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Personality-Based Simulation For Cooperative Learning Interactions

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Abstract

Agent-based simulation models are very useful tools to study and understand the interactions between members of a group or between various groups in a simulated environment. The agents, which are the members of the group make decisions and interrelate with each other. In this paper, the researcher used the aforementioned tool to investigate the interaction of students in a cooperative group with varied personality traits based on Galen's temperament classification. A Cooperation Model is generated that simulates a scoring mechanism for different interactions between students in a group and consequently sums the scores to get a cooperation index. The indices are ranked to determine the optimum possible combination of students with various temperaments in a group for cooperative learning. The results suggest that a particular personality (phlegmatic) has a more favorable presence for a group to be successfully cooperating.

Keywords: Cooperative learning, personality, computational modeling

1 Introduction

As early as 1965, computer simulation was already a popular option for researchers and scientist to utilize in the study of organizations. However, despite the growing interest in the field there came a time of intellectual stagnation in its initial years brought about by skepticisms in its acceptability and purpose in social science research and development. It was only in these recent years that the revival for the association between computer simulation and organization theory and research saw its light of day. This can be accounted to two parallel trends. The first is towards a more relational, bottom-up understanding of organizations as ongoing processes arising out of individual and group decisions. The second trend, which is taking place within computer science, is toward representations based on interaction between ‘‘agents’’ rather than computation of variables. These models are available very naturally to social applications where artificial ‘‘agents’’ represent real social actors. [1]

Based upon the literature it is worth noting that models of computer simulation like the one in this paper are only good for replicating interactions between agents in an organization and not appropriate for data processing. The model only seeks to aid scientists and researchers in validating the implications of the hypotheses they are making in relation to their study problem. As stated by Fioretti, these models actually implement conceptual experiments on interactions between social

actors, a kind of mental exercise that can easily grow too intricate to be explored with the aid of paper and pencil. In addition, he said that organizational problems dealing with alliance, opposition, and alignment of individual actions and interests are likely to benefit from this sort of model, as well as all research problems dealing with inter-organizational relations. In particular, simulation of repeated interactions may open up insights on the emergence of organizational goals, organizational decision-making, and organizational intelligence out of relations between single actors.

Consequently, models of social and economic organizations based on the interaction between artificial agents are becoming more common.

2 Cooperative learning

Cooperative learning has been one of the most interesting and productive field in educational theory and research. According to learned educators and researchers, it exists when students work together to accomplish shared learning goals. [2] This means that the students in each team are responsible not only for learning the material being taught, but also for helping their teammates learn.

Cooperative learning, according to Oxford, pertains to specific set of classroom strategies that develop interdependence among learners leading to the development of their cognitive and social skills. She also stated that it is defined as "group learning activity organized so that learning is dependent on the socially structured exchange of information between learners in groups and in which each learner is held accountable for his or her own learning and is motivated to increase the learning of others". [3]

Another author implies that it is innate within the cooperative learning paradigm that since the members of the group perceive that their success is dependent upon their cooperation within the group, they would feel more motivated to help each other in achieving their goals for a collective victory. To achieve this, group members would be more open to give and receive assistance, resources and ideas. Consequently, group members who work in cooperative groups outperform students who work by themselves or in competition with each other. [4]

While the benefits that accrue to students from cooperative learning are unequivocal, it is also clear that just placing students in groups and expecting them to work together will not promote cooperation and learning. It is only when groups are structured so that students understand what they are expected to do and how they are expected to work together that, the potential for cooperation and learning is maximized. [5]

With the aid of an Agent-based simulation model, the researcher believes that some of the structuring concerns of cooperative learning could be addressed. By generating a cooperative model that illustrates how agents interact with each other within a group and how each individual interaction affects the overall success of the organization, teachers and class administrators would have a tool within their disposal to create a learning environment and a group dynamic that would be most effective for student learning. This step before any cooperative learning strategy implementation can be very pivotal.

3 Personality

People have different learning styles that are reflected in different academic strengths, weaknesses, skills, and interests. Students with different type preferences tend to respond differently to different modes of instruction. For instance, extraverts like working in settings that provide for activity and group work; introverts prefer settings that provide opportunities for internal processing.

Understanding learning style differences is thus an important step in designing balanced instruction that is effective for all students. [6]

The concept of personality is mainly a formal and social image that is created based on the role played by an individual in a society. There are different definitions for personality, each of which emphasizes certain aspects. The oldest typological classification for personality is attributed to Hippocrates and Galen, the ancient Greek scholars. Galen believed that people, due to domination of each of these four humors would have choleric, sanguine, phlegmatic or melancholic temperament. [7]. According to Galen, each of these humors has its own specific characteristics. Choleric people are fierce-tempered, easily angered, ambitious, domineering, jealous and resolute. People with sanguine temperament are pleasure seekers, optimistic, active and superficial. Phlegmatic people are sociable and calm. People with melancholic temperament are anxious, pessimistic, and hyperactive, but irresolute and without endurance. [8]

It is, therefore, the interest of the researcher for this particular study to structure the individual groups of the students in a cooperative learning environment in terms of the individual personality traits or temperaments of the agents.

