

Artificial Life

The Cyberpunk Project

Artificial life - or "A-life" - is a relatively new branch of science that melds the highest levels of computing and biology. For some programmers, the goal is to come up with a superior form of AI by building software models of the smartest computer currently known, the brain, and seeing if those models can learn and adapt their behaviour as we can. Others approach it in a different way believing that computers can be useful for simulating biology.

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A-life uses both computing and biology to model the living world around us or to build new software with the adaptability and resilience of life itself.

The first ever manifestation of artificial life was John Horton Conway's Game of Life in which the life or death cells in a grid were controlled a few simple rules :

- if a cell has less than two neighbours or more than three it dies
- if a cell has two neighbours it survives
- if a cell has three neighbours it lives

Many interesting patterns have been seen over the years but to model a single-celled creature with these rules would require a grid measuring an estimated one million by one million cells. Systems which use this grid and rule approach are called cellular automata. Sim City falls into this category although it uses far more complicated rules than the Game of Life.

Cellular automata can seem far removed from the real world but others are much closer to home. Neural networks promise better artificial intelligence by borrowing from the structure of the organic brain. An individual neuron acts on signals from other neurons, either firing or not firing. Each neuron can either excite or inhibit other neurons. Stable patterns of activity appear in response to input given from outside the system. These patterns represent memories recorded as the connections between neurons. New memories may be laid down by changing the strengths of connections between neurons. New input patterns will be associated with similar input patterns the network has been taught in the past. This allows neural networks to generalise from past experience and cope with unique situations.

The theory of evolution has also provided a suitable crop of ideas. Imagine a computer which starts empty except for a single small program. The program, called the Ancestor, is 80 bytes long and can do one thing, make copies of itself. Soon the limited memory is full with Ancestors all producing more copies so, to free up space, the computer occasionally destroys older programs or those that cause errors. The operation of the computer is not perfect and sometimes copying goes wrong and a new program appears. This computer is not fiction, it is called Tierra. When it was first switched on the population grew and changed. The Ancestor program was soon ousted by a faster program with only 78 bytes. Later a program with 48 bytes appeared which survived by parasiting the code of its neighbours. On a later occasion Tierra threw up an individual which could survive independently with an amazing 22 bytes. Built safely as a simulation inside another computer, there is

fortunately no danger of an escape.

Are We about to Unleash a Frankenstein Monster ?

By *Curt Suplee*

Washington Post, as it appeared in Sacramento Bee (Sacramento, Calif.), May 27, 1990, Forum, pp. 1+.

The new science of artificial life (AL) is introducing new products and machines that may someday force us to rewrite the definition of "life" to include noncarbon-based materials. AL theorists speculate that computers will soon have the capacity to depict "life as it could be", thanks to the study of "chaos", which shows that seemingly obvious random occurrences may be linked by discernible patterns. Advanced computerized modeling now enables scientists to probe the process of evolution, introducing conditions into the equation with results that suggest the origin of life was not an accident or random occurrence, as previously believed.

Evolutionary modeling is leading to the development of prototype robots, powered by sunlight, that can be programmed for construction work in space. Humans will consider computer programs and the robots they run more as animals than machines, AL scientists predict, further blurring the distinctions between artificial and natural.