Artificial Life

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What is life?
What are the requirements for life?
Homeostasis: Regulation of the internal environment to maintain a constant state.

Warm Blooded - Internally

Cold Blooded – Externally

Life Has…. Monkey

Gecko
Metabolism: Consumption of energy by converting chemicals and energy into cellular components.

Plants use light and water to make sugar, this process is called Photosynthesis.
Growth

Tree Rings

Snail Shell

Hermit Crab
Adaptation: The ability to change over a period of time in response to the environment
Response to stimuli

Venus Fly Trap
Reproduction
Computers – What are they good for?

• Calculations
• Storing Data

Augmentation of Computers…
Need for an interface to the real world.

How do we make computers interact with humans and act more human-like?
(Sensors & Actuators, including Keyboard, Mouse, Monitor)
Reasons for creating an artificial world:

• Test theories about Biological Behavior or Physical Properties
• Fun and Games
• Training and Rehabilitation
In a simulated world, you define the rules and formulas for your world.

Watch your world live!
How To Create an Artificial World:

Observe real life and identify Variables…
Discover what effects things. If you change something what is the result.

Develop rules to simulate this life.
Interaction with the environment
Features of the real world (time, climate, etc.)
How to mimic these in an artificial world
What are our 5 senses?
• Sight
• Hearing
• Smell
• Taste
• Touch
What is real?
How can you sense what is around you if you cannot see (Substituting one sense for another)?

Echo Location (Bats, Dolphins)

Touch things
How can you tell something makes a sound around you, if you cannot hear?

Read Lips
How can a computer represent the 5 senses for artificial life?

Sight? Cameras

Hearing? Microphone

Touch? Pressure Sensor

Taste and Smell? Chemical Sensors
How do we learn?
We learn by…
Empirical Observation (Self)
• Extrapolation (Watching others)
• Reinforcement (Reward or Penalty)
• Someone tells you information
• Innate -
Innate behaviors are the things an animal can do or has the urge to do without being taught.

Behavior that is hardwired in from birth.
Memory:
If-Then Memory

If you do something and get a result, next time the result may be similar.
"Memories are formed by strengthening the connections between brain cells, known as synapses. If you touch a hot stove, the pain signal from your hand and the visual signal from your eyes reach the brain at about the same time, forging a memory."

Reference
Communication:
Discussing Ideas
History
Communications and memory for artificial creatures

Artificial Intelligence

How do computers remember what they learn and communicate to each other?
Computer memory (RAM)

Disk storage

Network access
Examples of Artificial Life
• Robotics
• Video Games (Street Fighter)
• Virtual Reality (2nd Life)
Transformer Video
Video Game – AI (Makes Mistakes)

The computer controlled racers do not avoid the car on the track.
Second Life – Thriller Video
Programming a Virtual World
Netlogo

An authoring tool to create a virtual world
Logo used to be for controlling a robot and drawing
Netlogo lets you create your own virtual world
Netlogo contains “turtles” which you can control.

In Netlogo you can observe the world and tell the turtles to do things.

You can ask all the turtles, or you can ask specific turtles.

Turtles don't have to look like a turtle, you can define them to look like anything you want to draw.
For example you can tell a turtle to:
• Move forward (or some direction)
• Move towards another turtle
• Set a value in the turtle (such as health)
• Hatch (give birth to a new turtle)
Agents – Controllable and interact in the world.

NetLogo enables the quick and easy authoring of models.
You’ll need some basic math
• Algebra
• Coordinate Plane
• Plotting a graph
Multimedia aspects
2D graphics
3D graphics
Graphical User Interface
Sounds
Closing Remarks:
• Come up with the idea for your simulation.
• Do research on how the simulation should behave.
• Create a storyboard or diagram for the look of the simulation.
• Program it.
• Test.
• Fix bugs until the project works perfectly.
• Publish.
• Think about taking a Six Week Seminar in Artificial Life!
Let’s play with Netlogo!

You can download it for your home computer. It’s available for both Mac and PC for free!

Let’s try some examples…
Rabbits Grass Weeds

This project explores a simple ecosystem made up of rabbits, grass, and weeds. The rabbits wander around randomly, and the grass and weeds grow randomly. When a rabbit bumps into some grass or weeds, it eats the grass and gains energy. If the rabbit gains enough energy, it reproduces. If it doesn't gain enough energy, it dies.
**Frogger**

This model is based on the classic arcade game, Frogger. The object of the game is to get the frog, found at the bottom of the view, across the traffic and river to a safe lily pad on the other side.
The End

Any Questions?