4 The Model

This project investigates the interactions of agents with different personalities based on Galen's temperaments by proposing a Cooperation Model, that can simulate a scoring mechanism for different interactions within a group.

The model relies on a large knowledge base from the social sciences and understanding of personality traits and temperaments, which offers concepts, descriptions, and classifications that guided the interaction scoring process. The simulation of nonverbal social interaction and group dynamics in a virtual environment was conducted through:

(1) an action selection problem, where autonomous agents were made capable of interacting with other agents within the group according to individual characteristics of themselves and others;

(2) a program that (a) scores these individual interactions within the group and summing them up for a group cooperation index (b) and inherently ranks these indices to select the best combination/s of these agents within the group.

In this cooperation model only four types of agents corresponding to the Four Classifications of temperament according to Galen are considered. The temperaments namely Choleric, Sanguine, Phlegmatic and Melancholic would be coded, 1,2,3, and 4 respectively.

The agents within the group of varied numbers from four to fifteen (4-15) are allowed to interact with all the other members of the group (itself being an exception). Every interaction would be scored accordingly depending on the temperament types interacting as stated below. The scoring is based on previously established references on the different temperaments and how they would interact with each other.

Summation of scores of all member interactions within the group is computed and group combinations are ranked subsequently based on the summed scores. The highest scoring combination for each group size is tabulated and the number of each temperament present tallied. For group size having more than one highest scoring combination, an average of the temperament tally is computed and tabulated.

To determine which particular temperament is predominantly favored within the top scoring (successfully interacting) group, an average of the temperament tally is computed across all group size and the one with the highest average is picked.

The scoring for each interaction is as follows:
(1,1) = 1.0 (Choleric to Choleric)
(2,2) = 2.0 (Sanguine to Sanguine)
(3,3) = 2.0 (Phlegmatic to Phlegmatic)
(4,4) = 1.0 (Melancholic to Melancholic)

(1,2) (2,1) = 4.0 (Choleric to Sanguine)
(1,3) (3,1) = 3.0 (Choleric to Phlegmatic)
(1,4) (4,1) = 3.0 (Choleric to Melancholic)
(2,3) (3,2) = 4.0 (Sanguine to Phlegmatic)
(2,4) (4,2) = 4.0 (Sanguine to Melancholic)
(3,4) (4,3) = 5.0 (Phlegmatic to Melancholic)

4 Results

The following are the top interaction scores for each group size from 4-15 members. Table 1 shows the scores of the combinations with the highest values for each group size and the corresponding tally of temperaments. The last column in the table gives the 'α' value or the "interaction index" of the group combination. It is computed by taking the ration of the score and square of the group size. However, it can be seen from Table 1 that temperament 1 (choleric) is not represented in any of the top scoring combinations. To address this possible misrepresentation of a specific temperament in a real-life organizational setting, we created Table 2. This table depicts the scores of the all-inclusive combinations with the highest value.

Table 1: Top Score Combination

# of Agents	Score	Ratio				α
		1	2	3	4	
4	48	0	1	2	1	3.0
5	78	0	1	2	2	3.1
6	114	0	1	1.67	1.33	3.2
7	158	0	2	3	2	3.2
8	208	0	2	3	3	3.3
9	266	0	2	4	3	3.3
10	330	0	3	4	3	3.3
11	400	0	2.67	4.67	3.67	3.3
12	480	0	3	5	4	3.3
13	564	0	3.5	5.5	4	3.3
14	656	0	3.5	6	4.5	3.3
15	756	0	4	6	5	3.4
Average		**0**	**2.39**	**3.90**	**3.04**	**3.25**

