Rebellion Project

How can the government model the behaviour of rebel people in a city?

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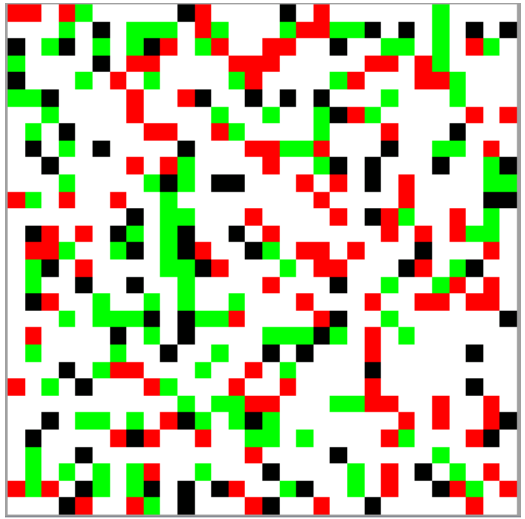
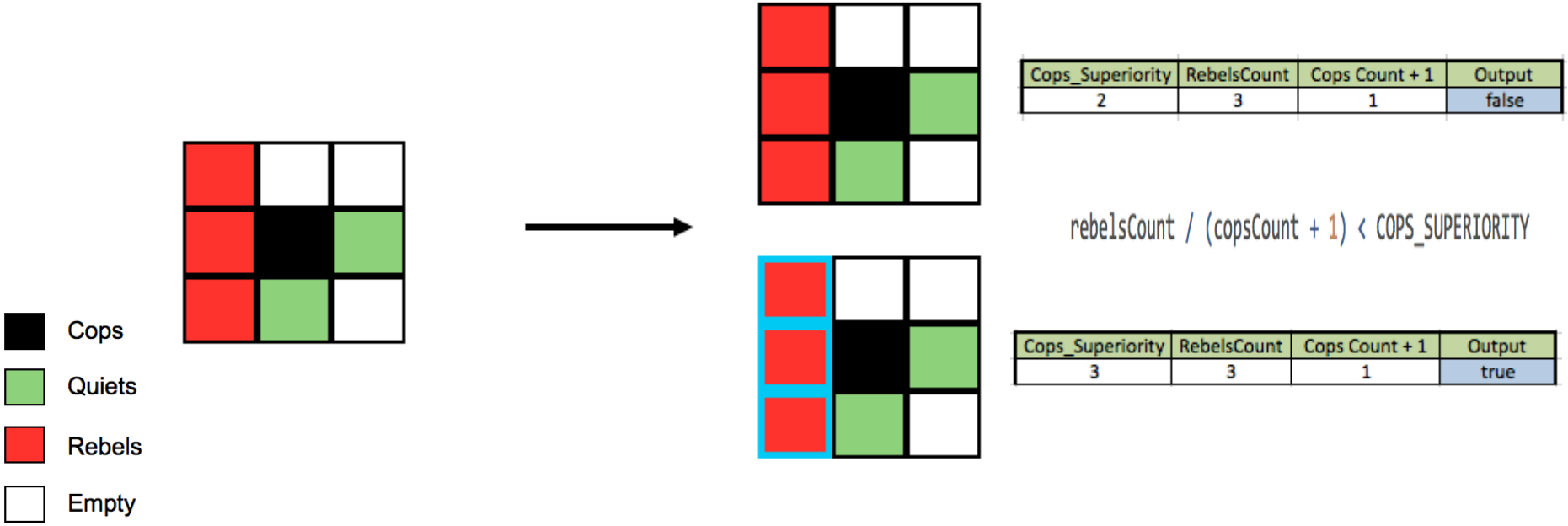
How it works

- There are two types of agents in the model:
  - Cops
  - Persons
    - Quite
    - Rebel
    - Jailed
- And:
  - Empty cells



Behaviours: cops

- Each cop moves randomly around the world each turn unless there is not cop superiority in his neighborhood (he stays in a zone likely to become a conflictive one).



Cops_Superiority	RebelsCount	Cops Count + 1	Output
2	3	1	false

`rebelsCount / (copsCount + 1) < COPS_SUPERIORITY`

Cops_Superiority	RebelsCount	Cops Count + 1	Output
3	3	1	true

Behaviours: cops

- In order to imprison a rebel.
  a. There must be cops superiority.
  b. If this is the case, the cop will choose one of the rebels
  c. He decides whether to send the rebel to the jail or not based on his own tolerance.
  d. If the rebel is imprisoned, the police will move to the cell the jailed rebel was in.

