

LIKE LIFE

PIA LINDMAN
AALTO UNIVERSITY

The New “Continent” of Synthetic Biology

It is a prevalent understanding among artists and scientists working within microbiology and related fields that synthetic biology is currently developing very rapidly and new applications and businesses might emerge explosively in the coming years. The buzz is on and the words “new continent” are often heard.

While Biofilia in Aalto University aims to openly embrace all life forms and to facilitate the study of these, I think it is important to bear in mind that the very notion of a new continent includes an aggressive notion of invasion. Indeed, calling something a new continent already subscribes to the idea of human race being entitled to expand its existence and consciousness whenever necessary for its own survival – or for the survival of a corporation. With the work in Biofilia, I aim to call for the exploration of life sciences without caving in for a sense of urgency and competition that might be taking a hold of emerging corporations and scientific enterprises.

The work done in Biofilia aims at addressing artists, the scientific community, philosophers, and the wider audience. It is my aim to provide the opportunity to researchers and artists coming to Biofilia, to take a step back and consider the ethical, ontological, and philosophical implications connected to life sciences.

As a base for art, Biofilia supports works and research approaches that are situated in the critical crossroads of activism, sciences, and business.

From Robots to Something Like Life

While a Research Fellow at the Center for Advanced Visual Studies at Massachusetts Institute of Technology, 2004-2007, I used to have morning coffee with Rodney Brooks in his office at the Computer Science and Artificial Intelligence Laboratory at MIT. We discussed embodied life, artificial intelligence, human consciousness, and the possibility of human rights given to humanoid robots in the future.

What remains in my mind as the most poignant insight I learned at those morning coffees, was the idea that since most of our (embodied) experiences are the end result of an array of biomechanical

and biochemical processes, why would it not be possible to imagine consciousness, experience, sensing, to also take place in plants or artificial intelligence, for instance?

Building on the work of many predecessors, such as Marvin Minsky at MIT¹, Brooks built colonies of small bots, equipped with extremely simple sensor-actuator relationships: bump into something – turn left, sense heat – back off, etc.

In laboratory tests, as the bots continued to interact with the environment and themselves over a period of time, the bots seemed to start moving and acting in an organized way, as if the foundations of a society were being created. This tendency reminded of various swarm activities, such as ants or bees, who, owing merely a simple neural system of senses and actuators create a variety of signals and actions, who take on meaning, and end up turning that bog wheel of the entire colony or bee swarm to relocate a hive, build an ant city, or move an animal carcass.

Might it be, that once we have all the sensors and actuators in place, a robot will evidence, not (mimicry) of social behavior alone, but also consciousness, emotions, and a sense of ethics? In this instance, will it become relevant to speak of the rights of humanoid robots? Or will they remain slaves, a category into which women and people of a different race were previously relegated?

Martin Hanczyc² seems to be looking at the same idea, albeit from a slightly different angle. He is seeing life-likeness of “dead matter” such as oil droplets in saline solutions. It is as if the droplets *behaved* in a certain way, even evidenced intelligence or will, when inserted in a saline solution with a gradation of density. Hanczyc’s findings invert the question to the following: if droplets seem to act intelligently, and do so consistently, whenever we humans expose intelligent behavior, might it often be a result of mechanical functions in and around our bodies? Perhaps our “conscious” actions only mimic or resemble a will, an intelligence – at least partly and part of the time? There are already concrete links between the ideas of experts in this field and those explored by our students. In relation to the work of Martin Hanczyc, one of our master students in ViCCA, Erik Parr, is now researching how a specific bacterium, the *Pseudomonas Syringae*, participates in the formation and dispersal of clouds.

I learned even more observing the processes of creating humanoid robots at Computer Science and Artificial Intelligence Laboratory at MIT. Rather than clunky human sized – or bigger – robots, the shift in focus has been for the past ten years towards nano- and micro- scale³. We may already receive nano-bots as injected into our bloodstreams to fix infections, cancer, or neural signals. Robots might never become humanoids (or only a small portion – the luxury items, perhaps). However, nano-bots might indeed become even much more so a humanoid slave, bearing an impact on human life beyond a human look-alike, as they operate inside and around us, sometimes completely invisible and unnoticed. Should these nano-bots be given the status of a life form – and some social/political rights with it?

