Rebellion Project

How can the government model the behaviour of rebel people in a city?
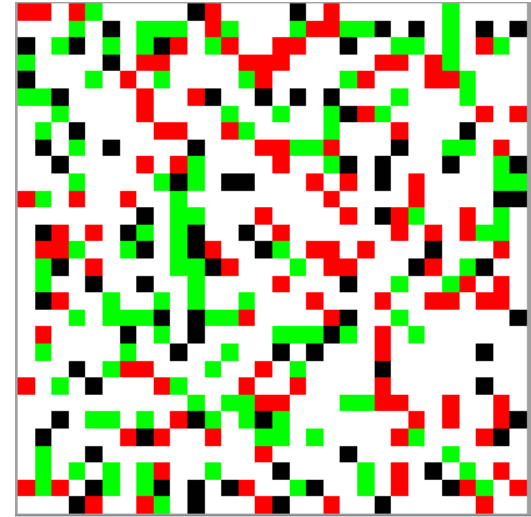
Germán Mendoza and Albert Acedo

How it works

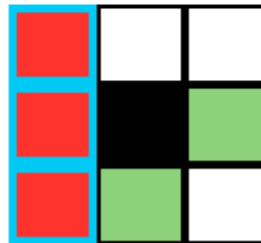- There are two types of agents in the model:
  - Cops ■

  - People
    - 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

- **Cops** (black)
- **Quiets** (green)
- **Rebels** (red)
- **Empty** (white)

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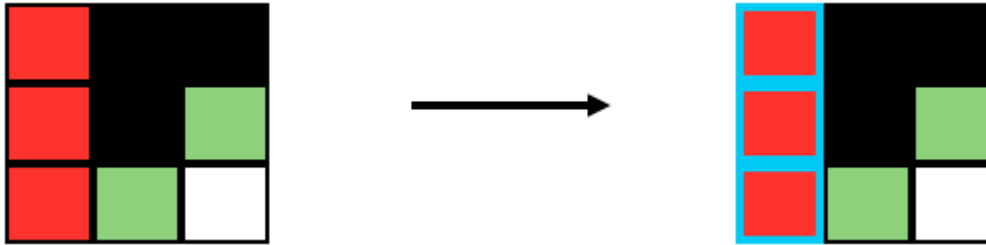
Cops_Superiority	RebelsCount	Cops Count + 1	Output
1	0	1	true
1	1	2	true
1	2	3	true
1	3	4	true

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

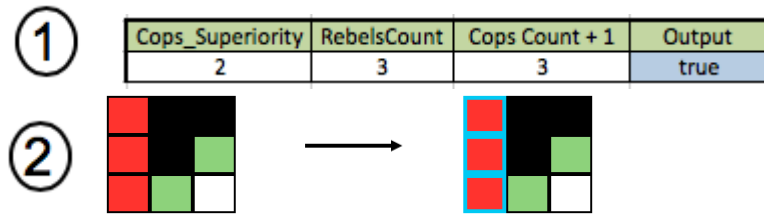| Cops_Superiority	RebelsCount	Cops Count + 1	Output
2	9	2	false
2	8	3	false
2	7	4	true
2	6	5	true

Behaviours: cops

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

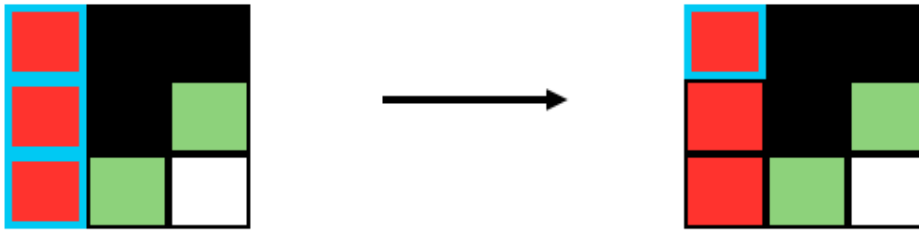If there are no rebels in the neighborhood, cop move randomly to a free space.

