FRANKENSTEINS' NEW SUCCESSORS
KLAUS MADZIA

The Maker prefers to create his worlds in the morning after the first cup of coffee. Throughout the day his creatures grow, give birth and die without him even deigning to look at them. Only in the evening shortly before going to sleep, he takes a look at the state of things in his cosmos. A few hundred generations have, in the meantime, lived their short lives: steadfast in the search for food and constantly fleeing from evil predators, always greedy for sex. The successful ones are able to pass their genes on to their offspring and consequently achieve some immortality. The underdogs have died out.

The Maker himself lives in the Garden of Eden of the modern computer world: in California's Silicon Valley, the birth place of chips and personal computers. He is Larry Yaeger and on his business card there is the typical American understatement "Micro Cosmic God".

Yaeger could be a roadie for the Californian rock group "Grateful Dead": black, greasy leather jacket, a gut betraying his 42 years, shoulder-length silver mane and rings on his fingers. Yet he is a modern successor to Dr. Frankenstein: a researcher who has dedicated himself to the new science "artificial life" — a science which describes how life grows in dead matter.

The goals of these researchers are high. They want to decipher life's very last secrets: recognize how nature creates order from chaos: understand how life was able to develop on our earth: and some even want the big jackpot: to grasp a piece of immortality.

This is why Yaeger has been creating new artificial life for the past three years — a life that does not consist of the natural ingredients protein, carbon and fat. Yaeger's creations are mere electronic impulses in the finger-nail sized chips of a super computer called "Iris", manufactured by the company "Silicon Graphics".

Each of his creatures is a small program imitating the functions of life and in doing so, is a life — at least this is what the artificial life researchers claim. Yaeger calls his computer cosmos "Polyworld", the world of polygons, as his creations are only visible on the computer screen in the form of colourful blocks. "My little animals", says the scientist affectionately, "meet all the important criteria according to which we define life. They have a metabolism, multiply, act with their environment and continue to develop under the pressure of selection and choice".

Artificial life researchers simulate life in the computer by giving their creatures a few simple "instructions" with the aid of a control program, such as "search for food" or "try to multiply". On the other hand, with software, they create a type of "world" — complete with digital continents and electronic flora and fauna. Once such programs have been set free in this computer world, they begin to grow, change, mutate, and in a short time develop a behaviour which is very similar to that of living beings. For example, computer birds automatically form a flock when flying, without having been programmed to do so.

Whoever watches Yaeger's little computer world for a quarter of an hour never doubts that living beings are darting around on the 1230 cm^2 area of screen. The creatures dart silently over a black matt screen: some spin around aimlessly, others seem to be determinedly hunting for square pieces of fodder. Depending on their "frame of mind", the artificial organisms

change the colour of their bodies: the green ones are hungry, the blue ones want to multiply and the red ones are ready to fight.

Yaeger has equipped his polyworld creatures generously: each one has a set of 2500 digital genes whose individual values determine for example, how big, how fast, and even how "clever" the artificial creation is. Sensory organs make it possible for Yaeger's little animals to recognize their surroundings and, as is the case with living organisms, a network of brain cells is responsible for their reactions: they "experience" tiredness. They "feel" fear of enemies.

During their short lives, the little Polyworld animals learn from experience, how to find food or even a partner, faster. The consequence is: they make or cut connections between their digital brain cells. Sometimes the creatures astonish the Maker with their behaviour: "a few organisms have taken up the notion to circulate at the edge of the polyworld, thus making possible a relatively safe life". Yaeger assures us that he would never have dawned on this.

Abilities that have been learned are passed on by two mating creatures to their offspring. A male and a female block sprint towards each other on the screen, a small spark can be seen and already there is a third small block crawling all over the place. This only takes but a few secends.

Yaeger has thought of everything: whenever a little polyworld animal dies, its body transforms into green fodder which is then very often greedily consumed by the offspring. A dozen of them once even got together to form a real cannibal cult: for hours on end, sons, daughters and parents circled around in order to consume each other at some point — also a successful survival strategy, as their Maker comments dryly. His Polyworld is hard world to live in.

What drives a person like Larry Yaeger to such life-long work? Why do we need life in the computer? Yaeger hesitates with his reply, plays around with the rings on his fingers: "With my work I want to contribute to ensuring that an intelligent being is made of the computer, at last."

In this sense, he wants, for instance, a research assistant "that I do not have to program, but I just have to tell what I want".

Programmers having been chasing this holy grail since the 1950s: The program to end all program, but the promise that computer sapiens would be reality in but a few years turned out to be heavy-handed propoganda in order to get research money from industry and from the military.

Artificial life researchers like Larry Yaeger, plagiarize the image of evolution. Why not electronically copy the simplest organisms and simulate a Darwinistic environment in the computer? Hoping for "survival of the fittest", intelligence should develop by itself in the computer memory. In this way, scientists also want, incidentally, to discover whether the development of mankind was a unique mistake of creation or if it will in the end inevitably repeat itself in the computer.

The advantage: instead of waiting for a few million years, our colleague — the computer — runs off the development of a few generations to the gods in front of the screen in just a few hours.

However, the EDP Frankensteins are not that far yet. Larry Yaeger feels "no sympathy" when he presses the "Off" button and hundreds of his little polyworld animals fly off into the electronic Hades. "We are just at the level of a hydraulic screw". Luckily for Yaeger, until now no group has been founded for "freedom to all electronic laboratory creatures".

But as we talk about the moment following the pressing of the off-switch, Yaeger suddenly becomes contemplative. "I'm going to tell you the real reason why I fell for artificial life. Shortly before my death I would like to have the possibility to copy my knowledge, my intelligence, my whole consciousness into the computer so as to live on in the chips".