In the future our ethical questioning might have to shift. What is life? What in life begs for “rights” of sorts, distinct from the rights of those deemed to be on the side of “non-life”? How about the rights of mountains, rivers, and atmosphere? I am also here reminded of Oron Catts’s and Ionat Zurr’s seminal work in the field of synthetic biology, questioning the ethics of the creation of, not mechanical robots, but microbes turned into living robots – slaves, once again.

From Synthetic Biology to LikeLife

Developments within synthetic biology have in recent years brought on an increasing amount of possibilities for the manipulation and recreation of life. Synthetic biology (expanding inwards to the

1 For a complete discussion of how Brooks revolutionized humanoid robotics research in the 1980’s check out, for instance, Brooks, Rodney. *Flesh and Machines: How Robots Will Change Us*, 2002, Pantheon Books.

2 Dr. Martin Hanczyc is the Principal Investigator at the Centre for Integrative Biology at the University of Trento, Italy.

3 Exceptions exist and notably here I mention Brooks’s most recent robot Baxter. See for instance: <http://www.bostonmagazine.com/news/article/2014/10/28/rodney-brooks-robotics/#gallery-1-8>.

spheres of cells and molecules) has rendered life as something that can be modeled, formulated, and speculated upon. The idea that we can define clear distinctions between living and non-living, indeed, the identity and integrity of life seems to be falling to dust. Life is no longer the autonomous realm untouched by human infliction. Life, with all its processes and on all scales, is cultured. Although not a blanket science to cover all life sciences, synthetic biology is now activating and connecting lines of thought, nerve paths if you wish, from various fields of science and experience and firing up nodes, stiffening tissue, pushing questions about notions we have been holding fast.

As our human perspectives on life are put to the test, boundaries are pushed both inside and outside of our bodies, and our skin proves to be permeable in more than one way - rather than protective and containing.

In the light of this expanded field, reviewing a rather traditional binary model of a living body, organism, or cell, with an inside and outside, three relations emerge as acutely interesting:

Life and Food: Food is the exchange rate of life. Food is a messenger between the “inside and outside” and feeds material for the transformation of life. Cuisine has always been a science at the level of molecules. If we now accept that life is always already cultured, food also takes on an expanded meaning. Nutrition is part of the identity of any life form. What implications and applications does synthetic biology bear upon our cuisine?

Life and Matter: What implications and applications does synthetic biology bear upon the realm of materials and objects? How should we relate to a world of matter that is vividly animated, or actual living tissues, fibers, sculpture, and architecture? Can we learn more from biomimetics, or do we go beyond?

Life and Mind: If not only are various life processes taking place in our bodies autonomous in regards to our own will, but our body is also susceptible to manipulations by the will of others, where does that leave our apparently very limited conscious mind? Are we and have we always been temporary guests in our own bodies? What implications and applications does synthetic biology bear upon ethics, philosophy, social sciences, and psychology?

As the frontier of synthetic biology keeps being pushed forward (or inward) we keep pushing these questions.

Spring 2015. New Visitors

Within the focus area *Beings and Things* in ViCCA, The Master Program of Visual Culture and Contemporary Art at Aalto ARTS, and as part of the program of Biofilia, we offer two courses in the Spring semester of 2015: “Interspecies Dialogue” and “Senses and Communication”. Within these courses we teach several workshops, such as *DIY BIO*, *Koli Environmental Art Festival*, and *Making Life III*. In the following, I will highlight some details of these workshops in brief.