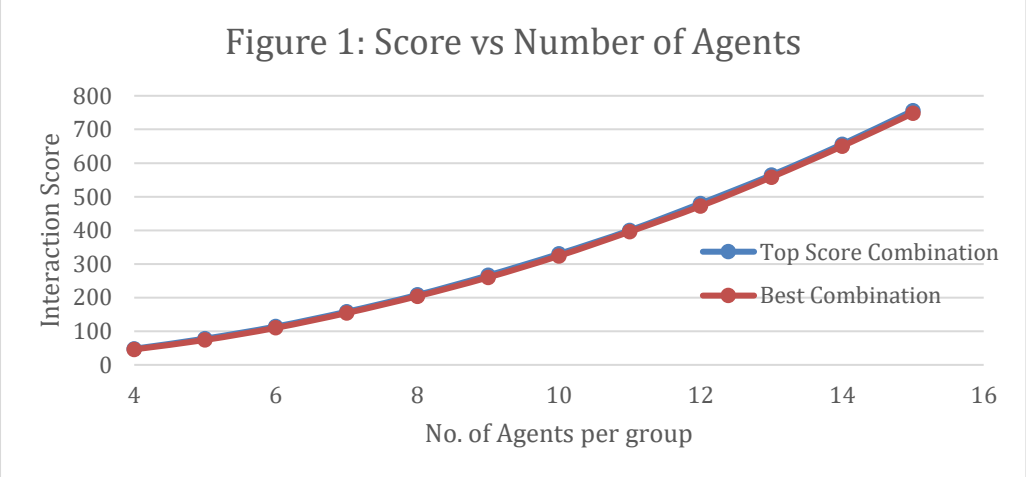
Results show that for the Top Score Combinations, the ratio of the tallies for choleric, sanguine, phlegmatic and melancholic is 0:2.39:3.9:3.04 respectively. This implies that, we have a: (0:1:2:1) ratio of temperaments and a mean cooperation index of 3.25. It can be inferred, that

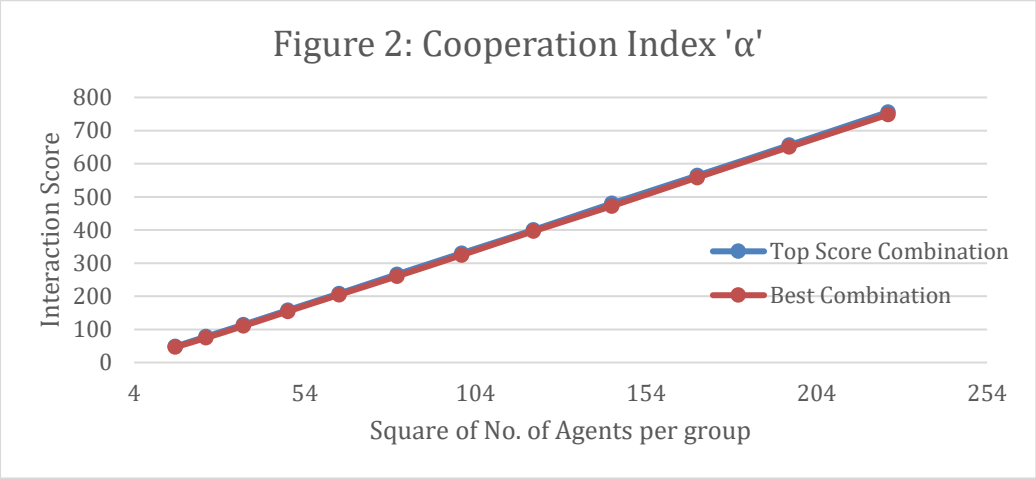
according to this model, the most cooperative group is more likely to favor phlegmatic than choleric members. In fact, no choleric temperament is present in any of top scoring combinations.

Table 2: Best Combination (All Represented)

# of Agents	Score	Ratio				α
		1	2	3	4	
4	46	1	1	1	1	2.9
5	74	1	1.5	1.5	1	3.0
6	110	1	1.5	2	1.5	3.1
7	154	1	2	2	2	3.1
8	204	1	2	3	2	3.2
9	260	1	2.5	3	2.5	3.2
10	324	1	2.5	3.5	3	3.2
11	396	1	3	4	3	3.3
12	472	1	3.33	4.33	3.33	3.3
13	558	1	3	5	4	3.3
14	650	1	4	5	4	3.3
15	748	1	4	6	4	3.3
Average		**1**	**2.43**	**3.36**	**2.41**	**3.18**

Table2 on the other hand, shows the scores for the All-inclusive Combinations, where the ratio of the tallies for choleric, sanguine, phlegmatic and melancholic is 1:2.43:3.36:2.41 respectively. In its simplest form, the ratio of temperament then is (1:2:3:2) and the mean alpha value is 3.18. Same as the previous results, the cooperation model also favors the phlegmatic temperament more than the other personality traits. The similarity in the trend between Top Score combinations and Best Combination (All-inclusive) is also depicted in Figure 1 and Figure 2.





5 Conclusion and Outlook

A Cooperation Model has been developed that investigates and quantifies the cooperative index of a specific number of agents within a group. For this specific model, it has been found that agents who are phlegmatic by nature occur in greater number in the top combinations compared to the other three. This may indicate a more favorable presence of this type of personality for a group to be successfully cooperating. On the other hand, choleric agents are the least observed occurring in the top combinations. According to the model a top performing group in terms of cooperation would have a ratio of (0:1:2:1). But for an all inclusive personality, the top performing group should have an agent ratio of (1:2:3:2).

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