

## **BIODESIGN PRODUCTS - CO-DESIGN WITH NATURE?**

*Hannele Koivunen*, Ministry of Education, Science and Culture, Finland

*“Art tells the jokes that science insists on explaining”* (Henry Warwick)

### **Concepts of bioart and biodesign**

Bioart is a new interdisciplinary paradigm of artistic expression utilizing biotechnological and medical methodology, and organic materials. Bioart explores the dialogue between culture and “nature” on the interface of the natural sciences and the fine arts. In bioart and biodesign artefacts are designed by manipulating organisms by biotechnological methods and interpreting the results through the cultural framework.

The concept of bioart appeared at the turn of the millennium, but it is still unestablished. There are parallel terms like biological art, geneart, sciart, genesthetics, metascape, genome sound, transgenetic art, nanopoeetry, amoebal scripting, molecular sculpture, biomimicry, genethics, even bioporn.

Bioart has no generally agreed theoretical framework. Besides biological, medical and cultural studies, it intersects many scientific and artistic fields like cybernetics, cognitive studies, philosophy, ethics, sociobiology, or agriculture, forestry and gardening. Its applications can be found from hybridization or, plant breeding, up to environmental arts or plastic surgery. The identity of bioart is taking shape as a dialogue between ethical, ecological, technological, and artistic dimensions.

The concept of biodesign has mainly been used in the context of biotechnological and bioeconomical applications. In the web there are several internet-shops selling biotechnological products: enzymes, hormones, proteins, cellular materials etc. The term has also represented ecologically sustainable landscape planning, and so on. Fluorescent radiant albino Bunny (2000) by Eduardo Kac may be internationally most famous artefact of biodesign, but there are several other examples from the fields of science and art.

With several examples, the presentation explores potential approaches to and interpretations of the concept of biodesign. How the concept and the identity of biodesign take shape in biotechnological, economical and cultural discourses, in the context of bioart, or in common contemporary parlance.

Biodesign may connect art, science, technology and economy. It makes visible the ethical and ecological dimensions of design. Biodesign could also function as a bridge and interface between *digeratis* (the cyber elite) and reality. The applications and products of biodesign could, for instance, be utilized in creative economy, the conservation of nature, education and learning methodology, simulation technology, and so on.

## **Morphogenetic evolution**

Mother Nature does not exist! Human way of talking about “nature” as a creator or designer of the forms and structures of life is basically only a erroneous metaphor, or substitute for the concept of gods and goddesses. Fantasies of gods replace the unpleasant reality of evolution without any intellectual plan. Perhaps this archetypical relic of conscious creator or designer reflects ancient hierarchical religious structure of society, or herd of chimpanzees.

My claim here is that by perception of nature, and research of natural biodesign of evolution, designers could learn a lot from essential morphogenetic structures. Morphogenetics means ideal systems relating to or concerned with the development of normal organic forms.

The interfaces of morphogenetic evolution can be found from system theory, cybernetics, thermodynamics and adaptive control theory. The best solution of shape or structure is the economic functionality of a system. Evolution spares most economical and effective approaches to realize certain purpose or function. This means the most effective use of resources: nutrition and energy. In the long term the most effective and fluent flow for realizing certain functions produce the best shape.

Classic, and perhaps most well-known examples of basic natural structures are the golden section, the golden string and the Fibonacci numbers. The Fibonacci numbers are repeated and function as models for the petals of flowers, seed heads, pine cones and leaf arrangements, and so on. The Fibonacci numbers have been mystified, but there is no need for mythology or magic in this connection, it may be just functionality and economical evolution.

The Fibonacci numbers also function as regards the human hand. If you measure the lengths of the bones in your finger, does it look as if the ratio of the longest bone in a finger to the middle bone is Phi, and so on. The design of human hand leads straight to the design of tools, for instance design of knife.

Dictionary gives the concept “*artefact*” following definitions: “*An object produced or shaped by human craft, especially a tool, weapon, or ornament of archaeological or historical interest.*” Or: “*Something viewed as a product of human conception*”. According to this definition artefact is definitely something far-away from nature and evolution. Something intentional, made by humans.

My question here is could we consciously utilize biodesign structures and solutions of evolution in creating artefacts in design and creative economy?

