NetLogo experiment report: Bug Hunt Camouflage

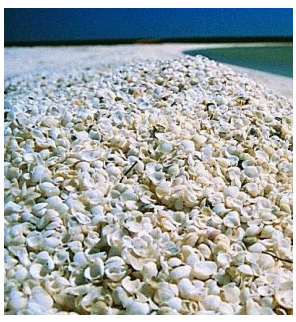
Abhishek Dasgupta (06MS07)[†]
Sambit Bikas Pal (06MS03)[†]
Challenger Mishra (06MS01)[†]

[†]*Indian Institute of Science Education and Research Kolkata*

This report is on the NetLogo[1] experiment of Bug Hunt Camouflage. We shall describe the experiment, the results and give an interpretation.

NetLogo is a computer simulation software used to simulate various kinds of scientific experiments, which would otherwise take a long time to do or be cumbersome. We conducted our experiment on the role of selection in evolution using the *bug hunt camouflage* module in NetLogo.

The program simulated increase in camouflaging over generations in response to natural selection. A choice of three landscapes: seashore, poppy seeds and glacier were there:

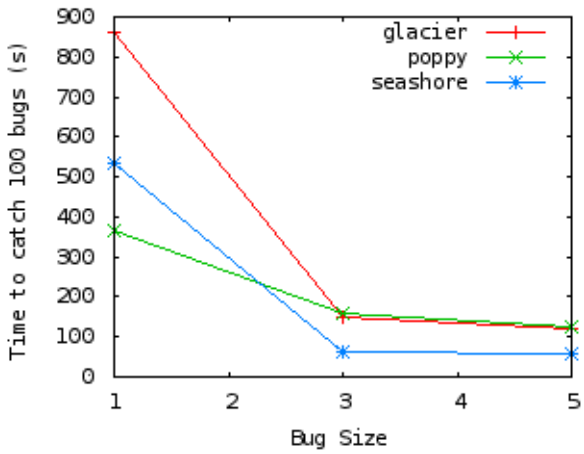


We could fix a specific bug size and the total population. The experiment was conducted in two parts:

- With bug sizes 1, 3 and 5, each of them for the three landscapes, and the mutation rate fixed at 20.
- With bug size 1, and varying the mutation rate from 20 to 100 in steps of twenty, and also by varying the landscapes.

Our task was to identify and 'kill' (by clicking on the bugs) as many of them as possible in the minimum possible time. We arbitrarily measured the time taken to kill 100 bugs for each set. The population size was kept constant at 15.

The results are summarized below:

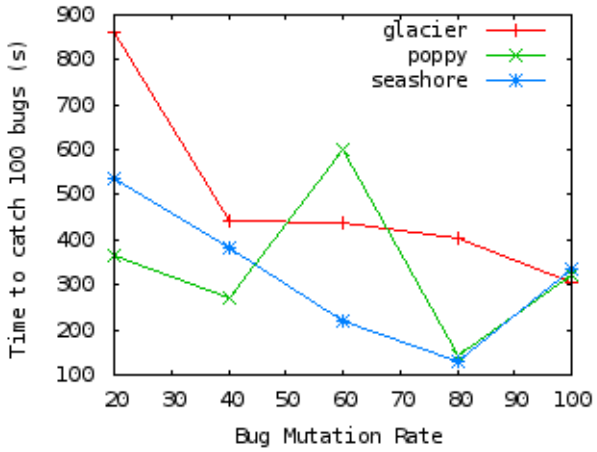


From the graphs, we see that as the bug size increases, it becomes easier fot the predator (that is us!) to kill the bugs, as they are more

visible against the landscape. In general bugs were killed faster on the poppy landscape and slower on the glacier landscape. This could be because the glacier landscape was more homogeneous than the poppy, thus natural selection there would be more unidirectional, causing better camouflaging. In fact some other groups at our laboratory reported that the colour of the bugs had become virtually indistinguishable from the glacier background even before they had reached the limit of 100 bugs.

However, as the bug size increases, the difference between the glacier landscape and the other landscapes in terms of the time taken to kill 100 bugs decreases. This is probably because as bug size increases, it dominates over the differences in landscapes, and the predator is able to spot the bugs with nearly equal ease in all the landscapes.

In the second part of our experiment, we took bug size 1, and varied the mutation rate. These are our results:



Again, we see the strikingly high time taken to kill in the glacier landscape. We would expect that the time taken to kill would drop a bit with higher mutation rate, as it would be more difficult to attain homogeneity in the population with more mutations being thrown up each generations. In fact this is indeed the case. However the time taken for **a part** of the population to reach camouflage would also be faster due to the higher mutation rate, though this fact would not be reflected in our data. The sudden spike in the time taken to catch the poppy seeds at mutation rate 60 could be because of human error, otherwise the data follows expectations. An interesting point is that for mutation rate 100, all the three landscapes fared equally well, which could be interpreted as the notion that environment matters less in determining evolution if the mutation rate is too high

This experiment enabled us to see and explore evolution; though schematic, it showed us how natural selection works, and even this simple experiment gave us lots of information and insight into the process of selection. We would like to thank the authors of NetLogo, who made this amazing program enabling us to enjoyably explore evolution. We would also like to thank Dr. N.G. Prasad, without whom we wouldn't have been exposed to this wonderful subject and this wonderful software.

References

[1] The NetLogo software can be obtained from http://ccl.northwestern.edu/netlogo/