this idea we should just to be conscious about what we are doing, even if we don't feel it. This is the same way a scientist being separated from Nature makes an observing, proving, naming condition. It's a kind of philosophical distinction, but for me, it simply makes sense to work from another point of view.

At same time the science itself is proving that our sensing does have a limit. For me, science doing something that art has already known for a long time: namely, how to interact with the unseen and unknowable.

I'm not a scientist, but I've studied science, I understand science, I can do the science, I can do the math, I can use a scientific approach and science influences what I still am.... And yet it still moves. What I mean is that like Galileo, but in a somewhat tangential way, I must refuse some part of science when my art making is concerned, as things that cannot be observed are at play within me and around me.

When I first arrived to the Master of Glass Art and Science course, I was floating; my feelings about my work were not very clear, my work was decorative and I think, not yet mature. But I had arrived really hungry to learn more about art making, eager to learn all I possibly could during my study.

My previous training and art degree had been in painting, so this was the first time I had ever seen glassblowing, also the first time I had the chance to find out about working with ceramics. Those new encounters meant more to me than I can ever express.

So many new ways to make art but. What is it I wanted to express.....?

That question was too difficult to answer at the time, but my teacher Robert Wiley began by encouraging me to find my answers to much more basic questions. Still even that was not easy, and I often felt myself lost. But in any case I was convinced I had found a very good mentor I could trust. In addition, the scientific atmosphere surrounding Vicarte seemed to assure me that I would, of course, at some point get all the clear answers I so wished to find.

In short, on arriving here, I found that I could feel very open to learning, and tried to do that as diligently as I could possibly achieve. After a time, some very good things started to happen with me. My ideas about art started to develop becoming much clearer and, for my feeling, my personal voice started to find an impressive level.

One of the things I encountered during my study was the field of fractals, a really amazing encounter for me. In illustrations of fractal patterns, I could recognize very clearly some strong connection with shapes my hands and heart had already made! Didn't that mean that I had sensed and explored something that existed everywhere in the real world without ever knowing of its existence? If that was true, it gave me a new and very confident relationship with what I'd call the song of my art voice. By that I mean that considerations of my conscious mind, my subconscious mind, and of my ability to simply sense things were keys that opened up for me an ability to understand by way of science many of the things I do in Art which I hadn't understood before.

After that realization, I started to discover many new and important things about myself. First of all, I discovered that by far the most important source for my personal inspiration is Nature. From that moment I went far deeper into art, departing from the previous tendency I'd had to get lost and unable to escape from making largely decorative imitations of nature. I was immediately sure that I could completely trust in what I could extract from the way Nature shapes itself, learn directly from that. I had no ambition to reproduce Nature, my deepest desire was to become like her, merge as closely as possible, learn to create things in a fashion as close to hers as I could discover and use. Because I know that I also AM Nature, I want to learn to continuously locate the path to that living and central essence of myself, and create from that place.

That idea led me to the conviction that I needed to learn more about Nature's shaping mechanisms. It seemed to me that morphology and fractal geometry were the things I needed to find out more about, they seemed to me the most immediate paths to understanding more of what I wanted to find out. I was then fortunate to meet a biology teacher, Prof. Elena Teresina, who was able to teach me something about physical shaping mechanisms in Nature. That freed up the way for me, to go looking for and finds highly useful relationships with Nature in my work. And it seemed clear to me that I could likely somehow harness a sort of natural mechanism to develop my own way to arrive very directly at new creations, new shapes. It occurred to me that I could perhaps duplicate this phenomenon by focusing my mind on two very different kinds of activities for a time, and would perhaps then arrive at the appearance of the kinds of new shapes I wished to find, behind the activities, somewhere in my 'inner eye'.

Along the way I discovered some fractal mechanisms from Morphology that were analogous for me to what I do when I make art. It seems almost as if shapes can grow at the interface between the material I'm forming and my fingertips, similarly to the way an organism grows.

Quite important openings for me was that Fractal Geometry as a reflection, looking back on the frequency which an events occurred in Nature, gives us a possibility to measure a Nature's shapes. A chaotic objects and events stop to appear chaotic after we clot them in accord. We can see that all has a bifurcation (a repeatable cycles), but we can never predict exactly how the events (or shape) will develop in the future, which type of bifurcation will happened. A Fractal Geometry is a young math science and we never know what the next opening is.

According to this, we can observe a large number of repeating patterns in Nature; as well we can build the way of our activities, according to this simple natural law to get best results. Now I can say that the forming process of biological organisms, fractal geometry and the patterns they exhibit, emerging from chaos are at the present time the key to my understanding of my expression in art.

EXPERIMENTAL PROCEDURE the basic steps of research

«...It's gonna take a while. It's normal to take a while.
You've just gotta fight your way through.
Only to by going through a volume of work,
it will be as good as your ambitions».

Ira Glass

I am the experiment. It already means I'm doing science with myself, and maybe philosophically, the experiment is evidence of a paradigm inconsistency between my artistic and scientific approach.

