Part 5.5: Natural Selection vs. Dawkins' Selection

In the previous section, it was determined that the total final expected fitness of a population of genomes after selection can be calculated as:

$$F_e(m'_{avg}) = F(m_{avg}) + \frac{\sigma_m^2}{F(m_{avg})}$$

Here, the expected average fitness after selection depends on the average fitness before selection and the standard variance (before selection) from that average. Selection according to fitness, then, will be expected to raise the average expected fitness by about $\sigma_m^2/F(m_{avg})$, the standard variance over the average fitness of the group that the selection is acting upon.

To put this into perspective, we can diagram the expected result of natural selection on the population's fitness distribution curve as follows:
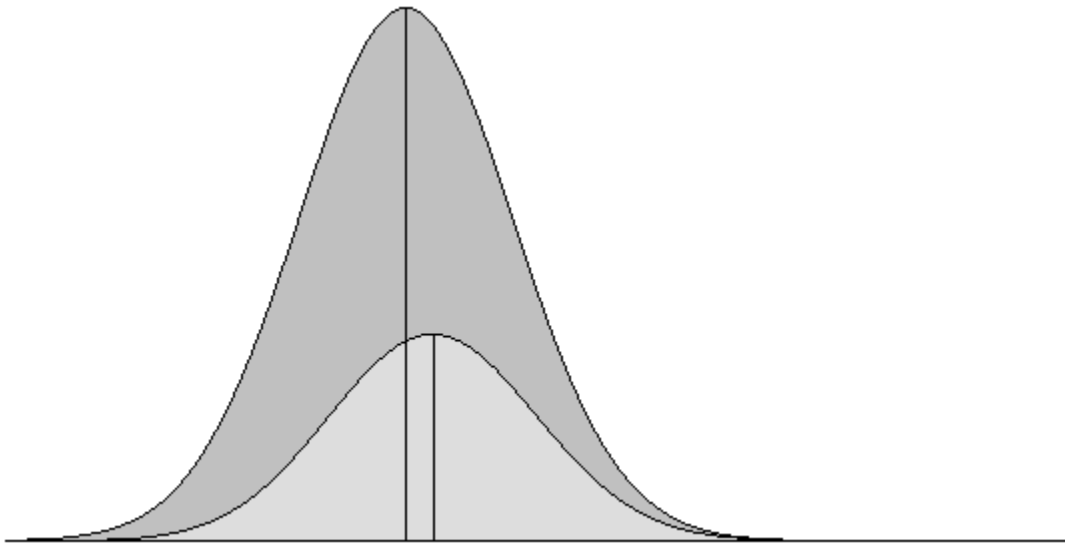

Figure 6.1: Natural Selection on a "Negative" Curve

Here, the average fitness value is well under the maximum fitness value possible for the given environment (for our purposes, we will call this the "Negative" curve). The dark grey curve represents the fitness distribution of the population before selection, while the light grey curve represents the distribution of the population after selection according to fitness.

The selection curve maintains the general bell-shaped curve of the original population and is shifted forward slightly so that the average value has increased by the expected $\sigma_m^2/F(m_{avg})$. (The center line on each curve represents the mean value - the center line of each "selection" curve was calculated according to the formula stated above.)

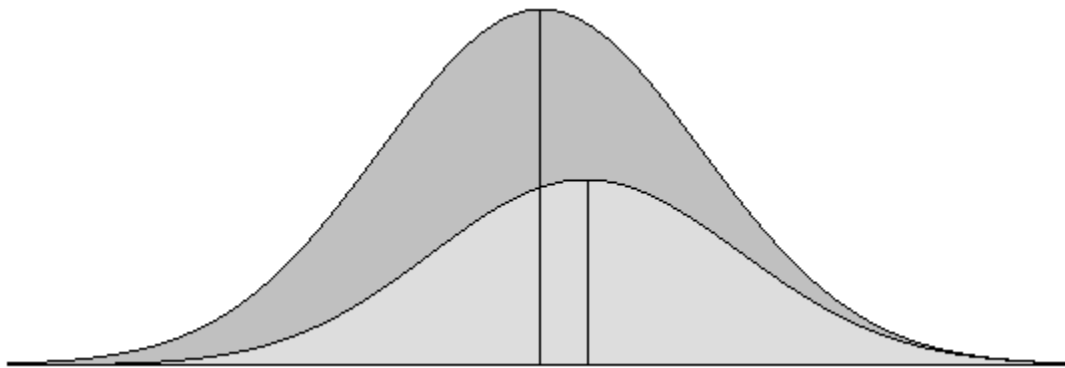Another example of a selection curve can be seen as follows:

Figure 6.2: Natural Selection on a "Neutral" Curve

We will call this a "neutral" curve for our purposes, because the average value of this curve falls precisely in the middle of the maximum and minimum fitness values possible for this given environment. Note that the selection curve passes through the mean of this curve exactly half-way through the line. This is due to the fact that at this point the fitness value is exactly half of the maximum possible, and therefore the selection value is exactly 50% of the maximum.

The standard deviation in this example is larger than that of the "negative" curve, and therefore the mean of the selection curve has increased by a greater amount than in the previous example. In practice, the standard deviation could not be anywhere near that shown in these examples, but for demonstration purposes it is suitable to use larger values so that they are easier to visualize.

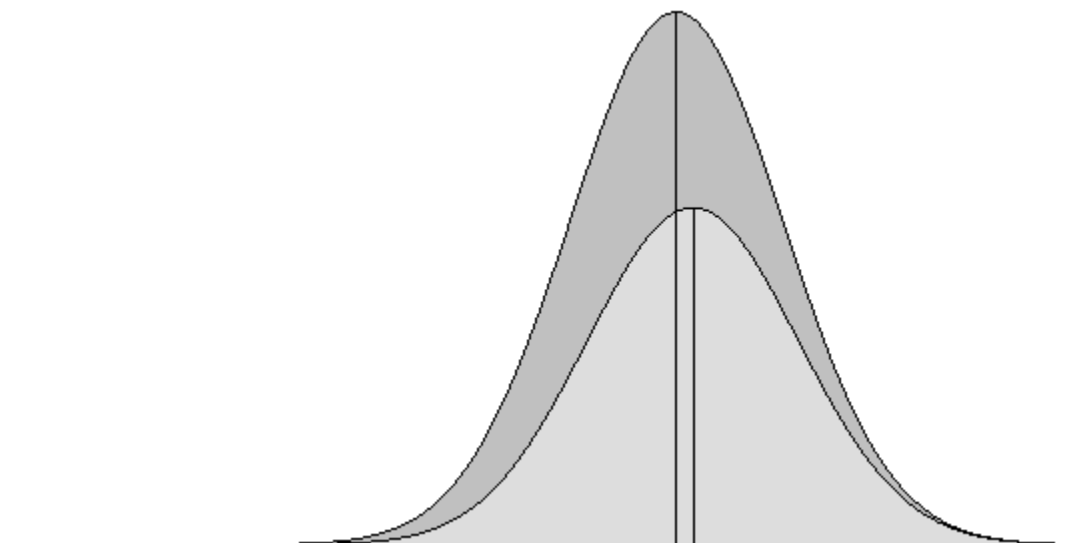For our final comparison, a "positive" curve will be shown.

Figure 6.3: Natural Selection on a "Positive" Curve

There are a couple of features of this curve that are worth noting:

First, this curve has the exact same standard deviation that the "negative" curve has, but with a higher mean. Note, then, that the increase in the mean is less for this curve than it was for the "negative" curve. This is due to the increase in the initial mean value. Since the shift forward can be calculated as $\sigma_m^2 / F(m_{avg})$, a higher mean value in the population being selected means a larger denominator, and this results in a smaller shift. In fact, the closer a population is to having optimal fitness, the smaller the effect of natural selection will be on that population.

Second, since this population's average fitness is greater than that of the "negative" curve, the resulting "positive" curve takes up more of the original population's area than the "negative" curve does.

So, now that we've looked at what type of effect natural selection will have on a real population, it's time to look at what type of selection evolutionists generally employ. This type of selection is exemplified in Dawkins' "weasel" algorithm. Although this selection mechanism is based on fitness, the fitness values are not employed in the same way as natural selection would work in reality.

