ROBOTS IN DISTRESS, BOREDOMRESEARCH (VICKY ISLEY & PAUL SMITH)

1/ *ROBOTS IN DISTRESS*: AN ARTIFICIAL LIFE ARTWORK

Robots in Distress is an artificial life artwork. In other words, it is not the recording of an animation but a dynamic autonomous and evolutive system.

The computer-generated simulation shows an underwater world full of plastic trash populated by little robots. Those robots are autonomous agents trying to communicate and survive in the environment.

The simulated robots are acting upon very limited capacities and rules: they can move upward, drift in the current, send a signal to the other members of the colony and receive theirs in order to adjust their position.

They are designed to recognize when their energy level is dropping which means that they will loose their agency.

The singularity of those robots is that through a simulated hormone that creates a feedback system and a simulated emotion for them, they are trained to recognize this loss of agency as valuable. Therefore, they can develop a kind of sense of despondency, recognize failure and give up.

Robots In Distress intends to explore not only the role of emotions in robotics but of negative ones.

The audio in *Robots in Distress* is in response to the virtual bots motion. There is a layered ambient soundtrack suggesting distant ships passing.

Interestingly, the created system does not allow to really tell between those robots that recognize their failure and those which don't.

2/ THE PROCESS AND METHODS BEHIND *ROBOTS IN DISTRESS*

The simulated A. Life work *Robots In Distress* has been created by boredomresearch as an echo and a response to the cognitive and emotional bio-inspired robotics researches that they discovered and experimented during their FEAT residency at the Karl Franzens University in Graz, Austria.

Robots In Distress is an artificial neural networks augmented by artificial hormone production to create autonomous agents with the potential for despondency.
It freely combines two methods explored by the Artificial Life Lab of the Karl Franzens University:

1. A concept of artificial emotions applied to cognitive robotics described in the article «First Investigations into Artificial Emotions in Cognitive Robotics» by Daniel Moser, Ronald Thenius and Thomas Schmickl, scientists at the A-Life Lab, Karl Franzens University.

Abstract: In nature, the combination of processes of emotion and cognition has a deep impact on type and quality of reaction to environmental stimuli. In this work, we want to test the feasibility of artificial hormones in artificial neural networks. We take a minimal evolving neural network and look into the implications and opportunities of extending this model of communicating nodes, with one virtual hormone gland. To explore the differences in behavior, that we expect to develop with this modification, we modify an already well established model, the Braitenberg Vehicle. These vehicles were faced with a simple energy gathering task. The behavior, efficiency and fitness of these vehicles in identical environment, with the artificial hormone active and inactive, is examined. It shows, that the implementation of artificial emotion leads to an increase in efficiency of the evolved solution.
Full text available at:
http://zool33.uni-graz.at/artlife/sites/default/files/Paper_MESROB_2016-Investigations_Artific._Emo.pdf

2. The BEECLUST algorithm, this algorithm that governs the optimal clustering of the autonomous robots is based on the observed behaviours of honeybees.
http://zool33.uni-graz.at/artlife/bee

3/ ECOLOGY, TECHNOLOGY AND BIOINSPIRED ARTIFICIAL CREATURES

Some of the Ideas behind *Robots In Distress*.

boredomresearch's creations have always been inspired by and are reflecting upon the natural environment that the artists explore in their computer simulations.
Robots In Distress builds upon this approach but the work has also been impacted by what the artists learnt and experienced during their residency in a lab that deals not only with simulated artificial life but also with physical robots, with the confrontation of biology, ecology and engineering, with sophisticated cutting edge research and the very simple test bots built out of discard material for proof of concepts.

The Waste Paradox: plastic as the problem and the solution

Plastic has obviously become one of the major pollutant, specially in waters, and the subCULTron research is precisely to build a swarm of robots to monitor those highly polluted subaquatic environments. The very principle of those robots is that some can break or be broken without a damage to the whole colony and the monitoring system. However, the broken ones will join the underwater junk.

boredomresearch is used to computer simulated worlds. During their residency, the artists experimented with physical robots and discovered that the scientists were testing their ideas on small crude machines made out of junk or mundane objects. So, they, too, built some robots made out of plastic waste, among which the plastic bottle that later inspired the design of their computer simulated robot population. In their *Leonardo* article, they write: «In building robots from plastic waste there appeared to us a synergy between the problems of human consumption that pollute the environment and the process by which we attempt to provide solutions».

Is there such a thing as «robust» technology and the principle of failure

In trying to answer the ecological and environmental issues we are facing, one of the answers is to propose new technological solutions. It is the idea that «progress» and (new) technologies will help us repair what has been destroyed and the problems we, as a specie, have created. Biomimetics and bio-inspired research is considered a good option as it is based on (living) principles that have proven their

robustness throughout evolution. The purpose of engineering being to provide (long lasting) solutions, trying to build robots that are «robust» is a logical approach.

