Computer Systems Project Proposal

Modeling Virus Transmissions with NetLogo using Agent Based and System Dynamics Modeling

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Problem Statement
This project is to model the transmission dynamics of a virus based on user input.

Purpose
The goal of this project is to eventually be able to model the virus transmission dynamics of real situations, such as the 1918 Spanish Flu. Since there is a wealth of statistics about the 1918 Spanish Flu, the numbers can be recreated in the model.

Scope of Study
The more specific the model, the better. The model should be as close to real life as possible involving normal parameters. This model will try to recreate as closely as possible the situation, so the more detailed he parameters the better the results.

Background and review of current literature/research
Researchers are currently researching in this area, trying to create a model to represent a historical virus outbreak, so future outbreaks can be avoided. The research involves creating a model with detailed parameters for infection, susceptibility and transmission in different people in different age categories. This project just modeled one specific outbreak, but my model will be able to model a general outbreak.

Procedure and Methodology
-My breakdown of the project is as such:

     -Quarter 1-Create the basic framework for the program including people who are infected, uninfected and the transmission probabilities, birth rates, and death rates.

     -Quarter 2-Add age factors and create different classes of people so children and seniors are more susceptible to catching the infections. Model the birth and death rates of the different age classes, so people can age. Create the carrying capacity to model the limitations of infrastructure.

     -Quarter 3-Modify the general infection rate to specific susceptibility rates so each individual has a different chance of getting the virus depending on immunization, immunity rate and age. Create a population density stock to make people who are in higher density more susceptible.

     -Quarter 4-Troubleshoot and test final model.

-The model will be made using a combination of NetLogo System Dynamics and Agent Based Modeling. Just one cannot be used, and integration of both will give a better result as specific code pertaining to a method can be written using agent based modeling, and general methods can be modeling by system dynamics modeling.

-The input will require the user to enter information about the specific parameters they want to model. For example, the basic parameters will be:birth rate, death rate, infection rate, immunity rate, and virus strength. Each parameter will be input using a slider in the main NetLogo project screen, and a graph will show a graph of each type of people as a result of the parameters.
-Testing of the program is done as soon as a new part is completed. Since the model is dynamically affected by every new parameter, the testing is an ongoing phase. The final test of the model will include actually modeling a real situation, so the results of the model will be compared against the real situation and see how close the model actually was to predicting a real outbreak. NetLogo includes a built in method called BehaviorSpace, which tracks the values of every variable and outputs it into a csv file in excel. That can be used to plot and test whether the model works.

Expected Results and Value to Others

Models are used frequently to predict various situations in life and are used by individuals, companies, organizations and the government. Even though agent based and system dynamics models are used, they are not used often together, so integrating them will offer a different outlook to the model. My primary purpose is to model a realistic situation, so this model will not be specific to any situation, but rather just have the basic necessities for the virus transmission model and the user will choose the others values.