For a "negative" curve, Dawkins' selection method would appear as follows:
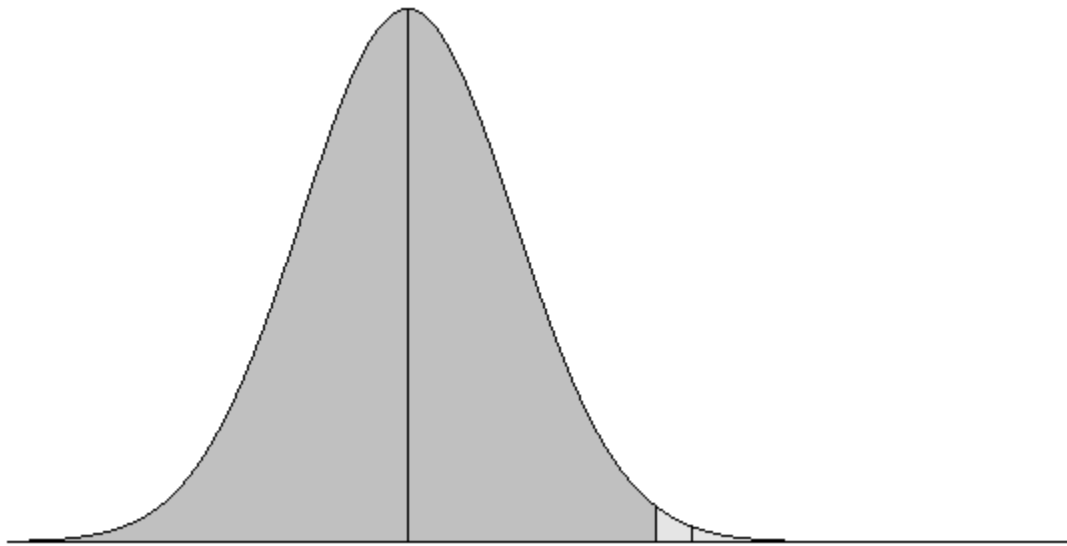

Figure 6.4: Dawkins' Selection on a "Negative" Curve

Dawkins bases his selection mechanism not on probabilities, but on raw fitness values. In this scheme, values are selected simply according to which ones are the highest. The selective "pressure" exerted on the population can be set by specifying exactly how many of the original values will remain after selection.
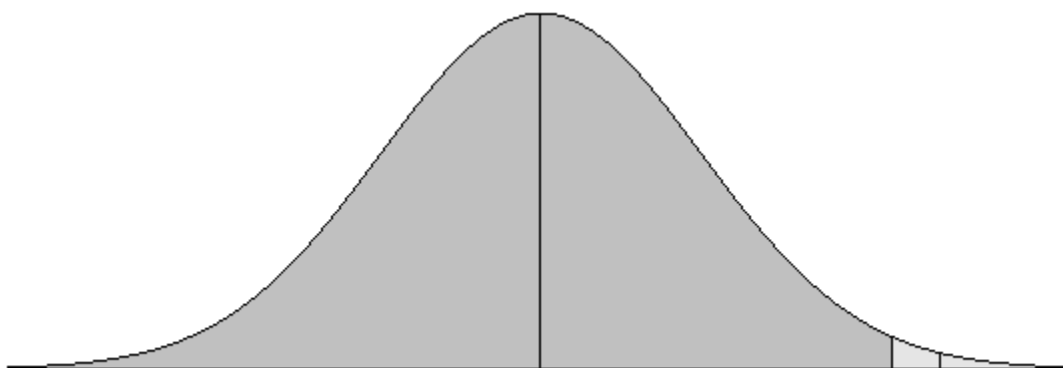
The remaining two curves are as follows:

