Ethnocentrism Model Construction

Final Report

Lihang Tian 975404

Mayank Sharma 936970

Yuanlong Zhang 772312

1497 words

# Background of the Model

Corporation - is a wired topic in our society. It happens everywhere among all groups from, human to animals. But why do we want to cooperate if there is a cost? The purpose of this model is to investigate how ethnocentric behaviour can be evolved by using a faster computational model which can simulate this behaviour.

In NetLogo's model, we are trying to understand the ethnocentric behaviour among the population of individuals and how different factors can affect the ethnocentric behaviour of the population. The factors include the corporation cost, the cognitive requirements and the absence of other complex social mechanisms.

# Design of our model

Each agent will be put on the world which is a 50x50 toroidal grid and has the PTR and three traits: 1, colour 2, whether they cooperate with same coloured agents 3, whether they cooperate with different agents.

There will always be four different agent strategies: 1, always cooperate linked to Altruism in real world 2, always not corporate linked to egoist in real world 3, only corporate with same coloured agents linked to cosmopolitan in real world 4, only corporate with different coloured agents linked to Ethnocentrism in the real world.

Each agent appears at a random location based on the number of IMMIGRANTS-PER-DAY with random traits. Agents start with the property INITIAL-PTR chance of reproducing. In one round, each agent will interact with Von Neumann neighbourhoods (left, right, up, down) and choose a corporation or not based on their strategies. Each adjacent pair tries to reproduce randomly based on the prisoner’s dilemma. MUTATION-RATE is applied to indicate how much the offspring has mutated. The child of an agent will be put in an empty cell in its Von Neumann neighbourhoods and will not be reproduced if there are no empty cells around its parent. In the end, the DEATH-RATE decides the probability of an agent dying freeing space for other agents and offsprings.

In the java program, the most basic moving unit, "Agent.java", has some properties and strategies that it uses to interact with different agents. The "Simulator.java" controls the agents based on some constant variables. A final statistical data of one simulation can be extracted from "Board.java". The parameter setting of different experiments is put in the “Config.java”.

# Extension

In reproducing our initial model, the child is only allowed to be placed in the Von Neumann neighbourhood (left, right, up, down) of its parent so that the children will be all around the parents, which finally lead to the ethnocentric behaviour in the default settings. However, in the real world, the offSprings of an agent is not necessary to be nearby.

In order to make the simulation closer to the real world, we add the new parameters into our model - CHILD\_DISTANCE. This variable allows the agent to have its new offsprings within the radium of the value of CHILD\_DISTANCE. No longer restricting the child surround.

When the agent is reproducing,

1. SET CHILD\_DISTANCE
2. Draw the square that the centre of the square is the position of the agent and the half of square’s side length equals to CHILD\_DISTANCE.
3. Reproduce the child in a random empty place within the range of square.

With the mention of CHILD\_DISTANCE, we could decrease the effect to the ethnocentrism brought by clones closing to the agent and decide the ethnocentrism arise more purely with local interactions.

# Results of Experiments on Simple Model

In the beginning, we will make the experiments with the initial parameters setting:

costGiving = 0.01, gainReceiving = 0.03, initialPTR = 0.12, mutationRate = 0.005, deathRate = 0.10, ImmigratePerDay = 1, roundNum = 2000, latticeSize = 50, Chance of coping same = 0.50, Chance of coping different = 0.50.

We have run each experiment 3 times for both NetLogo and our model and evaluated the average to obtain a more consistent value that could be compared easily and reduce the distribution that exists due to randomness.

For the extension, we conducted only one experiment with the same default settings to understand and evaluate its credibility and how well it works with our designed model. CHILD\_DISTANCE will be 2 in the default setting which means the child could be put in an empty cell from 8 positions around its parent.

The results of NetLogo’s model, our simple model and our model with extension are shown below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Average Altruists Ratio | Average Egoist Ratio | Average Cosmopolitan Ratio | Average Ethnocentric Ratio |
| NetLogo | 0.1667 | 0.067 | 0.0267 | 0.7333 |
| Our Model | 0.1223 | 0.0313 | 0.0230 | 0.8233 |
| Our Model with Extension keeping child distance = 2 | 0.0617 | 0.1157 | 0.0593 | 0.7637 |

**Experiment 1**

To determine if ethnocentrism dominates the world or still exists under a single parameter change.

Keep other parameters the same as the initial setting and change one parameter in each experiment.

The results of all experiment are listed below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Average Altruists Ratio | Average Egoist Ratio | Average Cosmopolitan Ratio | Average Ethnocentric Ratio |
| **When mutationRate = 0.305** | | | | |
| NetLogo | 0.2433 | 0.2433 | 0.2567 | 0.2567 |
| Our Model | 0.2413 | 0.3063 | 0.1537 | 0.2983 |
| **When deathRate = 0.15** | | | | |
| NetLogo | 0.2833 | 0.2067 | 0.2133 | 0.2967 |
| Our Model | 0.2597 | 0.2801 | 0.2063 | 0.2530 |
| **When immigratePerDay = 88** | | | | |
| NetLogo | 0.2300 | 0.2667 | 0.2233 | 0.2733 |
| Our Model | 0.2397 | 0.2663 | 0.2327 | 0.2617 |
| **When initialPTR = 0.03** | | | | |
| NetLogo | 0.2533 | 0.2167 | 0.2200 | 0.3367 |
| Our Model | 0.2167 | 0.2863 | 0.2490 | 0.2483 |

**Experiment 2**

To determine how related parameters changed, affect the ethnocentrism.