Behaviours: cops

1. There must be cops superiority.

```
if rebelsCount / (copsCount + 1) <= COPS_SUPERIORITY then
```

Cops_Superiority	RebelsCount	Cops Count + 1	Output
1	0	1	true
1	1	2	true
1	2	3	true
1	3	4	true

Cops_Superiority	RebelsCount	Cops Count + 1	Output
1	7	4	false
1	6	5	false
1	5	6	true
1	4	7	true

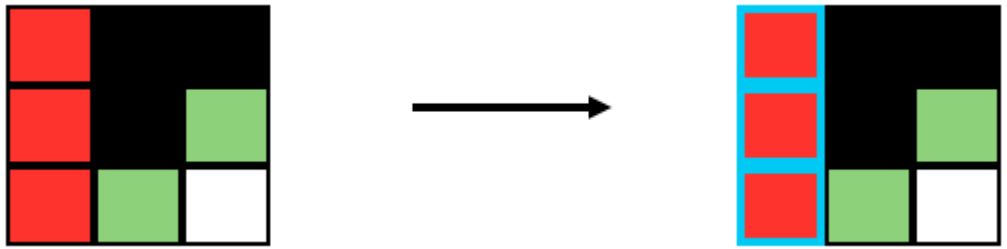
Cops_Superiority	RebelsCount	Cops Count + 1	Output
2	9	2	false
2	8	3	false
2	7	4	true
2	6	5	true

Behaviours: cops

①

Cops_Superiority	RebelsCount	Cops Count + 1	Output
2	3	3	true

2. If this is the case, the cop will choose one of the rebels



If there are no rebels in the neighborhood, cop move randomly to a free space.

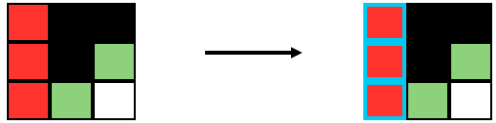
Cops
Quiets
Rebels
Empty

Behaviours: cops

①

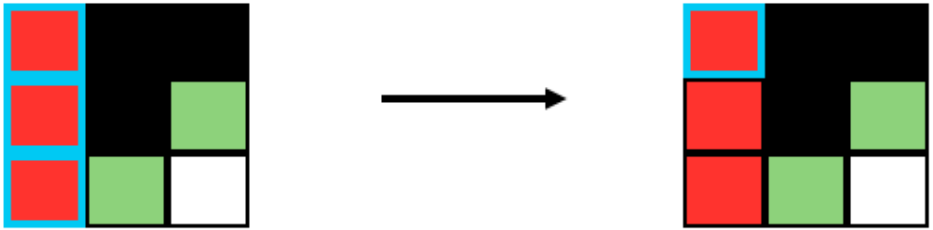
Cops_Superiority	RebelsCount	Cops Count + 1	Output
2	3	3	true