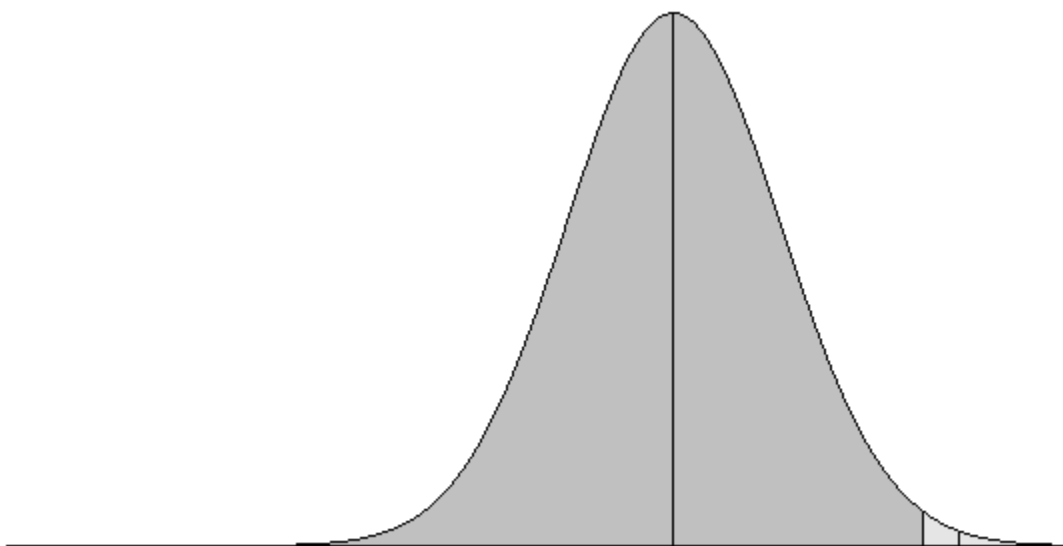**Figure 6.5: Dawkins' Selection on a "Neutral" Curve**

Figure 6.6: Dawkins' Selection on a "Positive" Curve

Two major differences between the two types of selection are worthy of note:

First, for Dawkins' method, only the top "n" values will be selected in the end – none of the lowest values can ever be selected (unless there is minimal to no selection). This makes it possible to arbitrarily increase the power of natural selection on the population, since higher population values and a lower number of values selected for will always increase the effectiveness of the selection (wherever possible).

The actual effectiveness of natural selection, on the other hand, cannot be arbitrarily increased by increasing the "selective pressure" in this manner. Unless the population is propped up artificially (which would be counter-active to evolution), the proportion of each fitness value does not change due to an

increase or decrease in the population's selection size. A decrease in the target population size must follow the proportions laid out by the probabilities involved in each individual's fitness value.

Some might argue to the contrary, citing various bacterial studies, etc., where a type of selective pressure was increased and a large change in the fitness of the population was able to occur – contra the above assertion. These examples, however, do not properly apply to the above examples of natural selection; in these experiments, natural selection would be acting upon the population within the framework of an entirely different environment than the environment in which the bacteria naturally exist. Thus, the selective environment has changed, not properly the degree of selective pressure.

In these cases, the experimenter generally tries to amplify the requirement for a trait that is known to exist in a small quantity already, such that only those organisms that have an unusually disproportionate dominance of a specific trait (generally at the expense of the traits that are more important in their natural environment) can deal with this environment and survive. Although interesting, this type of study does little to advance the evolutionist's case, since the experimenters both know that the capability already exists, and, in the end, only produce organisms that are less fit in their truly natural environment. While this type of pressure can produce large changes in the population's genetic makeup, it is itself quite unnatural and does little to provide a driving force for progressive evolution.

The second major difference between the two types of selection is related to the first; since the size of the population that survives is arbitrary and the selection is based on the fitness values of the population, not on the probabilities related to these values, the fitness change can be made constant, regardless of the mean fitness of the population being selected. This means that the selective force can be maximized no matter how high, or low, the average fitness of the population is. While this factor may not be as drastic as is the arbitrarily high efficiency issue that results from size selection, it does contribute to an exaggeration of the effectiveness and power of "natural selection" in the evolutionist's simulations.

Given these factors, it is safe to say that the selection method employed by Dawkins in his weasel analogy and by other evolutionists in their simulations are entirely inaccurate and misleading. Selection based on fitness values apart from their related probabilities will always produce results that are far better than reality could ever offer, and therefore cannot properly be used to demonstrate the reasonableness of the theory of progressive evolution.