#### Compatible with NetLogo 6.0.2

## WHAT IS IT?

Dawkins' Weasel is a NetLogo model that illustrates the principle of evolution by natural selection. It is inspired by a thought experiment presented by Richard Dawkins in his book The Blind Watchmaker (1986). He presents the idea as follows:

#### "I don't know who it was first pointed out that, given enough time, a monkey bashing away at random on a typewriter could produce all the works of Shakespeare. The operative phrase is, of course, given enough time. Let us limit the task facing our monkey somewhat. Suppose that he has to produce, not the complete works of Shakespeare but just the short sentence 'METHINKS IT IS LIKE A WEASEL', and we shall make it relatively easy by giving him a typewriter with a restricted keyboard, one with just the 26 (capital) letters, and a space bar. How long will he take to write this one little sentence?"

He goes on to point out that - by random mechanisms alone - a monkey is unlikely to produce the phrase in any reasonable amount of time:

#### "To put it mildly, the phrase we seek would be a long time coming, to say nothing of the complete works of Shakespeare."

However, Dawkins points out, with selection the problem becomes quite manageable:

#### "What about cumulative selection; how much more effective should this be? Very very much more effective, perhaps more so than we at first realize, although it is almost obvious when we reflect further. We again use our computer monkey, but with a crucial difference in its program. It again begins by choosing a random sequence of 28 letters, just as before: 'WDLMNLT DTJBKWIRZREZLMQCO P'. It now 'breeds from' this random phrase. It duplicates it repeatedly, but with a certain chance of random error - 'mutation' - in the copying. The computer examines the mutant nonsense phrases, the 'progeny' of the original phrase, and chooses the one which, however slightly, most resembles the target phrase, 'METHINKS IT IS LIKE A WEASEL'."

Dawkins' Weasel is a working model of this thought experiment, demonstrating the effectiveness of selection for rapidely producing a given target phrase.

## HOW TO USE IT

### Settings

Write in the TARGET PHRASE input box to determine the target phrase for your simulation.

Use the MUTATION RATE slider to determine the rate at which each character in a string mutates. The higher the mutation rate, the more likely that each character present in the parent string will produce an error - mutation - in its offspring.

Write in the NUMBER OF OFFSPRING input box to determine how many offspring each parent string will produce for every generation.

Use the WITH SELECTION switch to decide whether your simulation will include selection or not. Without selection, you are simulating a monkey typing on a keyboard, causing random changes to the string. With selection, you are simulating cumulative selection, as described by Dawkins above.

### Buttons

Press SETUP after all of the settings have been chosen. This will initialize the program to create a random string to serve as the initial ancestral state.

Press GO-ONCE to produce the parent string for the next generation, which is selected because it is the closest match to the TARGET PHRASE.

Press GO to make the simulation run continuously. This will create new generations of strings indefinitely or until it matches the TARGET PHRASE. To stop the simulation, press the GO button again.

### Output

While it is running, the simulation will print out the results from each generation, which provides the current generation number and the closest matching string of that generation. For example:

#### 20 ZETHINKS IT AS LIKW A WEABEL

If/When the simulation produces a string that completely matches the TARGET PHRASE, the simulation will stop and print out the results of this simulation in the COMMAND CENTER box.

## THINGS TO NOTICE

The purpose of this model is to demonstrate that natural selection is different than accumulated changes occuring by pure chance. Pay attention to how the settings affect the rate at which the simulation produces the TARGET PHRASE:

1. What MUTATION RATE(s) produce the most or least rapid effects?

2. How does the NUMBER OF OFFSPRING affect this rate?

3. Does it matter how long the TARGET PHRASE is?

4. Which is more effective: with selection or without selection?

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Contact K N Crouse at crou0048@umn.edu if you have questions about its use.