Science has a limit for me and science helped me to understand where that limit is. Richard Feynman, one of the most brilliant scientists ever, noticed that a scientist's job is to disagree with authority when the evidence of an experiment shows that something is not true [19]. So the scientist's job is to not accept what people tell him, his job is to switch when the experiment deems it necessary. I have been shown science - if it doesn't work within my experiment, then I should go another way, right? I find, through a more scientific way of thinking about my art making process, that there is something happening that can be understood only through feeling. Words will not get me where I need to go in communication about this phenomenon, and it is here that science leaves me and my art making universe takes over.

But thank you, science - I needed to see that things in nature have recordable and recognizable patterns that influence who and how I am. But science is not enough, it's too limiting. So I'm going to take from science what I want. And thank you, science, again - we can have an interaction, we can communicate. But in my universe where I still have a disconnect, we have a different paradigm. So I listened to all the scientific information of this Master program, I carefully understood it, sometimes it was useful, but eventually, art making takes me to another place where science cannot enter.

It was interesting for me to know how its considered by modern art and philosophical theorists the problem of the subject's domination in objective implementation of the irrational thoughts within creating an artistic image; the unity of the artist (subject) with the object images, the occurrence of sensory fragments of life, as well as the rational construction of the artistic image in the consciousness of the subject; as well as the unity of the artist (subject) with the object images, the occurrence of sensory fragments of life and rational art making in the consciousness of the subject. [19] [23] [30] [33]

One of the next important openings for me from science was that I the best media for the life appearing is on the area of interaction of energy vortices of different environs of the Russian scientist, creator of science of biogeochemistry prof. Vernadsky VI, originator of the doctrine of living matter, "biosphere".

In 1926 prof. Vernadsky for the first time raised the question of the boundaries of existence of living organisms in his monumental work, "The Biosphere". The work was little known in the West until an abridged version was published in English in 1986 (Synergetic Press), and later the complete work in a Spanish version (Fundacion Argentaria-Visor) and an English version (Copernicus/Springer-Verlag), both published in 1997. However, the question then as now, has no clear answer.

According to the Vernadsky's idea, the distribution of life in the biosphere is very uneven. Modern life is common in the upper crust (the lithosphere), the lower layers of the Earth's atmosphere (the troposphere) and in the Earth's water shell (hydrosphere).

Vernadsky argued that the life originates and exists at the interface of environs, at the section of the physical phases, and it is not accidentally - here the most powerful convection currents, flows of energy and entropy. Mostly high concentration of living matter is at interfaces of the core media - in the soil (i.e. in the boundary layer between the lithosphere and the atmosphere), in the surface layers of the ocean, at the bottom of bodies of water (especially in the area of the seabed which is dried at low tide) and in a flooded river mouths (where all three media - soil, water and air - closely interact with each other). Places of the highest concentration of organisms in the biosphere Vernadsky called "the films of life." [36]

I started to use that special “films” idea in my creativity to make the way to implementation much shorter. For example, I could involve my mind in some different kind of activities for some time and, as the result, the shape which I looking for, appears behind them in front of my inner eye. It’s kind of growing the shape between the material and my fingertips the same way that an organism grows.

Another thing I found particularly useful were some mechanisms from Biology that seem quite analogous to what I do in art making. For example, self-organization as a transition from chaos to order is a very improbable event that has representations of classical thermodynamics. But these processes continuously occur in inanimate and animate nature. Some researchers prefer the term "self-assembly", understanding it as an autonomous organization of the spontaneous component at all levels, from the molecular to the planetary. A classic example of the spontaneous emergence of structuring can serve as Benard cells [Fig.4] in the bottom layer of silicone oil heated - is the emergence of a complex spatial organization and the formation of cells in the form of geometrically regular hexagonal structures. An early example of biological self-organization became aggregation of amoebae *Dictyostelium* in which cell source of an attractant becomes aggregation center. To put it simply, the idea behind self-assembly is that molecules will always seek the lowest energy level available to them, whether this means bonding with an adjacent molecule or reorienting physical positions. [28]

Thanks to that principle of self-organization I recognized *what really happens in Nature*. And from that moment I found a way to delve deeply and personally into my art making, despite my previous floating in decorative imitations before. I saw just how much I could trust to Nature’s way of shaping, and because of that I was happy to start to learn directly from Nature. My deepest desire is to merge with Nature; to be Nature itself and to create the same way, but not the same shapes.

I sense that a part of me is always at the disposal of Nature itself, but every time I make, I should find the path to naturally entering and creating as any other natural process. Thus I was forced to search for as much information about the Nature’s mechanisms for shaping matter as I could in order to have a more aware sense of its process.

And one more important opening for me was the Fractal Geometry. When I saw the pictures of fractals, it was exactly the shapes which my hands were already making from the heart before. Does this mean that I sensed something that actually exists, but without knowing it? I sensed the deepest relationship with the song of my art voice when I saw the fractals. It was an example of sensing something without a being aware of it. I realized that in this direction consciousness, sub consciousness, sense - are the keys which could help to open a connection with science and to understanding what I do in art.

