

Examining Leadership Dynamics in Agent Based Modeling Research Paper

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Abstract

The project attempts to explore leadership dynamics in Sugarscape. The goal is to discover which methods are most frequently used in group formation, which leadership traits form the best groups, and which traits are valuable in followers. This topic was not addressed entirely by Sugarscape, and thus is a good topic for a Syslab project. In addition, Sugarscape spends very little time on combat, and this project intends to fill this gap as well. Socio-economists and other members of the intelligista will be interested in the results.

Keywords: agent, Sugarscape, leadership, group dynamics, decentralized

1 Introduction

In the renowned Sugarscape simulation, one element was missing. The decentralized rise of leadership dynamics. This trend is prominent within the world's history, in nations such as the Holy Roman Empire during the 17th century, where a disjointed patchwork of nations conducted their own business with very little central interference. However, it is very hard to create leadership dynamics that remain decentralized, as the very presence of leadership often can lead to greater degrees of centralization in the simulation. This problem can be solved by treating groups as if they were agents; by

making the group attempt to gain as much wealth as possible. In addition, the loyalty of the group to its leader is partially determined by the wealth of the group, which prevents the leader from keeping perfect control over his followers, retaining decentralization at all levels.

The goal of the project is to implement these leadership dynamics into Sugarscape. The first step toward achieving this would be to implement more complete system of combat into Sugarscape. I chose to use combat because it offers a diverse array of traits that could be used to distinguish different leaders from each other. Physical Strength, Intelligence, Charisma, and Wealth are all heavily effected by combat and each has a purpose in the conduct of war. These four traits are also well-suited for groups and for leaders.

Strength has the most obvious effect on combat, it is the base component of fighting. Those with high strength are likely to have access to the most productive sugar areas through strength of arms (and gain wealth from dead enemies). This wealth can later allow them buy followers, or their strength can lead to their recruitment by a group.

Intelligence has little effect on fighting, however, combat proves as a balance for intelligence, which would dominate any other line of work. Intelligence instead determines vision and judgement of another's stats. This allows them to avoid stronger opponents while more efficiently harvesting sugar. If they become leaders, then their abilities are extremely useful, as they can direct a group to the proper conflicts and they know who to try and recruit.

Morale has a significant effect on combat, but not to the extent that strength does. Morale helps leaders increase the loyalty of their followers and prospective members. In addition, followers with high morale are more loyal to their leader.

Wealth is the food and the gold of the simulation. Agents covet it, gathering as much as they possibly can. Every action in Sugarscape is derived from the same desire; to gather more sugar. I do not inted to make leadership any different. Wealth shall be the measuring stick with which the followers judge their leader. The leader must make sure his followers are well fed and have a considerable amount of sugar, otherwise he risks desertion. Almost all agents request a tithe from the leader at every step, making Wealth, or the ability to gather Wealth, a crucial component of leadership. Free agents who have low sugar will seek out groups or other free agents with high Wealth, and attempt to join them. For this reason, Wealth can often be used to attract

followers.

Loyalty is the basis of groups. An agent joins a group because it is economically advantageous; the leader gains power while the agent gains wealth. Loyalty is based on the rate at which the follower's wealth is increasing, on the morale of the leader, and on the morale of the agent itself. The higher any of those variables is, the more loyal the follower is. The more loyal the follower is, the lower his stepply tithe. However, if the Loyalty gets low enough, the agent will leave the group. Not even the most charismatic leader can keep his followers when they are on the brink of starvation. The agent will always leave the group rather than starve.

2 Background

The premier project in this field is Sugarscape, which is the basis for this project. The main area of social science that Sugarscape did not cover was leader dynamics. In addition, the Sugarscape system of combat was far less complete and realistic than the other aspects of the project. This project attempts to address these shortcomings. While the project will incorporate an alteration of the Sugarscape method of combat initiation, the rest of the additions are wholly new. It will be necessary to implement common group theory, such as flocking, however, the rest of the project goals have not been covered from a decentralized prospective.

3 Shaving down Sugarscape

This project hopes to achieve these goals by altering a version of Sugarscape that was made on MASON for my project. However, the intent was to start simply, to use only sugar consumption and the aforementioned system of combat, but the MASON version came with the full trappings of the earlier project. Thus a considerable amount of time has been spent temporarily removing the extraneous features. This has been accomplished by commenting out all the variables and methods that are not needed in Agent.java and Sugarscape.java.

4 Combat

Development has been underway on a combat system for Sugarscape. The current model adds the Strength, the Morale divided by 2, and the Wealth by 4 in order to determine the winner. However, it is likely that this places too much importance on Morale and Wealth, two heavily influential traits as it is. It might be a sound idea to cut Morale out of the combat equation entirely, or at least halve its impact. As for Wealth, a slightly smaller modifier would be appropriate.

References

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