②

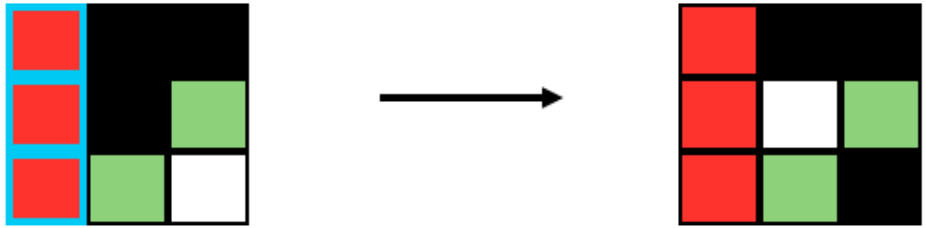


3. He decides whether to send the rebel to the jail or not based on his own tolerance.

If randNumTolerance < copAgent.tolerance then



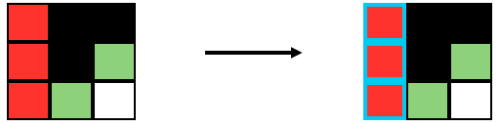
If not

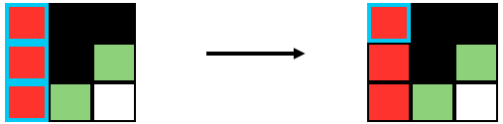


Behaviours: cops

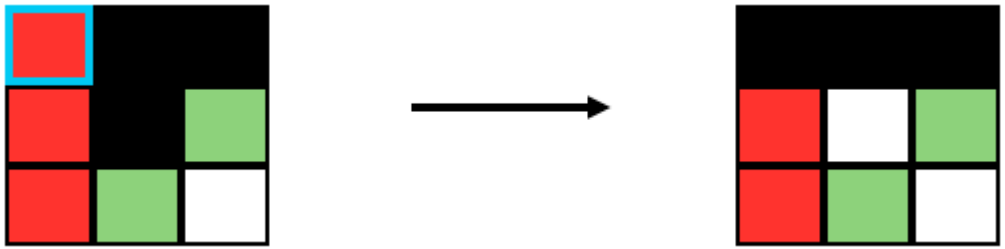
①

Cops_Superiority	RebelsCount	Cops Count + 1	Output
2	3	3	true

② 

③ 

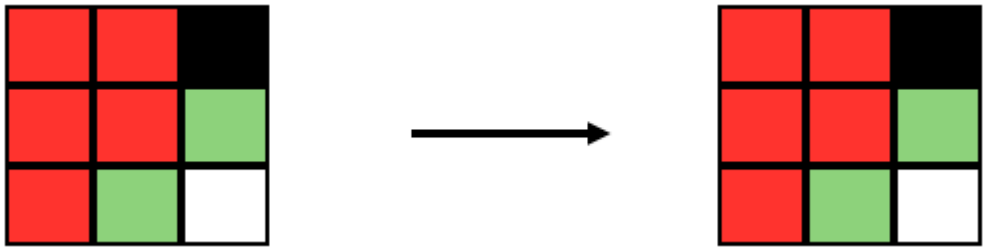
4. If the rebel is imprisoned, the police will move to the cell the jailed rebel was in.



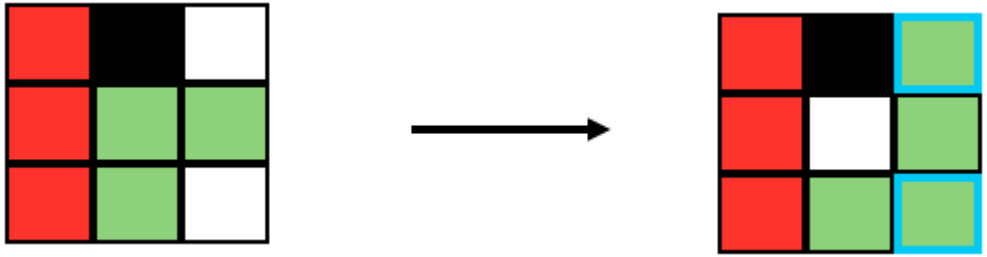
Behaviours: person

- Each person in the model will randomly move in the world unless in its neighborhood there are enough homologs.

  If the homologs are majority (more than half) in the neighborhood:



If not



Behaviours: person (rebel and quiet)

- A quite person can become rebel and vice versa, depending on whether the following expression is true:

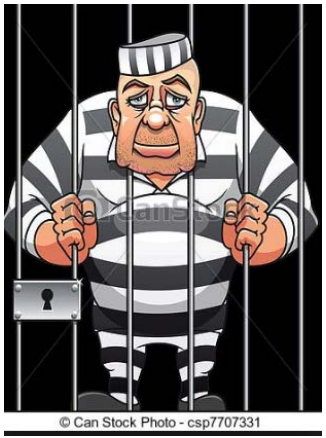
```
if (agent.grievance - agent.riskAversion * arrestProbability) > REBELLING_THRESHOLD then
```

Grievance

Risk Aversion

Random number (0,1) per each people

Arrest probability



if num of active people > num of cops then 0%, else 99%

THRESHOLD = 0.1

Behaviours: person (rebel and quiet)

- Grievance

```
agent.grievance = rand:number(0,1) * (1 - GOVERNMENT_LEGITIMACY)
-- rand:number(0,1) is perceivedHardship
```

Perceived hardship

Government legitimacy

Behaviours: states of person

- Statements:

Quiet

Rebel

Jailed

(number of the days decided by cop)

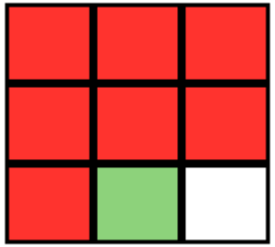
Statistics

- In the world certain statistical values are kept:

Neighborhood:

Quiet

Rebel



Police

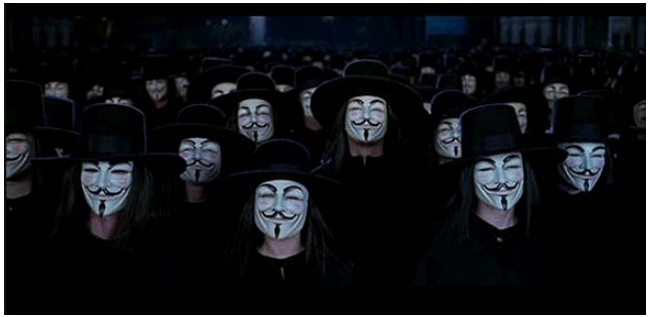
Statistics

- In the world certain statistical values are kept:

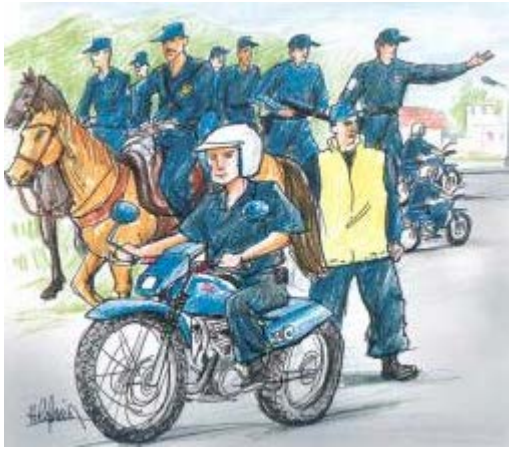
Situations:

Utopic

Rebellion



Repressive



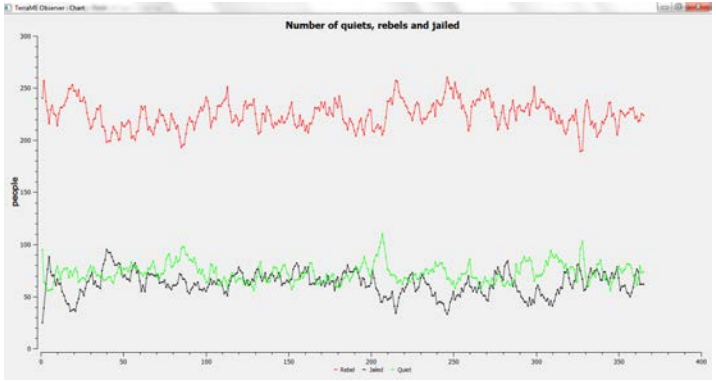
The amount of neighbourhoods in each state should be bigger than a given threshold

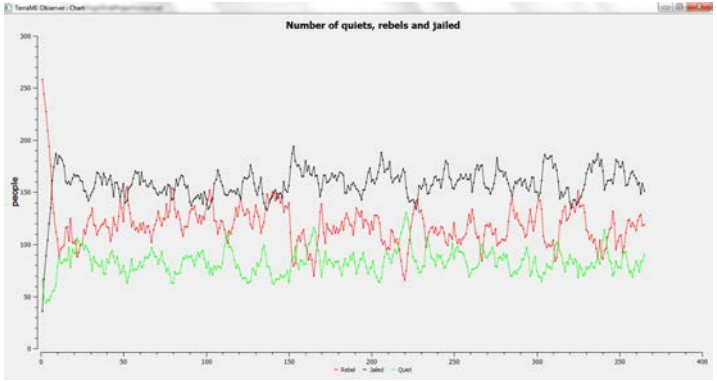
Parameters: Others

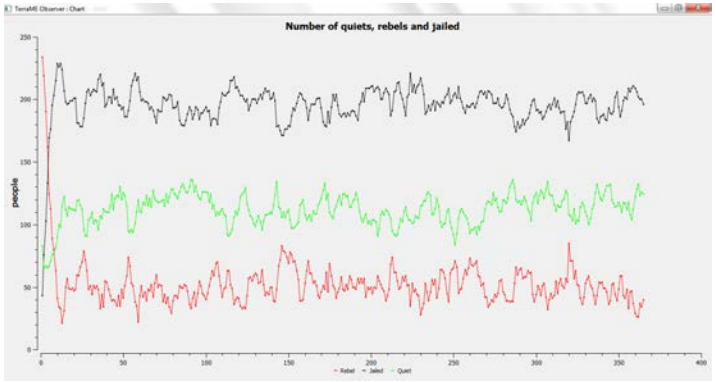
- Jail Time
- Government Legitimacy
- Neighborhood size
- World size
- Cops and people density
- Initial proportion of rebels to people
- Cops superiority

