NetLogo Worksheet #2

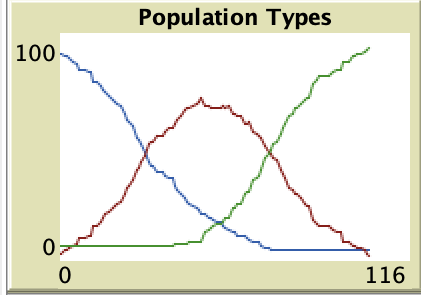
NetLogo Diffusion of Innovation models, data export, updates to final paper

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# Problem #1: NetLogo Model with Random Mixing

1. small number of agents, no movement allowed:
   1. Nothing; the agents depend on proximity to change states
2. small number of agents, movement allowed:
   1. 
   2. Or, put another way, with beta = 0.48 and gamma = 0.49, N % initial adopters = 0.03 and N % initial disposers = 0.06 out of Population size N = 100, we see a typical diffusion model begin to emerge.
3. low number of initial adopters and disposers
   1. If N = 0 for both, nothing happens.
   2. If Adopters >= 0.01 adoption will diffuse
   3. If Adopters >= 0.01 and Disposers >= 0.01 or more, the model will perform normally over a longer time span
4. high number of initial adopters and disposers
   1. The model converges on all-disposed quickly for N-Disposers -> 1.
   2. As N decreases across both population subsets, model time to final state decreases.
5. low value for beta and gamma
   1. Beta and Gamma impact the rates of adoption and disposal. When they are low, the simulation time is greatly decreased.
6. high value for beta and gamma
   1. The opposite impact of low values: the simulation time to converging on a final state is increased, but the smoothness of the curves created is also increased. I tend to prefer this state for this model, as it is more visually appealing and the simulation is light enough that iterations don’t matter as much. It is quite easy to run 100,000 iterations (sub 1 second), and 1,000,000 is under 10 seconds. Convergence happens much faster than this, so system resources permit the use of a limited extension of simulation times to yield more user-friendly visual output.

**Provide a short 1 paragraph discussion of your findings.**

The interesting variables (as seems to often be the case) are the coefficients beta and gamma. Ceterus parabus, when beta > gamma by a large relative amount, the model becomes primarily potential and disposers, with no remaining adopters left to diffuse the innovation. When the opposite is true, the model quickly shows all agents adopting, followed by a much slower disposal curve. In this case, N = 600, percent initial = 0.02 for adopter and disposer, and beta and gamma were 0.25 and 0.50, both respectively and vice versa. When these are much closer (0.26 and 0.24), if beta < gamma, the model ends in a state of the technology having diffused completely or nearly completely through the population, with a state in the middle of near-complete adoption before disposal begins to rise. In the opposite scenario, where gamma < beta, the adoption rate never completely covers the population. The disposal rate is high enough that only a portion of the population will be simultaneous adopters.

In reality, this seems to indicate a method of determining how pervasive a technology is based on the observed curves. Flip phones, for instance, likely had a gamma < beta if studied in such a model with the same parameterization. 3D televisions, on the other hand, reached a state of having more disposers and potentials, indicating that gamma > beta.

# Problem #2: NetLogo Model with Social Networks

1. low number of initial adopters and disposers:
   1. With beta & gamma = 0.2, N=500, adopters/disposers = 0.01, 12 ticks time to final state
2. high number of initial adopters and disposers:
   1. Changing only the percent of adopters/disposers to 0.5, the model takes 2 ticks to reach a final state..
3. low value for beta and gamma:
   1. For N = 500, % adopters/disposers = 0.02, and beta/gamma = 0.02, the model reaches a final state in 4 ticks.
4. high value for beta and gamma:
   1. given the same parameters but changing beta/gamma to > .3 causes the model to reach a stable state with a low rate of adoption, but also nearly no growth in disposal. Lowering these to below 0.25 causes the model to begin to run more normally, but again reaching a primarily potential state that is stable as these parameters approach the low values.

**Provide a short 1 paragraph discussion of your findings.**

The more limited influencers in this model mean that parameters much be more carefully chosen in order to replicate diffusion statistics of observed phenomenon. Betweenness and centrality become important concepts in determining who will change the states of other nodes, making movement an irrelevant factor in this model. It might be improved by destroying links if neighbors lose proximity for an extended period, and creating new links if they share proximity for an extended time, where extended time is some defined number of ticks that can be adjusted with another slider for study.

# Problem #3: NetLogo data export

Plot:



Python code:

﻿ import pandas as pd

data = pd.read\_csv("diffusion\_cleaned.csv")

lines = data.plot.line()

# Problem #4: Final Paper updates

Attached PDF