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Final Project – Design Proposal

I plan to design and implement a NetLogo model that assesses city damage (in dollars) due to a tornado. It will depend on the density/sparseness of the layout of buildings, and the height and strength of buildings. It will also take into account the wind-speed/direction of the tornado, the tendency for the tornado to move around or stay in a certain area, and whether or not there are any trees/cars/other objects that could be thrown around in the vicinity of vulnerable buildings/structures.

Since the damage done to buildings depends on the town layout (are they close together or farther apart?), their height (do taller or shorter buildings get affected more?), and their material (stronger buildings are more expensive but will withstand storms better), the model will attempt to show what combination of layout, building stature and material are best equipped to handle tornadoes and how damage can therefore be controlled. This is especially helpful in cities that reside within Tornado Alley and similar areas. I've always been fascinated with how tall buildings which seem unstable in case of a tornado can withstand such high winds and undergo minimal damage, so this project will be a way to model the effects of tornadoes and the damage they do in cities that have a dense layout of buildings versus a sparse layout of buildings.

The agents will include patches that represent buildings and other structures of the city. The size of the building will take up a user-defined number of patches where they decide the height of the building. The color the building will be determined by the user, who will choose a strength-level for the building and the color will represent the material it's made out of. The trees will be represented by turtles in the shape of trees which will be spread out randomly across the world. The tornado will be represented by a bunch of turtles all in the same location (the type of circle we see if we create 100

turtles at the origin). The number of turtles will be determined by the user and what size/strength of tornado they want, and it will move randomly about the world, based on a probability of moving from place to place (set by the user), for a pre-set amount of ticks (also set by the user). The tornado will move around the world and if it hits a tree the tree will be uprooted and thrown a certain distance, which could hit a nearby building and cause some damage (the velocity and direction of the tree will most likely be based on equations of motion if time permits). If the tornado hits a building, then depending on the building's height and strength and the amount of time that the tornado spends in that area, it will do a certain amount of damage to the building. The damage will be visible by a color change and a counter that keeps track of accumulated damage. After the tornado dies out, the final damage will be displayed in the counter. I'm also planning to do a BehaviorSpace analysis that shows the damage as a function of the height/strength of buildings, the strength of the tornado as set by the user, and the layout of the buildings (how spread out is each building from the others). It will help to get a better idea as to which settings can help minimize the damage.

NetLogo gives me all the tools I need in order to create the model, and BehaviorSpace allows me to compare the effect of the different settings on damage accumulated due to the storm. The example we did in assignment 4 on BehaviorSpace gave me the idea to use its analysis capability for my final project as well. While this model may not have much particular use in re-designing cities as they've already been built and are not easily changeable, this is more of an interest project. I've always been curious as to how cities are designed and why so many buildings are laid out close to one another when it seems like one strong storm could destroy a lot of them together. My goal for the project is more the research process on design and rationale of city layouts. I then want to apply that to the model and see if changing the spread of buildings could help minimize damage based on the probability of the storm moving from place to place.