Fractals as a reflection, looking back on the frequency with which events occurred in Nature, gives a possibility to mathematicians to measure Nature's rhythm. Apparently chaotic objects and events stop to appear chaotic after we plot them in accord. We can see that all has a bifurcation (a repeatable cycle), but we can never predict exactly how the events (or shape) will develop in the future, which type of bifurcation will happened.

Fractals, like a highly ordered system, appear from chaos – from that formless aggregate of matter and space, which in the human representation is opposed to the order. Basically when we see the natural patterns that seem to be chaotic, we can realize that there is an underlying structure to the world around us that seems to transcend a more classical scientific model. As mentioned earlier, it is almost as if there is more information involved that we are led to believe in what shapes our world. It is this type of evidence that the sensitive artist might grab onto as proof of the magic that they feel all around. Artist do not go to the science to get all the answers. I just get a proof which comes from observable, experimental scientific information, and that is not enough to explain what I feel. So as an artist, I use fractal geometry to say: “Look, this is the evidence of what I sense!” We can observe a large number of repeating patterns in Nature; as well I can build this same way in my art making activities. According to this simple natural law of a bifurcation, I can “feel” my way into the best results in my art making, and see something observable that matches my feelings.

Thus I can say that pattern forming as seen in biology, fractal geometry and patterns occurring from chaos are the key to my understanding of my personal art voice.

RESULTS AND DISCUSSION

the point

"First, make sure you know the structure of the things, you want to express".

Leonardo da Vinci

The science is limited by observations, but when I say that my fingertips interact with the material, I speak about limits dissolving. Because for me it's how the world works: I don't make a distinction between me and the rest of Nature. I don't have this occidental separation from Nature or from God. I just try to exist the same way as a Nature and there is no distinction between Nature and my artworks.

I sense the possibility to engage in a sense of oneness in the world, even without knowing that thing. Science might name it Quantum Entanglement [7]; that mechanical phenomenon opened by Albert Einstein, when, in spite of the principle of locality, tangled photons remain in stable direct connection, regardless of the distance between them. And my work is the work based on that entanglement, on connection without knowing.

I have a strong sense that material knows what to do. I simply allow my body to hear the matter. I am in the service of the material, which is a bit different from what we normally know - material is in the service of humans. So, it is exactly the same as we see in fractal geometry, in biological self-organization and biosphere's appearing of the shapes from the "films" between interfaces of environs. What I mean is that same way like a cells do their work being service of life shapes, I serve material while art making.

When I making a piece, I, as a conscious being, disappear. During the making I am not there, but everywhere (it's the best condition for my mind to exist). It seems like I turn my thinking off, but it doesn't, I gone to a different state, where the I becomes less self-conscious and I am deciding by sense rather than by thinking. This is what I've come to understand about the art making. This is what I learned from trying to study science.

Just as with fractal, I can never predict how my art work shape from matter beforehand. I can only see the previous steps, the shape which has already come. What kind of bifurcation will happen next? I never know.

It looks like there is a Strange Attractor here, somewhere between my body and body of art matter. That phenomenon, which was coined by David Ruelle and Floris Takens, obviously present here, in the creation of my art objects. Strange Attractor's geometric structure is very complicated fractal structure, and it's ability to gather spontaneously a new forms around - is undeniable.

After the piece finished, when I make a first step back to look on it, I feel a numerous flashes of joy! But I cannot make any judgments or compare my pieces either that moment, nor after. I see them emerged and existing by themselves. More than that, after the piece were finished I never return back to it again in my mind, I never think about it. It's completely done for me in all aspects.

I found that an art making for me is only a joy of the process, the joy that I serve a very clear purpose, the best way I can. And there is no question about whether it right or wrong thing. I just do what I should do. It is so infinite, that I don't need to think about it - and that is the only reason.

CONCLUSION

the statement

"Each of new art cycle it is always a legal lawlessness. "

DS Likhachev

It is my strong feeling now that every time I go to Science, I deepen my sense of the nature of material existence. It is of great help to me to immerse myself in the 'source code' of what is manifested in the world, and start to make my own creations from that location. In this sense, it is for me a way that Knowing (which I can with Science) can support Sensing (which I equate with Art).

Science is showing me how to investigate and know, and that information becomes the source of feelings, sensing things about what that implies. Attempting to integrate what scientists tell me I should know, what is proven and immutable, with the moving dance performed by unpredictable bifurcation and chaos is for me, creates almost a life giving energy field between these two so seemingly opposite planes of existence, I now believe I have come to understand what Science is. But understanding it does not mean it is what I do. I think of scientists as most comfortable with what is known and proven, or at least demonstrable. But I don't think of them as being quite so comfortable with what can only be sensed but not demonstrated, i.e. manifested as true or false. In my view, that second state of existence, in what can be sensed by is not knowable, is where artists often feel most comfortable. In any case, that is what I do, and where I feel comfortable. I extract information from a curve, from fractal geometry for example, I analyze it in my own way and extract a sense, a feeling from it. And from that sense, I am able to grow my own shape, my art.