■ Cops

■ Quiets
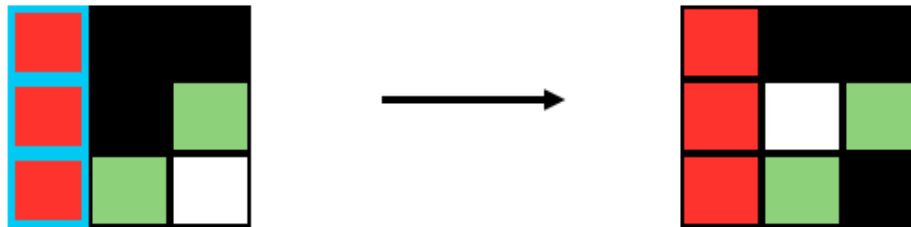
■ Rebels

☐ Empty

Behaviours: cops

	Cops_Superiority	RebelsCount	Cops Count + 1	Output
①	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
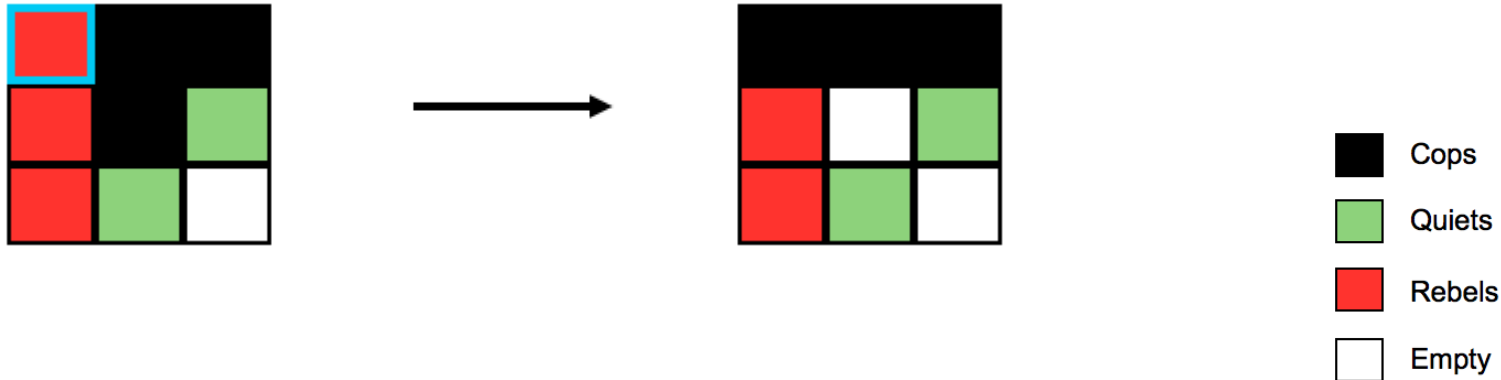

If not

Cops

Quiets

Rebels

Empty

Behaviours: cops

Cops_Superiority	RebelsCount	Cops Count + 1	Output
2	3	3	true

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

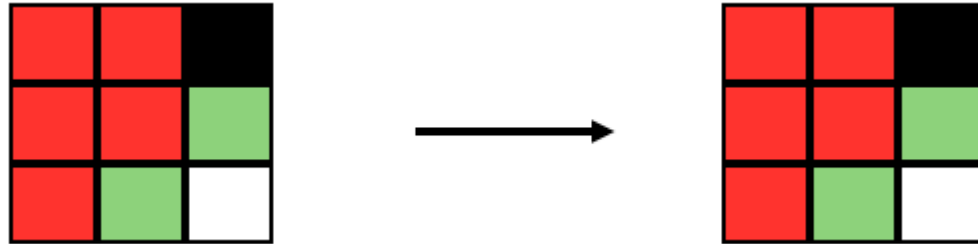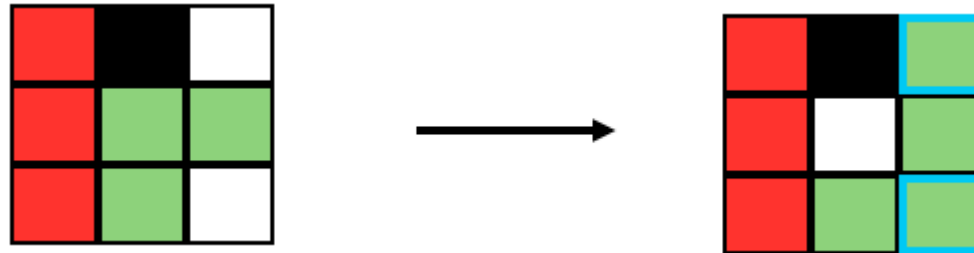|	
⬛	Cops
🟩	Quiets
🟥	Rebels
⬜	Empty