Parameters: Jail Time

- Effect on amount of agents, for values 5, 10 and 20

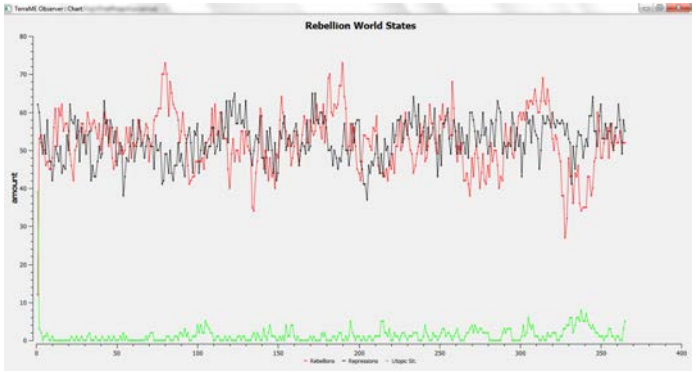


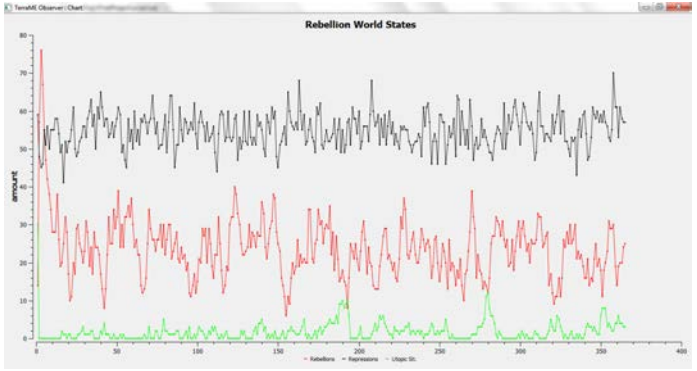


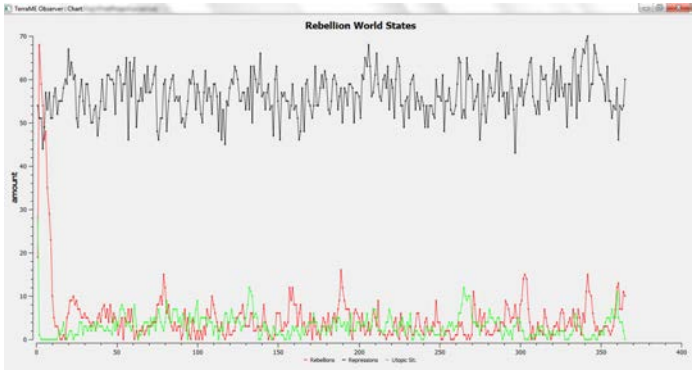


Parameters: Jail Time

- Effect on amount of world states, for values 5, 10 and 20

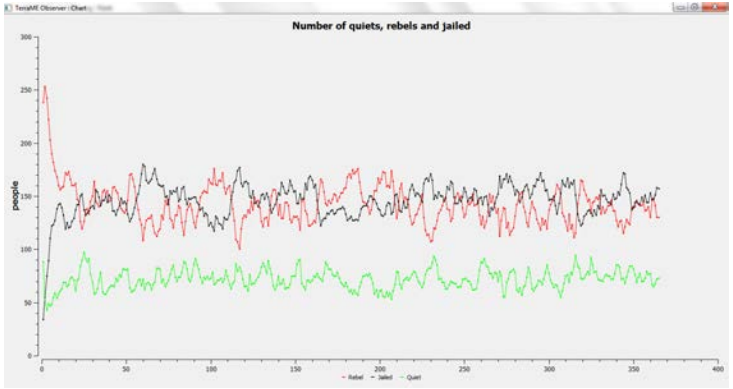


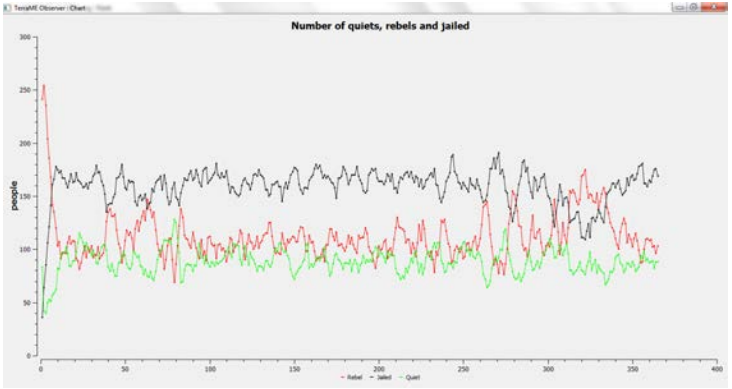


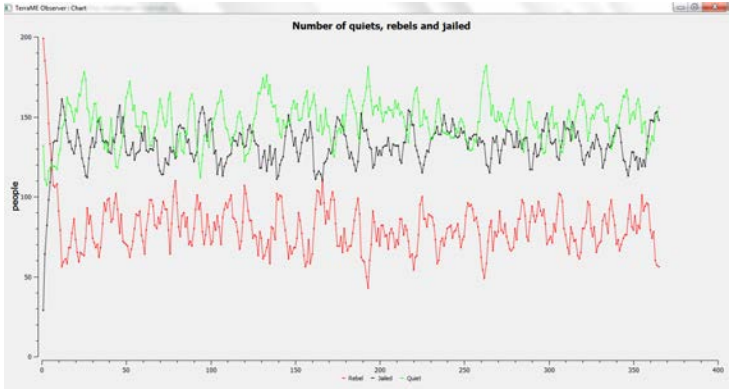


