Cosette Hampton, Assignment 3 – Question 1
MACS 30000, Dr. Evans
Due: Wednesday, Oct. 24 at 11:30am

Read the paper, Moretti (2002), and write a one-to-two-page paper responding to the following questions.

a) The author discusses the role of simulation as a tool for exploring theory. She also highlights the importance of establishing “validity" of the simulative model of the theory. That is, validity is the degree to which the theoretical constructs and their computational implementation are representative of the real-world. What are some potential weaknesses in validity that the author describes with regard to multi-agent systems and cellular automata?
b) The author highlights “dynamic feedback" as a key characteristic that computer simulation is good at modeling. Dynamic feedback is where some initial stimulus changes behavior, and then that change in behavior creates new stimuli which in turn cause further behavioral change. Give an example of a model that the author cites from Sociology that exhibits this characteristic. Come up with an example of a research question on a political science topic where the underlying system exhibits dynamic feedback.

Simulations of system dynamics help social scientists focus on global characteristics of social structures, and act almost as experiments where it would be infeasible or even unethical to impose a concept outcome. In the natural sciences and in economic studies, models are quantified and variables can be labeled with fixed values, while in the social sciences, systems dynamics cannot be explained with precise numerical values. The lack of quantification, among other issues lead to weaknesses in validity that can be described with respect to both mult-agent systems and cellular automata.

Multiagent systems have the goal of having simulations that can develop autonomous agents that can learn and adapt to the external world, and they can be used to model social interaction and formalize social roles. Multiagent simulation itself is based on individual behavior, though Moretti states that bounded rationality resulting from these applications is weaker than economic rationality because it includes limited knowledge and ability of the decision maker. Thus, more realistic theories of rationality need to be used when there is limited knowledge. Additionally, both aspects of psychological theories and knowledge need to be formalized to achieve greater validity.

Cellular automata are a type of multiagent system where agents have a specific position in a network and are homogenous in behavior and interaction. The goal of cellular automata is to verify properties of a social system and responses from individual behavior. Unlike multiagent systems, cellular automata formalizes behavior of each unit and its results from simulation are better understood because they are represented graphically. However, its validity depends on synchronous updating and spatial manipulation. Transition rules only need to modify some unites, and there needs to be a clearer way to define the neighborhood of a unit that each individual interacts with. Overall, both cellular automata and multiagent systems deal with

formulations of models in a set of established circumstances following a "what-if?" trend, and it does not produce results with empirical reality like classical experiments do.

The concept of dynamic feedback fits into this validity question a bit, because it alludes to the cyclic nature of behaviors in a system. "The validity of a simulation can be determined above all from the validity of the theory that the model is based on and from the validity of the computational tools making its definition possible." According to Moretti, feedback can only be analyzed if a study considers that changes can take place in a system over time. Further, an example she gives of this is with World Dynamics (Forrester, 1971) where a technological innovation could change the relationship between natural resources and population growth using a model undertaking a long-term simulation. She also speaks to our first issue with validity, discussing how a neighborhood can change over time or interactions taking place among those who aren't physically close to one another, like as it occurs with the use of social media.

Mutations and crossover help select best strategies to solve a problem or achieve a cultural transmission using some algorithm. An example I can provide of dynamic feedback using a political science research question is, what is the effect of single-family home zoning on a neighborhood? The initial stimulus is the zoning that limits buildings to single-family home, and a secondary, or resulting stimulus could result from changes in the neighborhood like building more schools in that area due to increased children living there because most single-family homes have children. That is a more environmental change, but an example with pure human behavior could be, what is the effect of police body cameras on police violence? Perhaps initial behavioral changes for police are to be more careful in general interactions and for people to feel safer and more confident in holding police accountable knowing they have a body cam on them. However, new stimuli created are more publicized recorded negative interactions with the police causing people to trust police even less and having more inter-community tension.