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

■	Cops
🟩	Quiets
🟥	Rebels
⬜	Empty

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   Arrest probability

Random number (0,1) per each people   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

- States:

Quiet   Rebel   Jailed

(number of the days decided by cop)
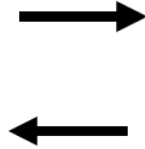
Statistics

- In the world certain statistical values are kept:

Situations:
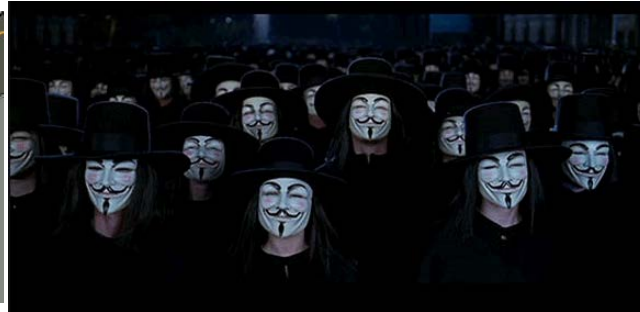
Utopic   Rebellion   Repressive

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

Statistics

- In the world certain statistical values are kept:

Neighborhood:

Quiet

Rebel

Police
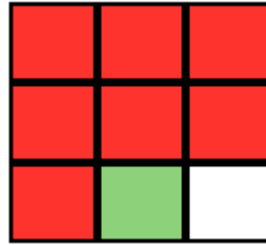
	Cops
	Quiets
	Rebels
	Empty

Parameters: Others

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

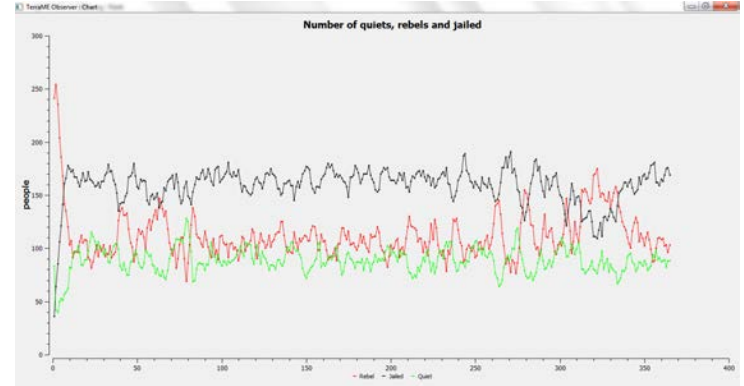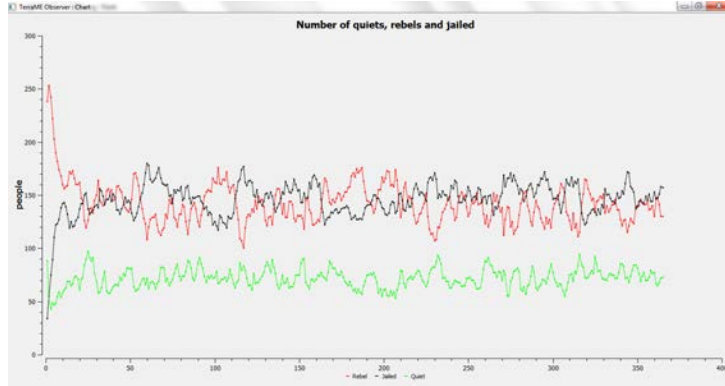# Parameters: Jail Time