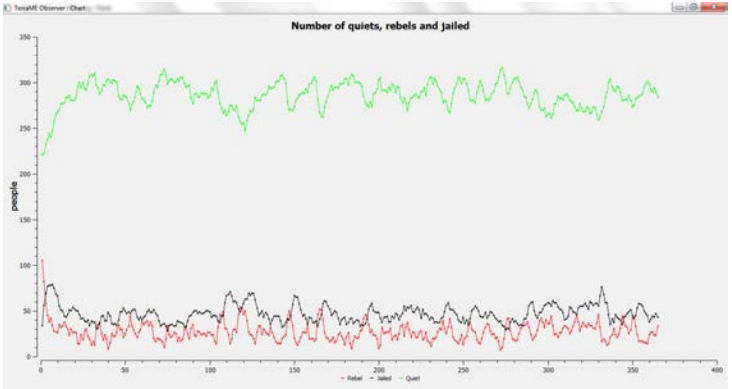
Parameters: Goverment Legitimacy

- Effect on amount of agents, for values 0.05, 0.25, 0.50 and 0.80



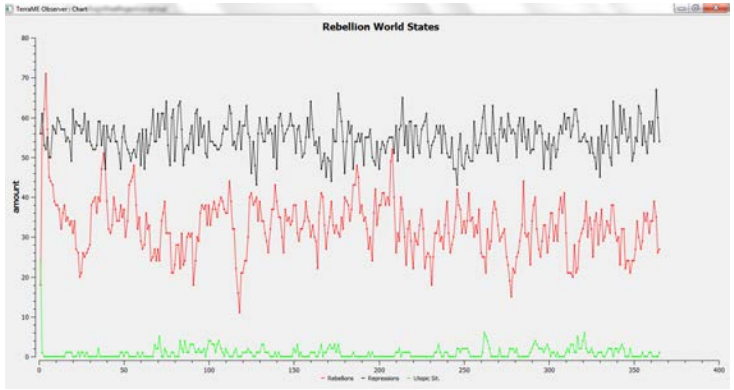


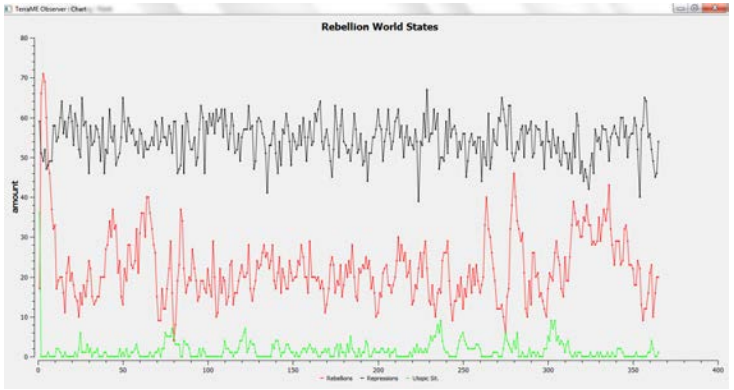


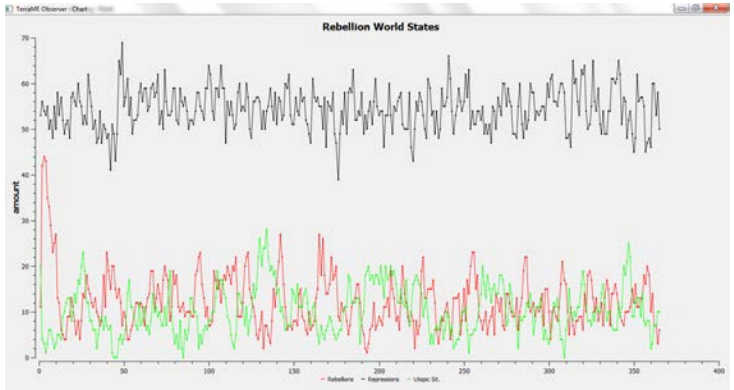


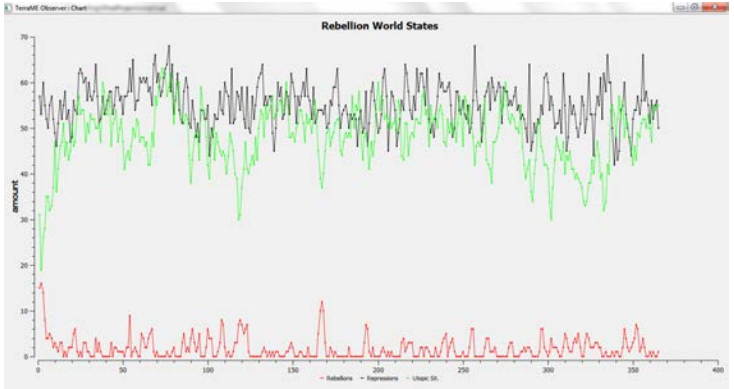
Parameters: Goverment Legitimacy

- Effect on amount of world states, for values 0.05, 0.25, 0.50 and 0.80



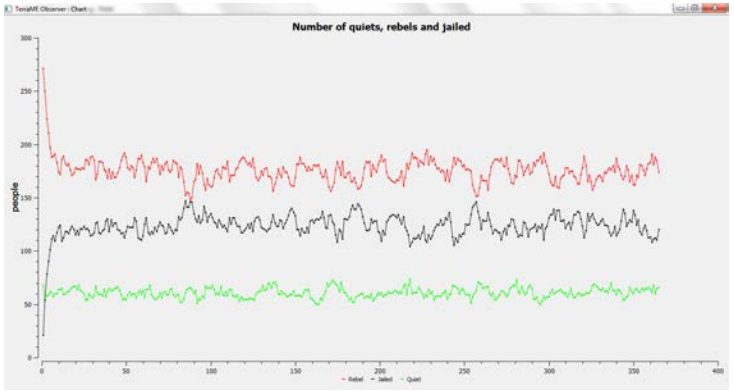