The morphogenetic evolution of the human hand, eye and brain (technology, arts, theoretical thinking) has always been interconnected. The human creative ability is the result of this co-evolution. Functional everyday product development owes a lot to the structures and materials of nature. The scale of design depends on perception and technology. The human being used to be the measure of design up to 17th century, when science widened the scale of design out to the universe. Biotechnology has opened up the scale of “nanodesign”, but simultaneously also a wider ethical scale. Biodesign structures recover Reality of the Universe and create a new way of watching our surroundings, conscious of the world hidden from our limited and primitive senses.

Evolution has no goals or aims, and absolutely no plans. Evolution does nothing – it just takes place. Evolution is nothing but the label with which human beings try to describe (with their limited imagination and perception) what they think is happening. Evolution is not linear or logical – it is just experimental play of different possibilities and alternatives. Evolution causes experiments and errors, and it may return to the start of some development line, and try it in another way.

But there is one thing necessary for the biodesign of evolution. It is time. Evolution becomes visible in mutations, but mutations do not exist unexpectedly. There has been a long development of creating invisible diversity and variation in the genetic resource before the mutation has its necessary preconditions (gene-tree versus species tree).

### **Evolutionary economics and design research**

I have talked a lot about evolution and biology in the context of biodesign by crossing the concepts of biology, art and design. At the moment perhaps one of the most popular concepts is creative economy, crossing creativity with economy. By crossing biology with economy we get *evolutionary economics*. Evolutionary economics is a relatively new economic methodology from 80's that is modelled on biology. It stresses complex interdependencies, competition, growth, and resource constraints.

The first 200 years of economic theory was modelled primarily on physics — economic terminology like “labour force”, “equilibrium”, “elasticity”, and “velocity of money”, are no accident. Conventional economic reasoning begins with the definition of scarcity, then assumes the existence of a “rational agent” bent solely on the attainment of one goal — the maximization of her/his welfare as defined by that agent. All relevant information is assumed to be held in common (“perfect information”), and the scheme of valuation (“preferences” or “tastes”) used by the decision-maker is also assumed to be constant and native to the agent (“non-envy” or “independent preferences”). Evolutionary economics derives from a more modern tradition of inquiry, which does not take the characteristics of either the objects of choice or of the decision-maker as fixed.

The idea of linear and effective product development is nonsense seen from the evolutionary economics point of view. Results are always unpredictable, and the best way in creating new innovations is increasing opportunities for variation: diversity is an intrinsic value in creative economy.

In the connection of creative economy the theory of evolutionary economics might help us to understand the preconditions of new design, new ideas and innovations. According to the basic idea of evolutionary economics we could compare product development in creative economy with parallel processes in evolution. Scale of development in evolution is thousand millions years. Understanding long cycles and short cycles in product development could teach to avoid wasting valuable resources into cheap hype or entertainment industries in the hope of quick profits. We could put the emphasis on ethical and functional satisfaction of real needs of the humankind. We might even learn the role of diversity in the society. Non-linearity is a key factor in the product development of biodesign.

## **Biostructure solutions as models for designers**

Eduardo Kac, is perhaps the most known artist representing bioart. Inspired by a passage from the Bible, in which God gives man control over earthly creatures, Kac's project *Genesis* gives creator power to humanity on a microscale. For *Genesis*, Kac translated a line of biblical text into Morse code, then encoded it into DNA and inserted it into bacteria, which are displayed on a microscopic slide in a darkened room.

This installation allows the audience create mutations by clicking the computer's mouse. Kac has said: *"The metaphor of art imitating life doesn't apply anymore. This is a situation where art is creating life."*

After all, what is "nature". Nature can be defined as a just huge product development experiment of life playing with different alternatives and solutions. It seems to me that in this biodesign process of the Universe *Homo sapiens* may prove to be only a short-time flop of evolution, just waste of material, probably ending up to the rubbish heap, or utilization by some more intellectual organism.

But applied to the practise of everyday designers work. In my opinion research of biostructures may teach to produce best solutions for human artefacts and design as well. I am also enthusiastic to take evolutionary economy into account in developing the theoretical framework for creative economy.

## **Biodesign Image Gallery**

One picture tells more than thousand words – to conclude I will show a small image gallery of some biodesign solutions made by "nature" and some made by new bioartists as examples of learning from intellectual and practical alternatives created by "Mother Nature".

The author is a semiotician, Ph.D., specialized in cultural studies and biology. She is a docent at University of Helsinki, and also works as a Special Government Adviser at the Ministry of Education, Science and Culture, the Department of Cultural Policy.