

## Final Project – Progress Report 4

### **Introduction:**

Since the last progress report, I believe I've figured out an appropriate formula for modeling damage done by tornadoes in my project (based on average damage reference patterns for tornadoes in the United States over the years) – as well as added some re-usable code into functions and created some monitors/reporters on the interface tab. I believe for the most part my project is finished – I will be tinkering my formula and some behavior as I test it out the but I all the major components should be done. The updated code can be found on the modeling commons page, and I will be updating my project proposal / final report with all the explanations for the behavior and model as I go along.

### **Agent behavior:**

The behavior of the agents hasn't changed all that much since the last report, though I've added the functionality that if a house/building gets completely damaged (damage  $\geq$  initial-value), then that agent turns black to indicate destruction. I'm thinking about adding other color changes that shows when a building/house is  $\frac{1}{2}$  damaged and  $\frac{3}{4}$  damaged as well to show a visual range throughout the world. I've also added monitors to the interface tab that keep track of the damage incurred in terms of dollars, the eventual combined final value of the city and the percentage damage in terms of value done to the city (just to get a numerical idea).

### **System behavior:**

The behavior of the system hasn't changed since the last report, other than the fact that I've added monitors that keep track of the different numerical values throughout the model runs, and that a color change indicates the buildings and houses that have been totally damaged. I'm still tinkering with the damage model a little but it seems to be working and attaining values that are backed by the reference

patterns I've garnered.

### **Rationale for agent rules:**

I wanted to visually show buildings that have been totally destroyed because in real life it would be obvious when a building has undergone complete damage. I also want to give a visual idea for  $\frac{1}{2}$  damage and  $\frac{3}{4}$  damage to get a visual idea. That may entail initializing the building/house colors a certain way in the setup to avoid clashing with the color choices for visual damage. The model I've chosen takes into account tornado-strength and exponentially takes into account the time that the tornado spends on a particular house or buildings because it's realistic that a structure would get weaker and so exponentially more damaged the longer it is attacked. I've also normalized the damage by (\$) $10,000$  to get dollar values consistent with the reference patterns I've garnered. The monitors I've chosen are different ways of looking at the damage done by the tornado. Numbers don't tell the whole story, the percentage damage to the whole city puts it into perspective.

### **Model output:**

The system is behaving exactly how I want it to so far, and I've added a decent damage model that gives decent estimates of damage by the tornado. I've also incorporated tornado movement-speed when calculating how far trees will be thrown because I'm using its speed as a sort of "initial velocity". The color of buildings and houses are also being changed to black to indicate total damage to give a visual idea.

### **Questions:**

The damage model is working decently, I'm figuring out how to fine-tune it now to give consistently accurate measurements. I may incorporate tornado movement-speed into the model as well but give it a small weight because that shouldn't matter as much. I'm also figuring out how to go about analyzing it using BehaviorSpace.

**Next steps:**

I'm also going to try and finalize the damage model and see how I will incorporate all the components into determining final damage done. I also want to add visual indicators as I've done so far for total damage. Lastly, I want to begin my analysis using BehaviorSpace and start explaining everything in detail in the final report and presentations.