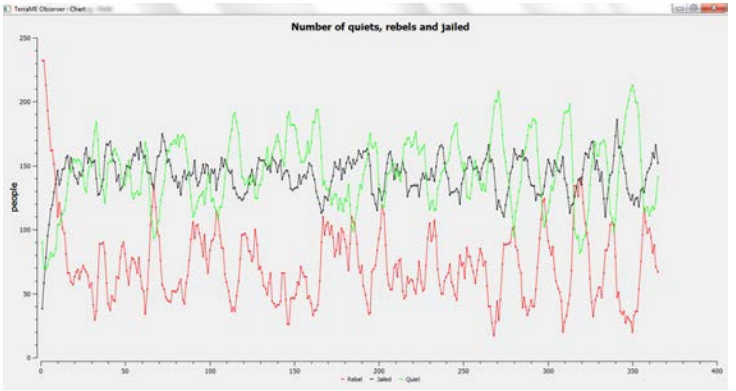


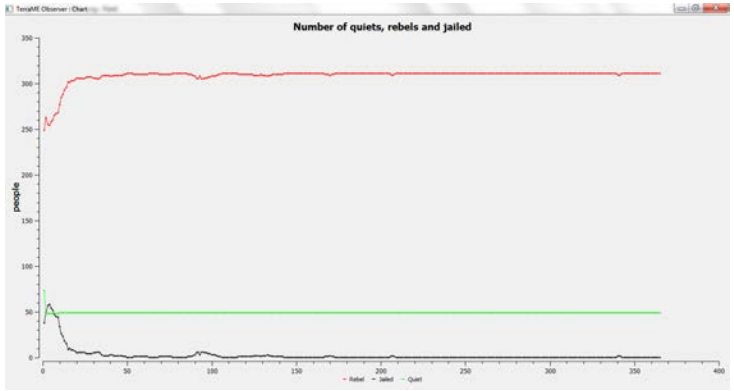


Parameters: Neighborhood size

- Effect on amount of agents, for values 3, 7 and 11

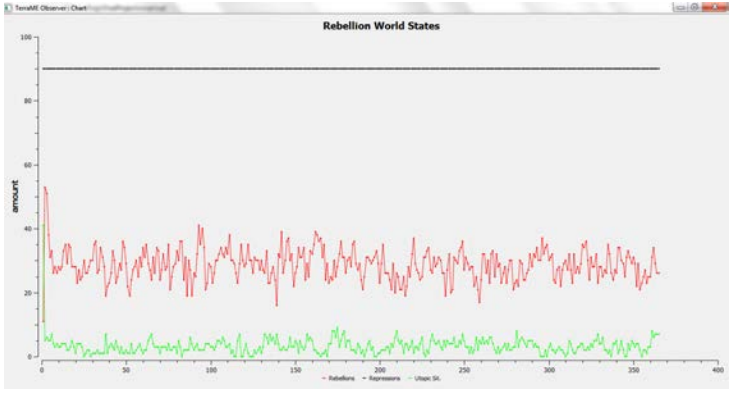


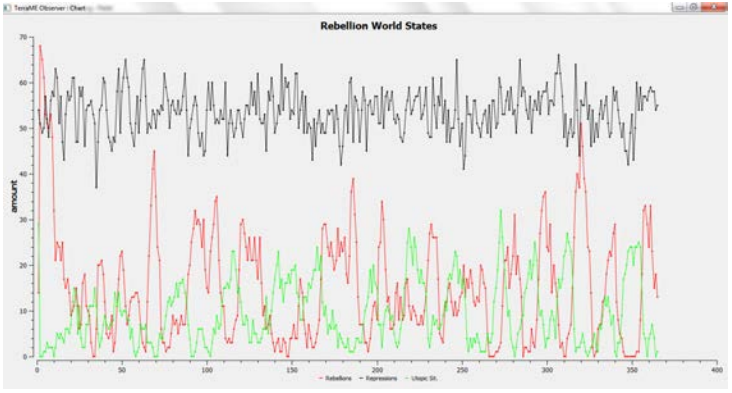


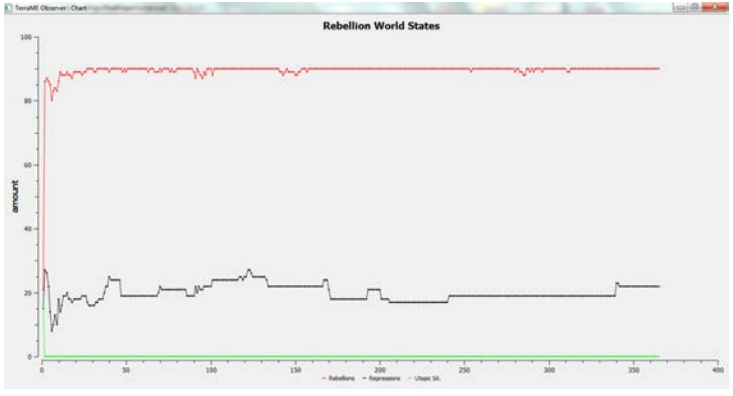


Parameters: Neighborhood size

- Effect on amount of world states, for values 3, 7 and 11







DEMO

Conclusion

- This model can be useful to have an approximation of the behaviour of the different agents in a city for the city council.
- The model is flexible (several parameters) in order to represent as much as possible the real world.
- Different agents are defined from Joshua Epstein's model of civil violence (2002) and extended to better fit the real world.
- Time in jail, government legitimacy and neighborhood size are parameter quite important.