I have come to realize in the course of this Master's that I am experimenter and experiment at one and the same time. My mind and perceptions are the same kind of matter as the glass and ceramics, materials to be experimented with, materials I can use for my questioning and research. For me, Art and Science are analogous, we can contrast or conjoin knowing and sensing, and I am lucky enough to have found that one can very effectively support the other.

I have always known myself to be more inclined to silence than to speaking. Art for me is a wonderful way to immerse myself in the beauty of silence, speaking without voice. The fact that I can also share that beauty with others is a great bonus, although it is by no means a central goal. But if anyone asks me what my mission is, - it is that bonus, to share the beauty of that kind of silence, the fullness of being before words and thoughts.

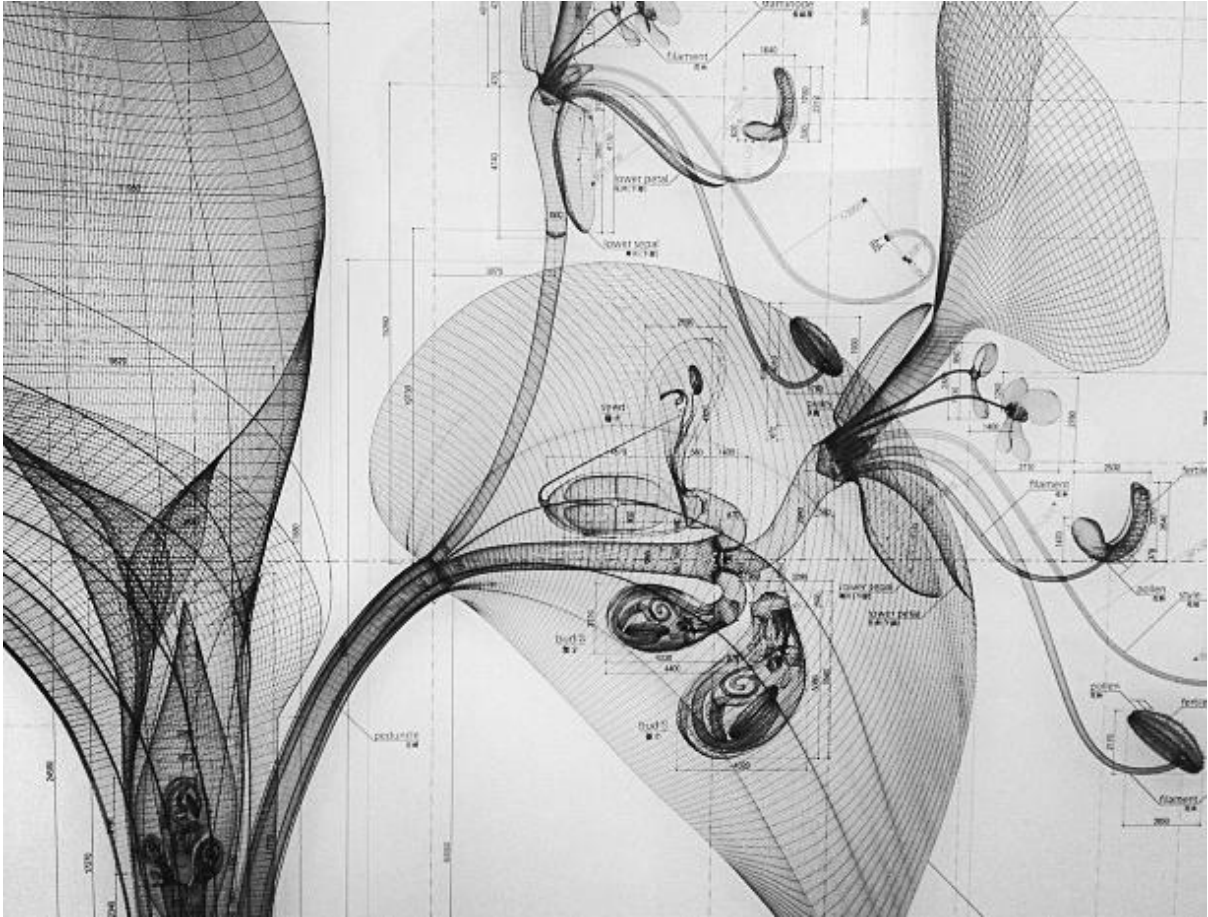
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THE FIGURES