BioStrike. January 26 - February 6

As part of the *DIY BIO* course, the artist/scientist collective BioStrike will visit Biofilia and stage a hack-a-thon. Confirmed teachers are Rüdiger Trojok, researcher at the Karlsruhe Institute of Technology, Pieter van Boheemen, project developer and researcher at the Waag Society’s Open Wetlab, and Eugenio Battaglia, a strategy consultant and molecular biotechnologist.

According to statistics cited by Rüdiger Trojok, during the past 15 years the number of companies

producing pharmaceuticals that also produce antibiotics has reduced from ten to two. Medical companies have redirected the focus of their research to long-term medical conditions (such as heart conditions and mental conditions), since the medication of those requires a sustained intake of pills often over a long period of time, rather than the intake of antibiotics of seven to ten days to battle a bacterial infection. Treating heart condition and mood is more profitable to pharmaceutical companies, rather than producing new antibiotics. Yet, new strands of bacteria call for constant development of new strands of antibiotics if societies are to secure the health of everyone.

BioStrike is a global open biology project supporting the ideals of open science. Participants screen soil bacteria, such as *Actinomyces*, *Streptomyces* and *Micromonospora* for antibiotic properties and collect a data bank through sharing and discussing open data. BioStrike challenges non-scientists to participate in the hunt for new antibiotics and teaches about microbiology that you can do in your own backyard and kitchen⁴.

Synthetic Biology and Cognitive Neuroscience

Currently Professor Mikko Sams⁵, Oron Catts, and I are in the planning stages for a collaborative workshop at Biofilia with SymbioticA and the Department of Biomedical Engineering and Computational Science (BECS), at Aalto University, involving cognitive neuroscience, microbiology, and art.

Advisory Board

The process of compiling a Biofilia Advisory Board has advanced to defining a core group of significant and active contributors and thus now comprises Erich Berger, Oron Catts, Terike Haapoja, Helena Sederholm, and Ulla Taipale. Ulla Taipale was the Project Manager for Biofilia from the year 2011 to the year 2013. Finnish-born Terike Haapoja is an internationally acclaimed artist, who has made significant contributions to art and bioart with projects, such as *Toisten historia*, 2013, focusing on issues of animal rights, and her installation *Falling Trees* at the Nordic Pavilion at the Venice Biennial, also in 2013. Dr. Helena Sederholm is a Professor in Art Education in the the Department of Art in Aalto ARTS. While the head of the Department her resilience and vision paved the way for the foundation of Biofilia, and she continues to contribute to the field of bioart on this board, with her research, and teaching.

Within the extended circumference of the Advisory Board, I have invited Peter Galison, Professor and Head of the Department of History of Science at Harvard University and Krzysztof Wodiczko, Professor at the Graduate School of Design at Harvard University. Recipient of the acclaimed Hiroshima Award in 2004, Wodiczko previously held the position of Director of the Center for Advanced Visual Studies at MIT. His long-term commitment to developing the dialogue between science, technology, and art, makes him a great contributor to the board.

Oron Catts, as a walking dictionary of the history and criticism of microbiology and a staunch promoter of bioart, has given me, an indeed quite distracted student of bioart, the greatest possible support, kindly introducing me to people, projects, and science. I look forward to an intensified collaboration of Biofilia with SymbioticA in the coming years. Among other endeavors, we plan to realize exchanges with faculty and students between the two laboratories.

Last but not least, Erich Berger has been my most important mentor on this path and I cannot thank him enough for all the inside knowledge, insights, and wisdom he has imparted to my refinement. Entering now into the fourth year of the life of Biofilia, I cannot wait to find out what new adventures

⁴ For more information on BioStrike, please visit <http://p2pfoundation.net/BioStrike> and <http://waag.org/en/project/biostrike>

⁵ Mikko Sams is professor of cognitive neuroscience in the Department of Biomedical Engineering and Computational Science at Aalto University School of Science, Director of the Master's Degree program in Brain and Mind.

and explorations are in store for us, and for which Biofilia and the Finnish Bioart Society will continue to join forces.

Pia Lindman is a professor of Environmental Art and the head of the Biofilia in the Aalto University, School of Arts, Design and Architecture.