EECS 472 Final Project Proposal

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I would like to model the global network structures and properties emergent from several additive network theories, including homophily, preferential attachment, contagion (social influence), and resource dependence theory (Monge & Contractor, 2003). Homophily describes the tendency for actors to search and select similar actors to oneself to create connections. In contrast, resource dependence theory suggests that the more resources an actor has, the more likely it is to attract relationships. Similarly, preferential attachment refers to actors' preference to select and form relationships with actors that are already popular network connection receivers. Contagion theory emphasizes the importance of social networks as a communication channel on the influence of attitudes and behaviors. According to Monge and Contractor (2003), several network theories are related to organizational contexts. However, previous studies primarily examine the influence of one type of network mechanism on the network structures and properties. Thus, one question remains largely untapped in the network literature, that is, how do network mechanisms work together to determine the patterns of interorganizational networks? Similar to the Segregation Model that we covered during the class, my goal in this research is to give individual actors some behaviors and see the network structures at the aggregate level. As such, my research question is:

RQ1: Are these network mechanisms additive or competitive to each other?

RQ2: Which one of the four network mechanisms has the most profound impact on the global network structures?

Based upon these four theoretical mechanisms, homophily is turtles' preference to similar turtles' with similar amount of resources (e.g., continuous wealth). In addition, I want to add an additional categorical homophily attribute, such as using color to represent geography. For resource dependence, turtles demonstrate a preference to create connections with turtles with more wealth. For preferential attachment, turtles demonstrate a preference to have relationships with turtles that already have a large number of relations. Finally, for contagion and social influence, turtles will look at their friends and neighbors and see what they have formed relations with. These choices will help the turtle make decisions about whom to form relations with. Further, contagion and social influence might include mechanisms such as transitivity, that is, forming relations with your friends' friends.

Core parameters include a turtle's color (representing geography) and its wealth. At each tick, a turtle will have a link with another turtle based upon one of the four mechanism. However, similar to the Segregation Model, some turtles might be influenced more by resource dependence while some turtles might be influenced more by homophily. This means that a turtle might link to another turtle based on homophily this tick but link to the next turtle based on preferential attachment in the next tick. At each tick, a turtle will also look at its neighbor (friends) and make decisions accordingly. Additionally, each turtle might demonstrate only one type of preference consistently. That is, some turtles only select connections based upon homophily while some friends only select connections based upon preferential attachment.

Agent-based modeling is a good fit to model my research question because it provides opportunities to examine controlled environments for turtles (organizations), similar to experiments. In addition, because interorganizational networks among organizations are self-organizing, agent-based modeling is appropriate to model the emergent network structures and properties. Further, because of the uncertainty in the network structures, agent-based

modeling enables me to change parameters and investigate what is certain from interorganizational networks.

For the measures, I would like to collect average degree, several centrality measures (betweenness and closeness), clustering coefficient, and centralization measures. In addition, I would like to think a way to quantify what means "which network mechanism has the strongest influence on network structures". I think I want to have four monitors indicating the number of nodes or connections that are influenced by homophily, resource dependence, preferential attachment, and contagion respectively.

For the additional features, I am considering a series of distinct but related models. These distinct models are mainly for educational purposes. That is, I want to model homophily, resource dependency, preferential attachment (already in NetLogo), and contagion (social influence) individually to demonstrate how each mechanism works.

Monge, P. R., & Contractor, N. S. (2003). *Theories of communication networks.* Oxford: Oxford University Press.