An equality of creative mechanisms in biology and art

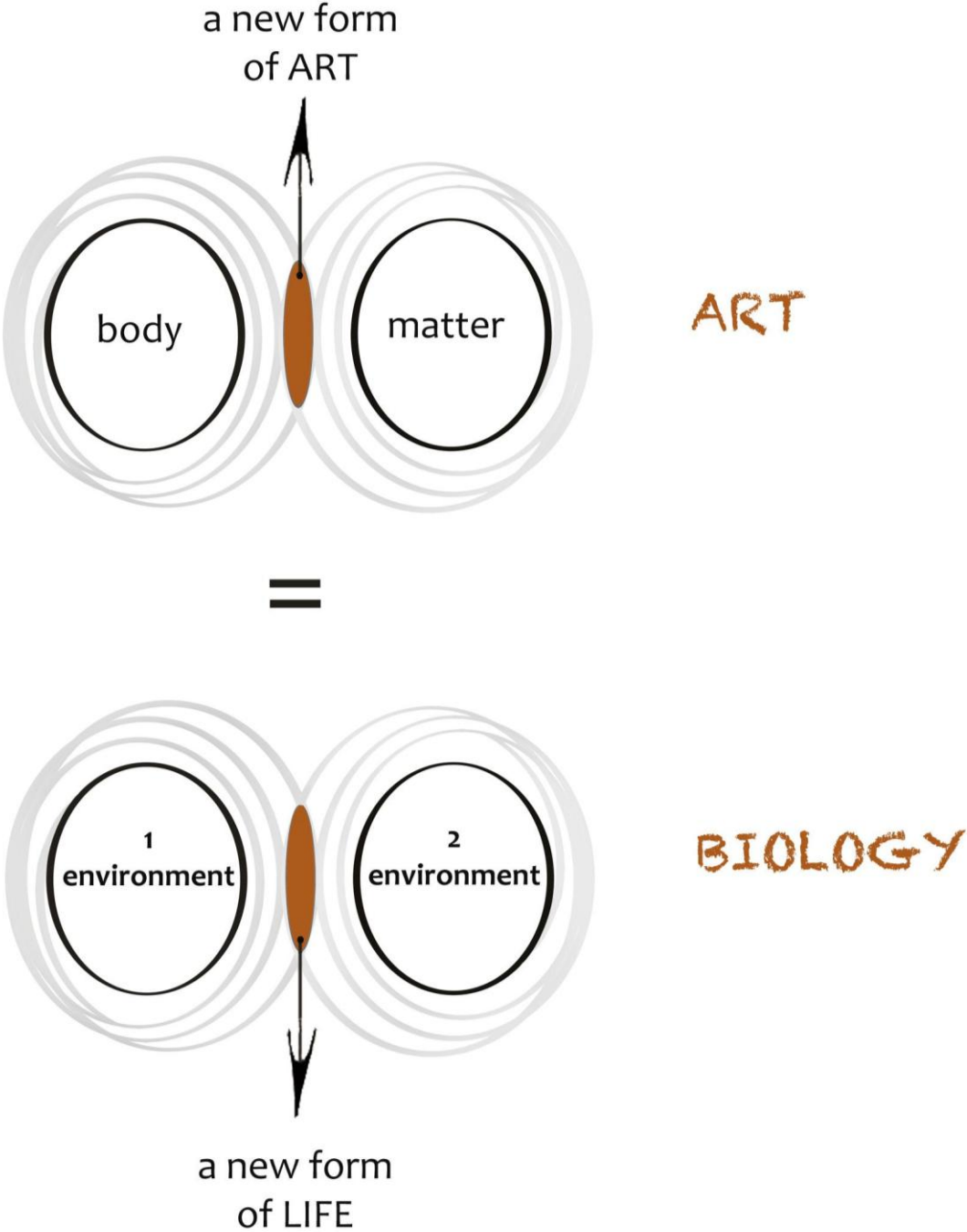


Figure 1

Examples of “Julia sets”