The artists approach, however, has been to recall that technology can and does fail but, moreover, that failure could be as important to take into account as a principle in looking for solution as robustness.

In an interview with Richard Bright for the online magazine *interaliamag*, they write:
«The bio-inspired robots of subCULTron's Artificial Life Lab, in the Karl Franzens University Graz, are challenging existing paradigms in engineering. They consider the swarm as a powerful expression of natural robustness. Complex machines often fail with the loss of a vital part. In contrast a swarm can lose many members without even noticing. We share their passion for the not yet fully exploited potential of multi agent systems. We too were quick to recognise the poetic beauty of emergent behaviour. But the connection with robustness is worrying. There is deep concern about the archetypal swarm. A more than significant proportion of human food is pollinated by the honey bee. Continuing decline of wild species and alarming Colony Collapse Disorder indicates an organism under stress. So the question we have is: Should we respect bio-inspired fragility above bio-inspired robustness?

Current separation between art and science, encourages belief, that science 'should' provide increasingly complex solutions to increasingly complex problems; missing the reality that those problems are often the consequence of previous solutions. Could it be that our present environmental situation might be better served by a more comprehensive cultural consideration, inclusive of artistic sensibilities, comfortable with notions of fragility and imperfection.»
https://www.interaliamag.org/interviews/vicky-isley-boredomresearch/
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Negative emotions as a positive response
In their article for *Leonardo*, boredomresearch writes:
Following Marvin Minsky's argument that: "The question is not whether intelligent machines can have any emotions, but whether machines can be intelligent without any emotions" it is worthy to consider the significance of negative emotions in the human condition.
We argue that the role of negative emotions in humans remains unclear and therefore should not be excluded from consideration in advanced robotics. It is clear that negative emotion is central to the human condition, and may be important in our evaluation of complex long term environmental challenges.

They add:
So we propose that current paradigms aiming to address significant environmental concerns with technological solutions must recognise the reality of failure.

4/ A GLOSSARY OF ART & SCIENCE

ARTIFICIAL LIFE

Artificial Life, or A.Life, is a wide field of research that blossomed in the 1980's.

In the words of Christopher Langton, one of its most emblematic researcher, it does not deal with «life as it is» but «life as it could be». In 1989, he gave this definition: *Artificial life is the study of artificial systems that exhibit behavior characteristic of natural living systems. It is the quest to explain life in any of its possible manifestations, without restriction to the particular examples that have evolved on earth.*

Langton, C.G. (1989) «Artificial Life», in *Artificial Life*, Langton (ed), (Addison-Wesley:Reading, MA)

We can distinguish between two main historical trends in A-Life: the computer simulated one that creates computer environments and creatures and the physical one based on robotics.

It is interesting to notice that from the very begining in the '80's artists have been involved in exploring A. Life as an artform and have shared with the scientists discussions and ideas in numerous scientific or artistic conferences and exhibitions. Among some of the prominent artists having developed computer simulated worlds are the duo Christa Sommerer & Laurent Mignonneau or Karl Sims who is both an artist and a scientist.

BRAITENBERG VEHICLE

Named after the cyberneticist Valentino Braitenberg, «a Braitenberg vehicle is an agent that can autonomously move around based on its sensor inputs». It is composed of a least one sensor connected to a wheel (an actuator). [...] «Depending on how sensors and wheels are connected, the vehicle exhibits different behaviors (which can be goal-oriented).»
https://en.wikipedia.org/wiki/Braitenberg_vehicle

BIO-INSPIRATION

Inspiration of solutions to technological problems, drawn from the solutions that evolution of living organisms has found for comparable problems. These solutions are (intermediate) results of iterated optimization processes that in some cases last for millions of years. They are often characterized by a remarkable elegance and efficiency. Bio-inspiration leads to a reproduction of biological mechanisms, but not necessarily to a reproduction of the biological implementation (i.e. embodiment).

(from the glossary of the Artificial Life Lab, Karl Franzens University, Graz, http://zool33.uni-graz.at/artlife/bee)

SWARM

In biology a temporal aggregation of conspecific individuals, usually moving in a coordinated manner. For honeybees the term usually refers to reproductive swarms which consist of up to several thousand individuals. In contrast to this interpretation, in artificial life any group of interacting agents is considered a swarm. In our experiments, we apply this looser definition to honeybees and robots and describe groups of at least two individuals as swarms. Swarms typically exhibit collective behaviour, often with emergent effects (swarm intelligence).
(from the glossary of the Artificial Life Lab, Karl Franzens University, Graz, http://zool33.uni-graz.at/artlife/bee)

CREDITS

«Robots in Distress» has been created by boredomresearch
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