The Regeneration of the Earth After Its Destruction by the Capitalist Powers

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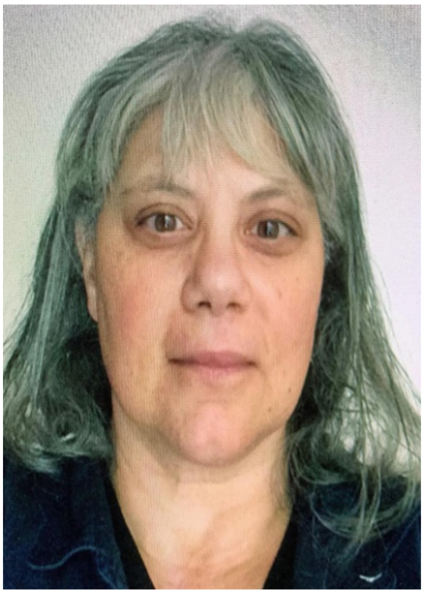

Abstract

The Regeneration of the Earth is an artwork that simulates the re-mergence of life on our planet after the sixth extinction. The system begins as an acidic sludge, a hostile environment seeded with a small number of digital entities that exist as a random collection of energy profiles and genomic instructions. Members of this 'generation 0' are not guaranteed survival. However, though horizontal gene transfer (conjugation, transformation, and transduction), entities are able to evolve. Over time, this initial population may gain the ability to sense, move, mutate, replicate, compete, or co-operate. In *Regeneration*, the fitness test is environmental sensitivity. Entities can evolve their instruction codes to gain greater adaptability to co-habitants and to the world around them by developing cross-type or multifaceted genomes. Ultimately, the more sensitive an entity is to its environment and its co-habitants, the greater its chances for survival.

Keywords: synthetic ecology, origins of life, gene transfer

1. Introduction

In this artwork, I apply recent 'origins of life' theories to a simulation that attempts to describe the re-emergence of life after the sixth extinction.

The model initializes as a hostile, toxic environment seeded with eighty to one hundred agents – briefs sets of instructions that may or may not survive their extreme surroundings. Entities use world materials to create energy and carry out lifecycle events. These entities execute their instruction sequences according to the order prescribed by their genome 'operator' and at the rate prescribed by their energy profile. Entities that reach high enough energy levels are allowed to join networks or communities based on their entity type. Even entities that are group members are not guaranteed survival, but group members are able to benefit from the resources of group membership. Entities may evolve both with and apart from groups and can gain the ability to replicate or transfer genetic material across a group or network. Using the measure of an entity's sensitivity to its environment and its co-habitants as its fitness test, a reaper function periodically sweeps the population and eliminates the lowest scoring or least sensitive twenty percent of entities ijn the environment. A generation function then reseeds the population at random.

Regeneration is an artwork intended to operate as a metaphorical system. It does not intend to model chemical processes statistically.

2. Project Overview

In *Regeneration,* the agent environment consists of composites or world materials (acid, heat, light, metal, plastic, radiation), agents or entities (acidophiles, halos, gammons, metallics, thermophiles), facilitators (donors, cooperators), communities (colonies, films, vents, vortices), and clocks (reaper, generation).

On startup, the system is initialized with somewhere between ninety and one hundred entities. Entities are immediately able to consume certain materials from the environment as well as output other materials to the environment. These allowable inputs and outputs are what define an entity's 'type' as described in Figure 1.

2.1 Design of Entities

Each individual entity consists of an energy profile, a genome, and an operator. From inception, an entity's type, sensitivities, and abilities are controlled by a short set of instructions – an array of 0s and 1s -- meant to act as an entity genome. The interpretation of this genome is controlled by an operator, a function that moves across the 'genome' string array to determine which 'gene

World Elements

Composites	Entities	Facilitators	Communities	World Clocks
Acid	Acidophiles (remove acid)	Donors (give genes)	Colonies (acid)	Reaper
Heat	Halos (remove light)	Cooperators (share genes)	Films (metal)	Generation
Light	Gammons (remove radiation)		Vents (heat)	
Metal Curtain	Metallics (remove metal)		Vortices (radiation)	
Plastic	Thermophiles (remove heat)			
Radiation				

Figure 1.

settings' are expressed and in which order.

Entities are also created with energy profiles that regulate an operator's efficiency along with the operator's rate of computation. Entity types were designed with initial lifecycle thresholds, including trigger events for phase and fracture behaviours intended to help visualize possibly emergent states that might occur in the simulation. The structure of entities is described in Figure 2.