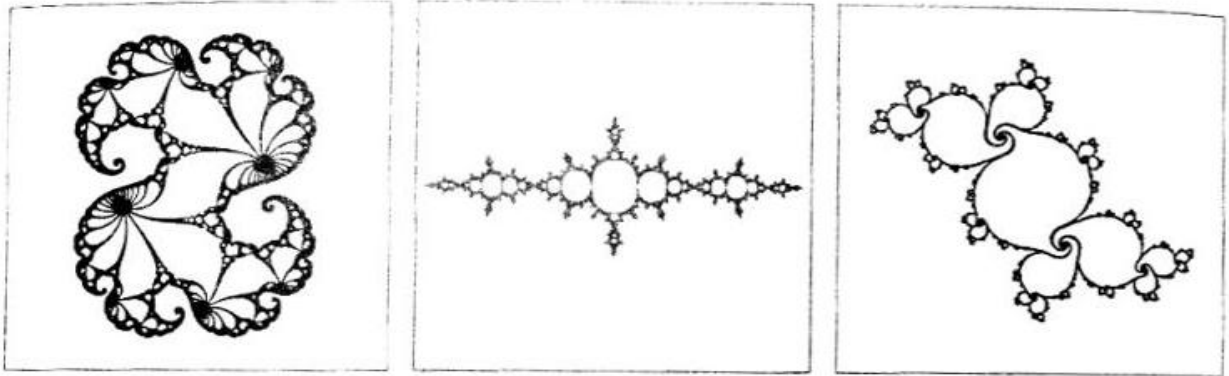


Figure 2

“Julia sets” that contain *part* of a “Mandelbrot set” of

$$f(z) = \frac{z^3 - z}{1 + 4z - z^2}$$

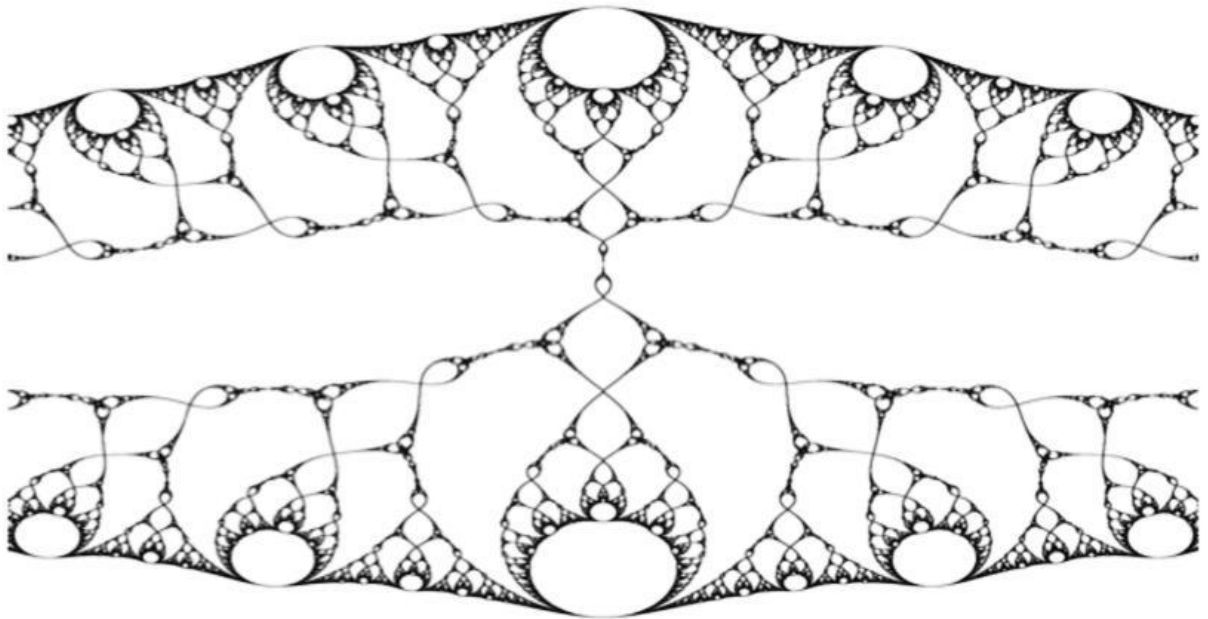