Keep other parameters the same and adjust related parameters at the same time in each experiment.

The results of all experiment are listed below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Average Altruists Ratio | Average Egoist Ratio | Average Cosmopolitan Ratio | Average Ethnocentric Ratio |
| **When costGiving = 1, gainReceiving = 0** | | | | |
| NetLogo | 0.0723 | 0.8067 | 0.1667 | 0.0083 |
| Our Model | 0.1930 | 0.3290 | 0.2687 | 0.2090 |
| **When mutationRate = 0, costGiving = 0, gainReceiving = 1** | | | | |
| NetLogo | 0.0633 | 0.0057 | 0.0057 | 0.9233 |
| Our Model | 0.1823 | 0.0077 | 0.0057 | 0.8037 |

# Discussion of the result of experiments

**Discussion of Experiment 1** : (The behaviour of a **single** parameter change)

Keep other parameters the same and changing one parameter:

1. mutationRate > 0.12
2. deathRate > 0.10
3. immigratePerDay > 70
4. initialPTR <= 0.05

Our Hypothesis: Based on the NetLogo Behaviour, ethnocentric behaviour should dominate simulation space.

Conclusion: Our model follows a similar trend to the NetLogo model under all conditions. As evident by our results, it is clear that ethnocentrism exists in all cases. However, ethnocentric behaviour fails to dominate under all cases. Unlike the NetLogo model, ethnocentrism in our model is usually suppressed by other behaviours by a minute margin. We believe that it could be the differences in the model environment and the NetLogo Environment that could be the cause of the difference. Other reason could be that we only ran each experiment 3 times and therefore we might not have obtained a more consistent result. One solution could be to run each experiment more times (around 100) to obtain more precise values.

**Discussion of Experiment 2** : (The behaviour of **related** parameter change)

Keep other parameters the same and adjust related parameters at the same time:

1. When costGiving = 1, gainReceiving = 0
2. When mutationRate = 0, costGiving = 0

Our Hypothesis: Based on the NetLogo Behaviour, ethnocentrism will not exist in the first situation and will be maximum in the second situation.

Conclusion: Our model follows a similar trend to the NetLogo model under multiple variable changes. The extreme value of costGiving and gainReceiving decide the existence and maximum value of ethnocentrism. MutationRate would affect ethnocentrism the most. However, we obtained a more similar value for all different behaviours when **costGiving = 1 and gainReceiving = 0.** The reason for this behaviour is that in our model, an agent only gives if it can afford to give in the first place. If it cannot afford to give, it would not give and hence we obtained a more natural growth. In the NetLogo case, each agent is giving as much as they can regardless of whether they can afford or not. Hence, there is a greater variety of values among the behaviours.

**Discussion of extension**

After adding the extension, the dominant power of the domination strategy is decreased slightly. We guess this means when the offsprings are more distributed other than grouping closely will increase the chance of interaction with different strategy groups, which in the end decrease the dominant power.

Conclusion: In the real world when the offspring is not closely surrounding the parent agency, the dominant power will be weakened.

Few possible explanations for the issue: “Sometimes in our models, the result has a tiny gap about 5~10% difference between NetLogo’s”

1. The NetLogo is using a slightly different formula to calculate the result, which may normalize the results.
2. We have some slight misconceptions regarding the true model.

# Appendix

## Bibliography

1. Wilensky, U. (2003). NetLogo Ethnocentrism model.[http://ccl.northwestern.edu/netlogo/models/Ethnocentrism.](http://ccl.northwestern.edu/netlogo/models/Ethnocentrism) Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.
2. Wilensky, U. (1999). NetLogo. [http://ccl.northwestern.edu/netlogo/.](http://ccl.northwestern.edu/netlogo/) Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.
3. Robert Axelrod and Ross A. Hammond (2003). The Evolution of Ethnocentric Behavior, *Midwest Political Science Convention*, Chicago, IL.
4. Hammond, R. and Axelrod, R. (2006). The Evolution of Ethnocentrism. *Journal of Conflict Resolution*, 50(6), pp.926-936.
5. Bausch, A. (2014). The Geography of Ethnocentrism. *Journal of Conflict Resolution*, 59(3), pp.510-527.
6. A. W. Bausch, "The geography of ethnocentrism," *Journal of Conflict Resolution,* vol. 59, no. 3, pp. 510-527, 2015.

# TeamWork and Challenges

## Success

The team members were all cooperative and were working time to time according to the schedule. All contributed equally and attended all the meetings in order to build a successful model and conduct accurate experimentation with the model. Each and every team member provided a sound discussion and also valuable feedback in order to build a reliable complex system.

## Challenges

### Original Plan

We did face challenges in following the original plan. The original plan was to follow divide the coding of the system into 3 members and then work on the experimentation and the extension. However, due to the delay by the reproduction bug, we had to reorganise the plan.

### Modified Plan

We decided to assign the coding part to one person of the team, Yuanlong, to resolve the bug. The other 2 members, Mayank and Lihang decided to research on the extension until the bug gets resolved. Once the bug was resolved. Once the bug was resolved, Yuanlong began to code for the extension and resolve further minor bugs while the others worked on the experimentation to validate the model.

With the change in the strategy, we were able to complete the work on time and were able to obtain credible results.

## Group Contribution Feedback

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Critera1 | Critera2 | Critera3 | Critera4 | Critera5 |
| Yuanlong | 3 | 3 | 3 | 3 | 3 |
| Mayank | 3 | 3 | 3 | 3 | 3 |
| Lihang | 3 | 3 | 3 | 3 | 3 |