Probably, says Yaeger, bitterly, "probably I will never live to see that, but perhaps my work will help give the next generation the possibility to defeat death".

The longing for immortality is also the driving force behind other followers of artificial life. "God damn it, I find it's a real swindle that we are only able to live for about 100 years", say Denny Hillis, computer researcher and successful business man from Cambridge, Massachusetts. We are sitting in an office in his company "Thinking Machines Corporation" and Hillis groans: "I want to live for 10,000 years. I have enough projects that I want to realize". In the course of his 35 years, he has done quite a lot. Driven by the idea of designing the thinking computer ("a machine that is proud of me"), in 1986 while he was still studying at the well-known Massachusetts Institute of Technology (MIT), he designed his super computer: the "Connection Machine", a matt, black cupboard, the height of man, with innumerable blinking red lamps. Every one standing for one of the 65536 micro-processors which are busy computing in the inside. Thanks to their enormous speed, Hillis's boxes have been a best seller; companies like American Express use them to show the buying habits of their credit card customers.

And the architecture behind his "Connection Machine" is excellently suited for artificial life programs. Each of the 65536 chips simulates a separate artificial life being, and consequently, programs like Larry Yaeger's run much faster. Hillis supplies, so-to-speak, the terrarium with a turbo-growth guarantee for artificial life.

Only a stone throw away from Danny Hillis's company, researchers at MIT are working meticulously on artificial life that can be touched: poodle-sized robots with the souls of artificial life programs crawl through the world on 6 legs. The idea originates from the Australian, Rodney Brooks.

Unnerved by the empty promises made by the recipe book computer scientists surrounding Marvin Minsky and their unsuccessful projects ("A robot needed three hours to erect a tower of building blocks)", he began, in 1985, to study thinking using tiny insect robots which had to be able to do little more than crawl around skillfully all over the place.

Brooks and a few students made their model robots — also called "mobots", for short — from metal sheets, LED's, model motors and, of course, computer chips. These little animals received world acclaim in but a few years, adorning the front pages of scientific magazines and even the US space authorities, NASA, started to become interested in the intelligent artificial animals as a replacement for astronauts.

In the meantime, Brooks is having a sabbatical; his Masters student, Colin Angle, just 24 years old and already the uncrowned king of the mobot tribe, had just founded the garage company "IS Robotics", in Boston. Silent partner in the venture is Brooks.

At the moment Colin is working 14-hour days with his wife, his best friend and a few mates, on his mechanical beings: "Cheap, fast and a little out of control", that is his motto. Equipped with all kinds of sensors, Angle's mobots also feel what is moving around in front of them and beside them; in the meantime, his design even lets the little artificial animals palaver amongst themselves.

Soon there will even be small robots, "which can be sent into the pipes and tubes of nuclear power stations for maintenance or repair work". Or even better: "a herd of shoe-sized vacuum cleaning mobots waiting in the dark corners of the living room for dirt to fall on the floor will then dart off and clean away the dirt". A dozen should be sufficient for household usage, Angle believes. A few more perhaps for bachelor apartments.

Without his mobots, artificial life would grind to a halt, says Colin Angle. "After all, intelligence cannot develop without stimulations from the outside". Simulating life merely in the computer memory is a necessary but boring commodity. Artificial life will only be really exciting, really "cool", with his little animals.

In order to prove this, Angle shows us one of his creations. He fetches his "Genghis 11" out of the dispatch box; Genghis 11 reminds us, in terms of weight (1.5 kilos) and appearance, strongly of a sheet metal lobster. It moves a bit clumsily across the carpet on its six legs, but tackles the obstacles very skillfully, e.g. soldering irons, ammeters or books that are lying around.

Even when Angles puts one of the six out of operation, Genghis II marches on, unimpressed. After a few minutes, the electronic animal starts to falter: the battery is empty. "I forgot to load it up", Angle apologizes. The software that enables Genghis II to come to terms with the environment is, of course, based on artificial life techniques.

From MIT, Angle knows the 31 year old Belgian woman, Pattie Macs, who thought out the programs for the Genghis predecessor. For her, artificial life research is her vocational dream combination: "I really wanted to study biology as my parent are doctors, but I was told that you couldn't earn any money with this". Then Pattie decided to study computer science and began working in Brussels on projects concerned with intelligent computers. The theories of the behavioural scientists, Konrad Lorenz and Nikolaas Tinbergen always seemed to her to be one-dimensional, too limited to explain the behaviour of man and animals. Pattie began to imitate the remarkable interlude of wishes, impulses and external stimuli in the computer, first of all using ants as an example, and now dogs.

There are now even artificial life programs for the home computer: Ken Karakotsios, aged 33, developed the game "SimLife" in two years, a game with which one can now and again play God at home", as Karakotsios promises. Leisure-time gods can create new animals and plants and observe their chances in the hard evolutionary struggle, on the screen. The game costs 70 dollars.

The military has also been interested in artificial life for a long time now. "The first practical applications in this new research field will be weapons", prophesies the US author Steven Levy*, who researched the beginnings and the facts behind artificial life. "Robot-controlled tanks, learning rockets and computer viruses which cannot be stopped by any defence program", will soon be available, thinks Levy. "The Pentagon is closely watching this field". Even if the battle machinery functions without people, warns Levy, "the victims will still be people".

But even more: with artificial life, we — mankind — could be digging our own grave as a species. For who can guarantee that artificial beings having outgrown the computer memory age and being unable to be stopped by any switch, will want to go on living together with us bio-masses. A prominent artificial life thinker: "It is a good thing that the public haven't really noticed what we are working on, otherwise we would have faced more resistance. By the time citizens have understood our research, it will probably be too late to pull out the plug".