Figure 3

The sequence of Dictyostelium amoebae population structuring and the Benard cells

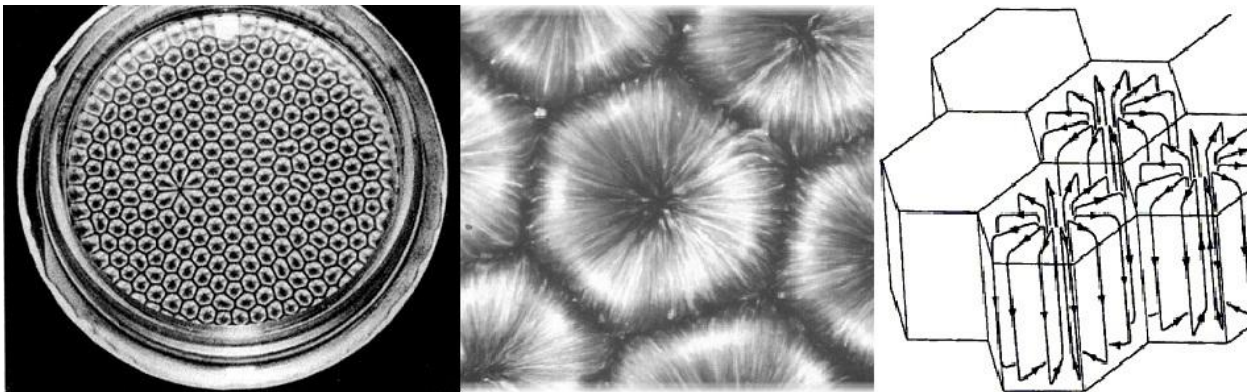
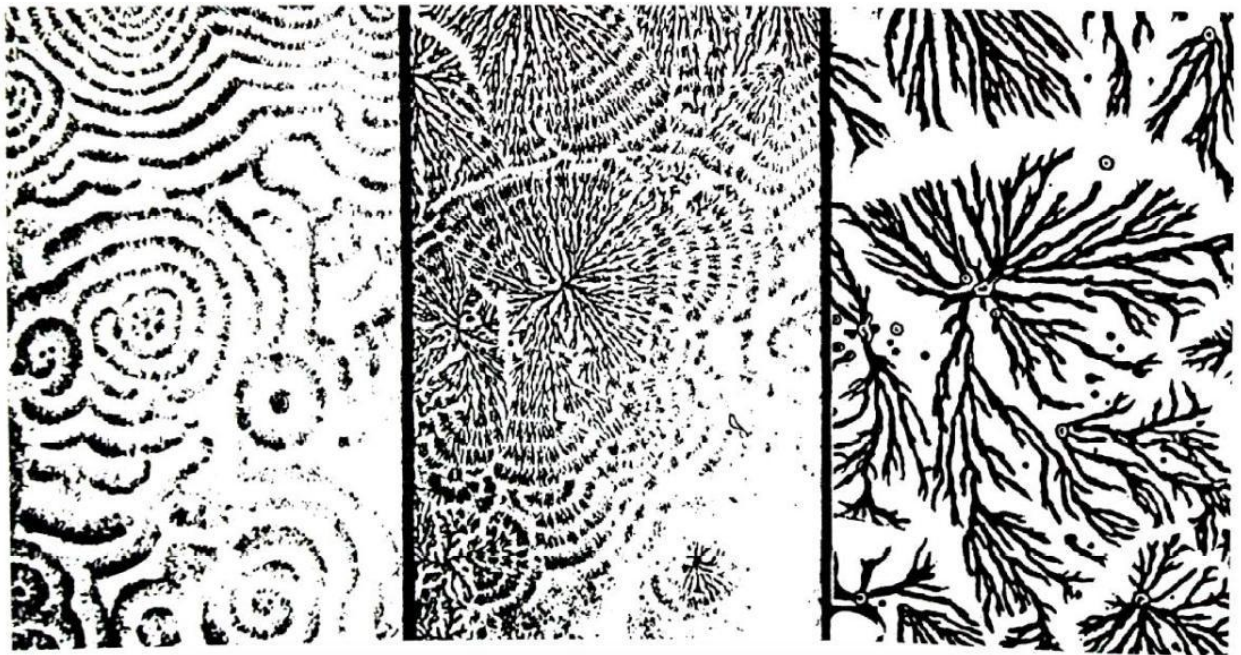