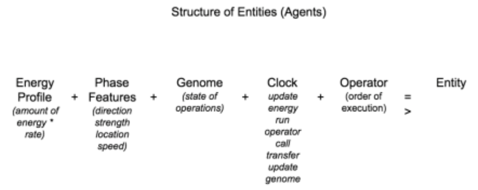

Figure 2.

2.2 Design of Genome

In this system, genomes can be through of as an entity's 'blue print' or 'type identity', but a better metaphor would be to consider the genome array as an evolving set of strategies for survival in a hostile environment. Genomes control each agent's sensitivity to world materials, their abilities, their energy efficiencies, their transfer styles, their community opportunities, and the sequential strategy of the agent's operator. Genomes evolve through the horizontal transfer of genetic information across an entity's available

Initial Acidophile Genome

{ 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 }

position --> operation

Entity ID
00 --> header, no actions

Sensitivities
01 --> feels_acid
02 --> feels_light
03 --> feels_metal
04 --> feels_plastic
05 --> feels_radiation
06 --> hears_sound
07 --> feels_temperature

Abilities
08 --> can_hue_up
09 --> can_hue_down
10 --> can_bright_up
11 --> can_bright_down
12 --> can_grow
13 --> can_shrink
14 --> can_branch
15 --> can_fold
16 --> can_move;
17 --> can_hunt
18 --> can_hide

Efficiencies
19 --> can_scramble_energy
20 --> can_scramble_rate

Transfer Styles
21 --> can_make_copy
22 --> can_take
23 --> can_insert
24 --> can transduction
25 --> can_mutate

Community
26 --> can_seek
27 --> can_cooperate
28 --> can join colony
29 --> can join film
30 --> can join ring
31 --> can join vortex
32 --> can join community x
33 --> can join community y
34 --> can join community z

Operations
35 --> sort operator
36 --> reverse operator
37 --> shuffle operator
38 --> can_make_energy

Figure 3.

networks. The sector organization of the genome array is described in Figure 3.

Entities that attain high enough energy profiles gain the ability to join communities or networks and are thereby able to share genomic instructions with others in their group. Initially, no entities have the ability to replicate. The genome setting allowing replication must be 'flipped' or 'turned on' through mutation or genetic transfer. On instantiation, entities with positive energy profiles can form networks based on type, but as genome settings are exchanged and mutations occur, entities can and are expected to develop as type hybrids that are able to share genomic information across multiple groups and absorb more kinds of materials from the environment. Ultimately, these heightened sensitivities raise the energy profile for advanced entities hypothetically allowing them to reach more complex levels of evolution.

2.2 Transfer

Horizontal, or lateral, gene transfer (HGT) refers to the nonsexual exchange of genetic information between unrelated genomes. HGT can include transfers across species boundaries. This concept is used here as a genomic survival strategy for entities attempting survival in a post-extinction environment.

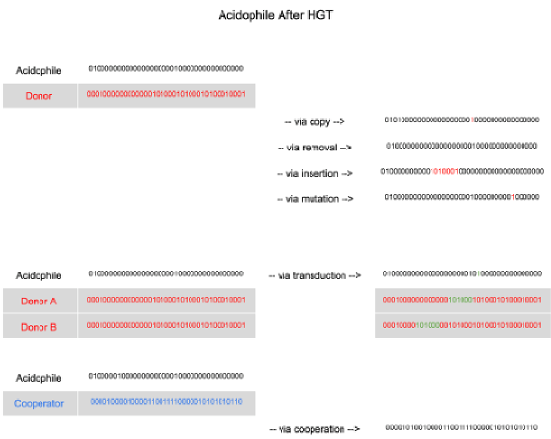

Figure 5.

An entity's genome controls its style of transfer. Entities can insert elements of their genome into a neighbor's genome (conjugation), consume elements of that neighbor's genome (transformation), or take elements from one neighbor's genome and insert those elements into another neighboring genome (transduction). An example of an acidophile genome after several styles of HGT is described by Figure 5.

Genetic exchange also affects energy rates and operators. Exchange is also open to mutation. Since entities must pass a fitness test that values environmental sensitivity, and since genomes control the consumption of material as well as action and sensation in the environment, genomes with the greatest number of abilities, or the greatest amount of variety, have higher survival rates. An entity's ability to sense change in the environment becomes its survival strategy.

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