Stayin' Alive

New Mexico

Supercomputing Challenge

Final Report

March 19, 2012

Team 81

Manzano High School

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Executive Summary

Most people know the past or what is believed to be the past, well at least the recent past. Anything before the evolution of humans is basically a mystery to us. Like the distant past the future is also unknown and what will happen in the future is open to endless possibilities. We have tasked ourselves with predicting what might happen, under extenuating circumstances, to pea-plants

Statement of the problem

The future, although theoretical, poses a great question for people like us, Supercomputing Challenge contestants. Our project aims to set forth yet another opinion of plant evolution due to future water differences. We hope to model a few of the many possible scenarios in which plants are forced to evolve and adapt to their changing surroundings. Our project is centered around Darwin's Theory of *Natural Selection* and we hope to replicate this using a computer model in Java, but in case we don't get the Java model working we will have a Net Logo 3D model.

Description of our Method

We started off by brainstorming ideas, and eventually, we came to the idea that we would model the process of evolution as seen through plants. We started off our research by looking into plant genes and genomes, but that wasn't exactly the direction that we needed to take our project in. After learning about Gregor Mendel and Charles Darwin in Biology class we decided to turn to the Theory of Evolution by Natural Selection, because we weren't having much luck in dealing with genes and the idea of inheritance. We looked at exactly what Darwin's Theory stated and we needed to decide which plant to use in our model. After learning exactly what The Theory of Natural Selection is and deciding that we were going to use pea-plants like Mendel did when he was studying the idea of inheritance. After ironing out all of the technical details we started programming a Net Logo 3D Preview 5 model. We started off trying to make an underground reservoir and make the water on the ground effect the plants, but that didn't work so well so, we trashed that model. We decided to take a different approach when it came to the model, we weren't going to allow the plants to have roots and the water was only going to come from the sky. That had solved a lot of our problems but then we had to isolate variables and how we planned to model evolution. First we tackled the problem of evolution and came up with the idea that every pea-plant would have a set lifetime and that they would be allowed to reproduce as many as two times in there lifetime but if they didn't receive at least half of the water that they need to survive in their lifetime that they would die without reproducing. Then we decided to add

temperature and lastly we decided to bring elevation into the equation and it started falling into place.

Our Results

We had predicted that the pea-plant species that were more able to survive in their environment would thrive and persevere. As we have seen so far that is exactly the case. Plants that need less water have been able to survive through the droughts and have flourished during the times of major down poor, exactly as Darwin said. Survival of the fittest is exactly what we have found so far and that is to be expected because we are after all working off of a heavily tested theory.

Our Conclusions

Together we have concluded that the pea-plants that are more tolerant of low temperatures and high temperatures have survived longer. Also, the species of pea-plants that need a smaller amount of water can survive during times of drought. Also we have noticed that the pea-plants so far have tended to like the higher elevations. So far most of our predictions have been correct except for the one about the elevation, but our model isn't quite up to full functionality yet.

Products

```
to summer
create-turtles 100
[
set breed radiations
set heat 240
scatter2
set heading 180
set hidden? true
]
end
```

```
to live
ask pea-plants
[
set life-span life-span - .05
if life-span < .01 and water-gathered > 0.5 * min-water-gathered
[
hatch 1
[
set life-span random 5 + 5
set min-water-gathered min-water-gathered + random (min-water-gathered - water-gathered)
set water-gathered 0
scatter1
set-location
]
die
]
if life-span < .01 and water-gathered < 0.5 * min-water-gathered
[
die
]
if water-gathered > 1.5 * min-water-gathered
[
hatch 1
[
set life-span random 5 + 5
set water-gathered 0
scatter1
set-location
]
]
]
tick
end
to rain
create-waters number-rains
[
set color blue
set shape "circle"
set size .5
scatter2
]
tick
tick
ask waters
[
set heading 180
fd 1
]
ask waters
[
if pcolor = brown
[
die
]
]
end
```

Significant Original Achievement:

We feel that our most significant original achievement is successfully modeling, in Net Logo, the theory of Natural Selection as seen by means of pea plants. We took Mendel's studies of pea plants and applied Darwin's ideas of evolution by Natural Selection to them and created a model. Our model takes into account temperature, elevation, and precipitation amounts. We feel that our model quite accurately takes into account a pea-plants ability to adapt to it's surroundings. Our model also takes into account the randomness of nature and how that affects evolution.

Acknowledgements

- We would like to Thank Nick Bennett for helping us with our programming.
- Karen Glennon for being the GREATEST teacher ever and letting us come back to Jackson Middle School for Supercomputing Challenge.
- And the Supercomputing Challenge Organization for allowing students like us to pursue our interests and have FUN!!!