Figure 4

ARTWORKS



who

stoneware
500x250mm
2016



Figure 1.1

breathing

stoneware
450x350mm
2016



Figure 1.2

stone

stoneware
260x150mm
2016



Figure 1.3

hive

stoneware
400x500mm
2015



Figure 1.4

honeyhomb

stoneware
800x800mm
2016

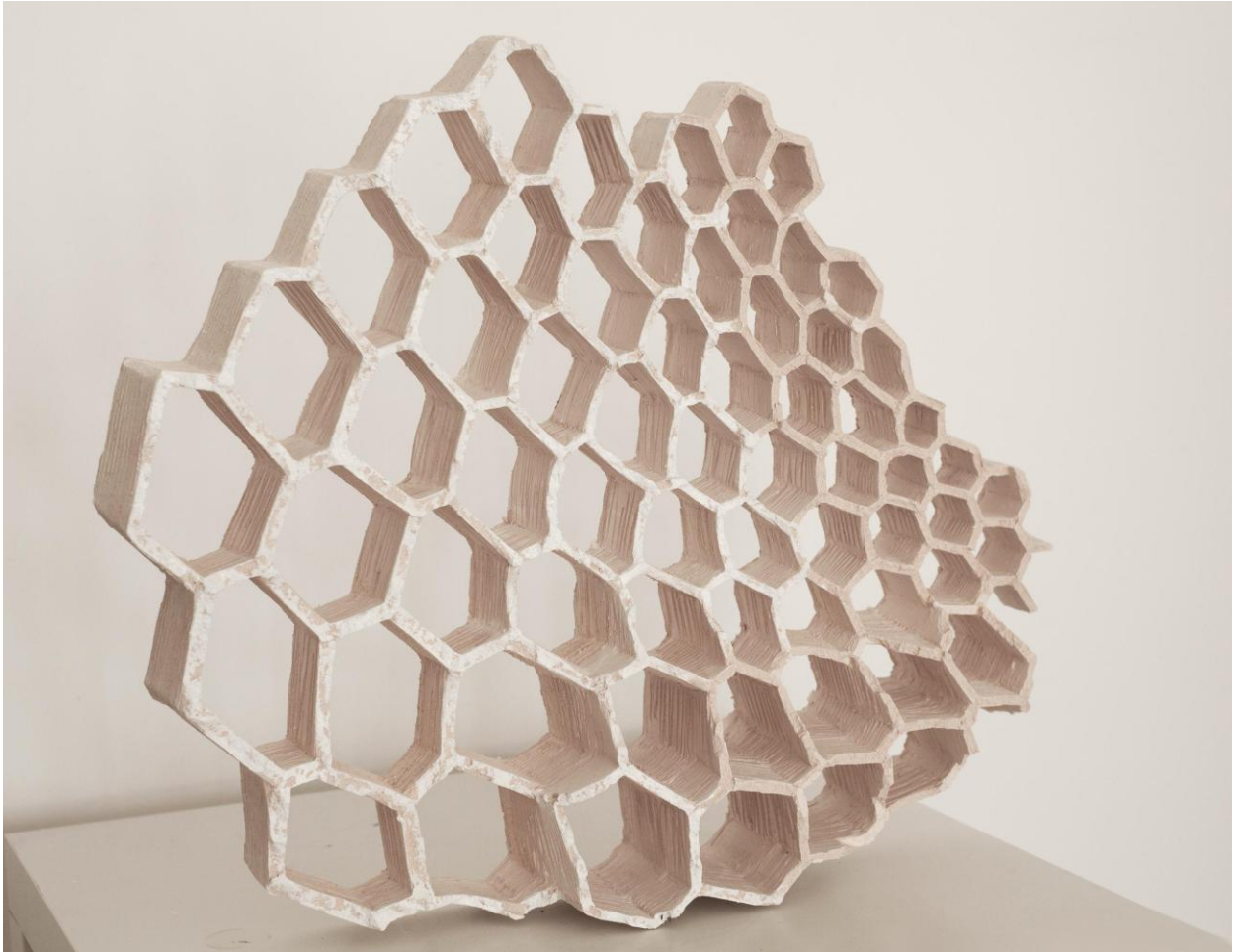


Figure 1.5

lady

glass

70x180mm

2014



Figure 1.6

coral flute

stoneware
1200x600mm
2016

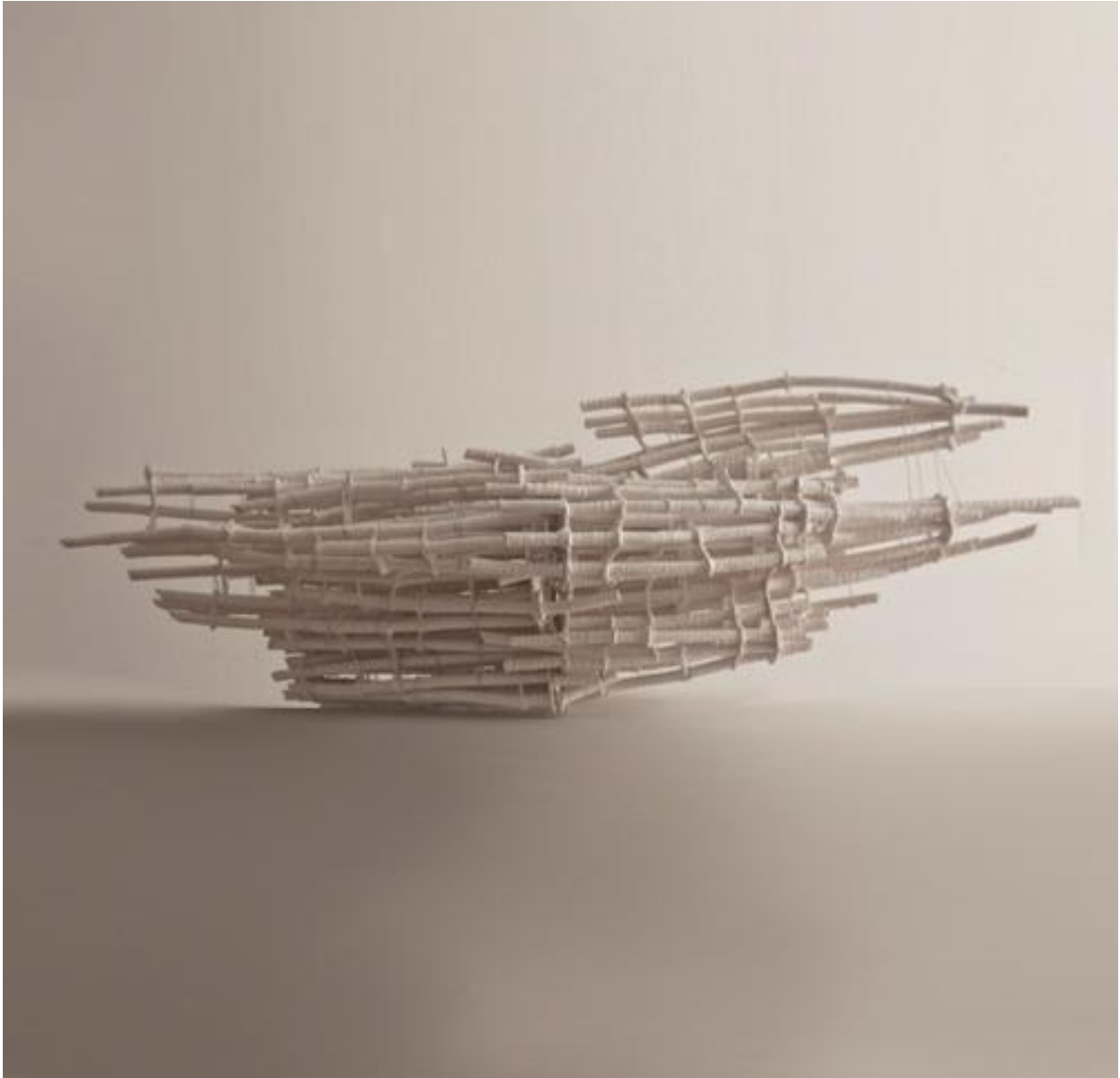


Figure 1.7

cup sculptures

glass
80x50mm
2014



Figure 1.8

shell

glass
80x80mm
2015



Figure 1.9