Assignment #3
Delores Tang
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Question 1

Sabrina Moretti (2002)'s paper mainly focuses on the application of computer simulation in the field of social sciences. Four types of simulation techniques-system dynamics, multiagent systems, cellular automata, and generic algorithm-were discussed in her paper, and their validities in explaining sociological theories are examined.

Among the four types of simulation, the multiagent system is frequently utilized in sociology and anthropology to investigate the interaction between individuals (represented in the system as "autonomous agents") and the external environment. One potential weakness of the multiagent system proposed in the paper was related to the concept of bounded rationality, a principle of microeconomics, that underlies all simulations based on multiagent systems. Bounded rationality is a less over-simplified assumption made by microeconomics that gives a greater level of validity to the multiagent system. However, it does not enable simulations to account for learning and adaptation of each agent, neither for other psychological forces such as emotions and motivations that could alter individual agents' behaviors outside of the systematic forces. Moreover, the author proposed another potential flaw of multiagent system-its assumption that all knowledge can be formalized. She recognized that these potential weaknesses could impede the use of simulations based on multiagent systems in accurately explaining and predicting real-life some situations and suggested that the framework would need to be extended for future research.

As for the cellular automata, Moretti pointed out that one limitation was the use of synchronous updating of states, suggesting that all cells in the system updated their states simultaneously. Because cellular automata is a technique of simulation that is heavily based on the graphical representation of cells, its simplicity is both an advantage and a weakness of its ability to explain real social processes as individuals in the real world do not make decisions simultaneously. Another limitation of cellular automata is also related to its reliance on graphical representations-its restrictions imposed by spatial structures. For example, in the agent-based model for segregation, it is usually assumed that the neighborhood of a given cell is the group of eight cells surrounding it. However, in the real world, it is unlikely that an individual defines his or her neighborhood based on the geographical location solely.

The author emphasized "dynamic feedback" as the key characteristic of computer simulation. Again, taking the phenomenon of racial segregation from sociology as an example. It is usually modeled using agent-based model, in which individual households are represented using agents. Researchers usually assign some attributes to agents such as their race and tolerance (defined by the ratio of other-race neighbors to same-race neighbors that one household could feel comfortable to stay) and rules for them (such as which agent moves the first in the system and how large the neighborhood area is) to move in the system. This simulation best describes the property of dynamic feedback because experimenters would change various initial attributes and rules, for instance, the level of tolerance, to study how the pattern of segregation would change after several rounds of simulation. In this case, each agent's change in moving behavior and moving locations could, in turn, modify their own behavior and that of other agents in the next round.

Another example coming from the field of political science could be related to the issue of climate change. For example, if the research question that I want to investigate is "to what extent a 10℉ rise in average global temperature could affect the popularities of two parties in an election?" I would have to first use voters as agents with different attributes (political ideology, beliefs, and attitudes about climate change, etc). Rise in global temperature would change those attributes correspondingly and, in turn, change themes of the two parties' political campaigns. These modifications in campaign contents would then alter voters' opinions about the two parties. Therefore, using simulation, I will be able to analyze how a change in average global temperature would affect political campaigns and voters' choices, as well as how the two factors interplay in this feedback process.