

Modeling Earthquakes

New Mexico

Supercomputing Challenge

Final Report

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Team 51

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## Executive Summary

Earthquakes are caused when tectonic plates get stuck or suddenly slip past each other due to friction. The boundaries of the plates are made up of many faults, which are where earthquakes occur. The size of the fault, amount of slip on the fault, and intensity of the earthquake determine the type of the earthquake. To predict earthquakes and help make earthquakes safer, many earthquake models are made. Last year, I made a model that had two kinds of different structures, and an expanding foci to represent the wave of an earthquake. I added 3 types of structures: steel-reinforced, concrete, and brick. This was to make sure that most types of house materials were accounted for.

## Problem Statement

The main problem that I tried to solve with this project was that earthquake models are difficult to access and complicated. I wanted to make a model where one could change a few variables and produce an easy-to-understand earthquake model. I did this in Netlogo in order to make sure that the visualization of the code was easy to understand.

## Solution

My approach for this problem was to make a simple Netlogo, agent-based model that could show an earthquake wave and how it affected surrounding structures.

## Project Validation

With the help of my mentor and teacher, Mr. Vigil, I made sure that the project is easy to understand. I created objects that would be affected by the earthquake, called houses. The earthquake wave is the patches, which are agents, turning white when they are over the age of 30, in the arrangement of a circle propagating outwards. This white earthquake wave depletes the houses' health, and when the houses collapse, or die, they are red X's.

## Results

My earthquake model is simple and easy to understand, with three types of houses made up of different materials with different strengths and earthquake resistances. The white foci is clear against the black background and its effect on the houses it touches is clear.

## Conclusions

In the end, I achieved what I wanted to do by making a simple earthquake model that shows how it affects surrounding structures. The model shows that structures with steel-reinforced beams have the most resistance to earthquake waves, and that concrete and brick houses do not fare as well.

## Significant Achievements

I learned a lot about Netlogo code, and how Netlogo is an easy-to-understand language for people to use. Netlogo code can have amazing products, however, even though the language itself is easy, and the fact that it is agent-based allows an easy way to make models to solve everyday problems in our world.

## Acknowledgements

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