Part 4: Evolutionary Advancement

For evolutionary advancement to occur, the average fitness of the population must increase from generation to generation:

$$\boxed{F(m'_{avg}) > F(g_{avg})}$$

Evolutionary Advancement

Where m'_{avg} is an average surviving child, and g_{avg} is an average parent.

This can also be defined as follows:

$$\boxed{\frac{\sum F(M')}{n_{m'}} > \frac{\sum F(G)}{n_g}}$$

Evolutionary Advancement

Where $n_{m'}$ is the number of children that survive to reproduce and M' is the actual child population.

There are four main ways that this increase in the average fitness can be brought about. These include:

1. Positive mutations can occur.
2. Better fit parents can produce multiple children and these children can out-survive their neighbors.
3. The size of the population can change.
4. Environmental conditions can change, altering or shifting the fitness values of individuals relative to one another.

The first method occurs whenever a positive mutation is gained. For example, given a parent population:

$$F(G) = \{\mathbf{22,} 20, 18, 17\}, F(g_{avg}) = 19.25$$

If g_1 mutates such that $F(m'_1) = 23$, we have:

$$F(M') = \{\mathbf{23,} 20, 18, 17\}, F(m'_{avg}) = 19.50$$

An average increase in the fitness of the population.

The second method occurs when a parent has two neutral children:

$$F(G) = \{\mathbf{22,} 20, 18, 17\}, F(g_{avg}) = 19.25$$

$$F(M) = \{\mathbf{22, 22,} 20, 18, 17\}, n_e = 4$$

$$F(M') = \{\mathbf{22, 22,} 20, 18\}, F(m'_{avg}) = 21.25$$

An average increase in the fitness of the population.

The third method occurs when the population size changes:

$$F(G)=\{22,20,18,17\}, F(g_{avg})=19.25$$

$$F(M)=\{22,20,18,17\}, n_e=2$$

$$F(M')=\{22,20\}, F(m'_{avg})=21.00$$

An average increase in the fitness of the population.

A combination of these three methods is also possible:

$$F(G)=\{\mathbf{22,}20,18,17\}, F(g_{avg})=19.25$$

$$F(M)=\{\mathbf{23,22,}20,18,17\}, n_e=2$$

$$F(M')=\{23,22\}, F(m'_{avg})=22.50$$

An average increase in the fitness of the population.

The fourth method involves changes in the conditions that underly the individual fitness values. In general, it would work in the following way:

$$F(G)=\{22,20,18,17\}, F(g_{avg})=19.25$$

$$F(M)=\{22,20,18,17\}, F(m_{avg})=19.25$$

- Environmental Change -

$$F(M')=\{29,14,16,21\}, F(m'_{avg})=20.00$$

An average increase in the fitness of the population.

This change comes about wholly according to the environmental changes. (The genome remained the same as it was before, only the fitness levels changed due to the increase in the population's ability to survive under the new conditions.)

For novel advancement to occur, (advancement that does not come about only by dominance of latent genetic information,) the first of the four methods *must* occur. In point of fact, the first of the methods must be the overall driving force of evolution if it is to produce new and more complex structures. While the second and third methods do increase the average fitness, they do so merely by homogenizing the population towards the higher genomes already present in the population. They can be used to aid in the preservation of the more fit genomes, but they cannot drive the population to higher and more advanced genomes.

The fourth method can potentially increase the average, but this increase could only be due to either pure chance (which is unlikely, or at least no more likely than the first method could be), or by genetic features that had already been developed in previous environments (in which case the real advancement would have come earlier from the first method). For actual advancement from lower to higher forms, the actual genome must be changed – this fact is unavoidable.