- Effect on amount of agents, for values 5, 10 and 20
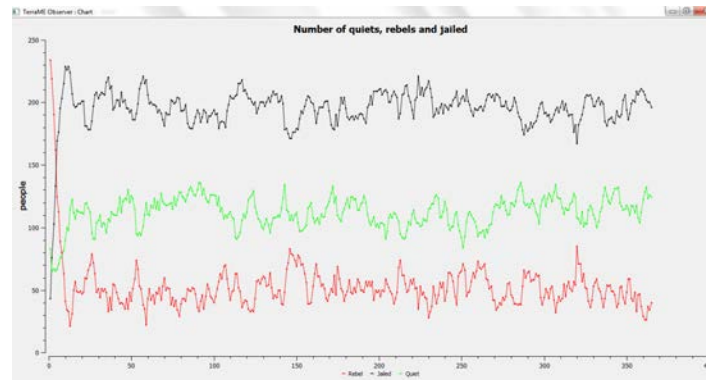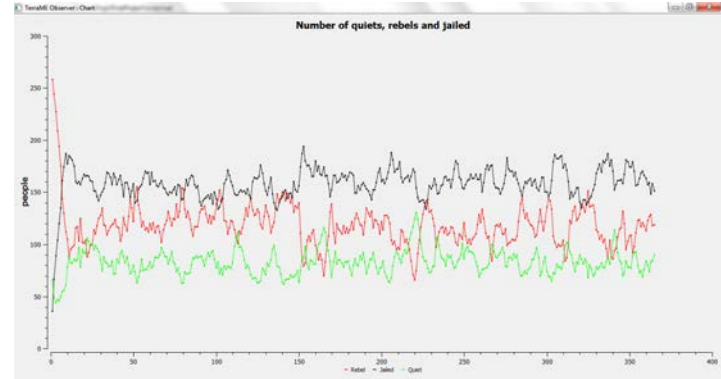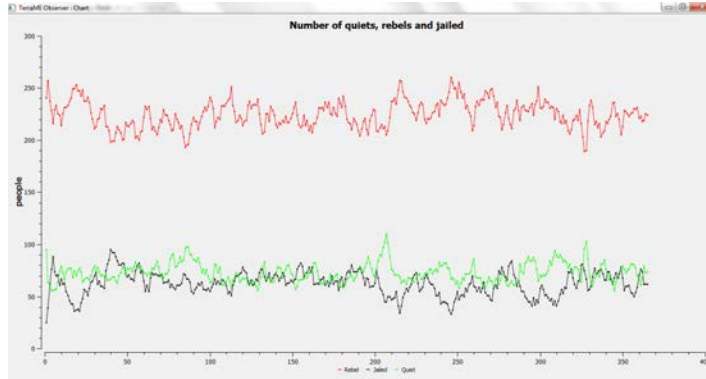
Parameters: Jail Time
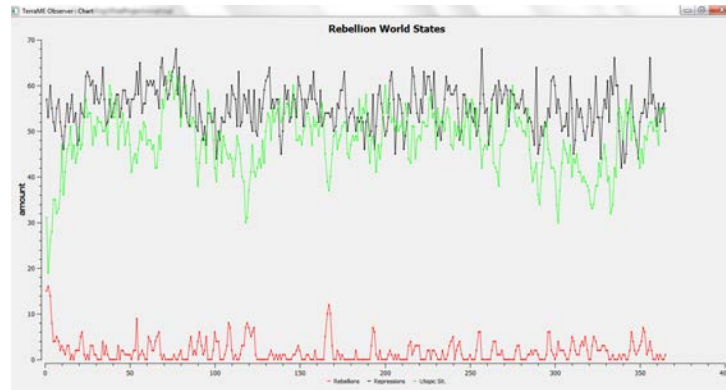
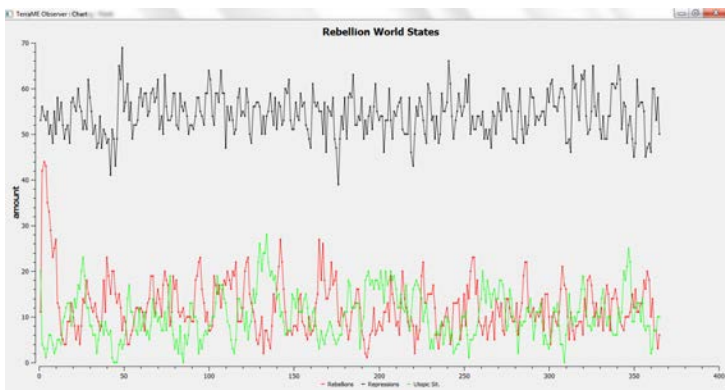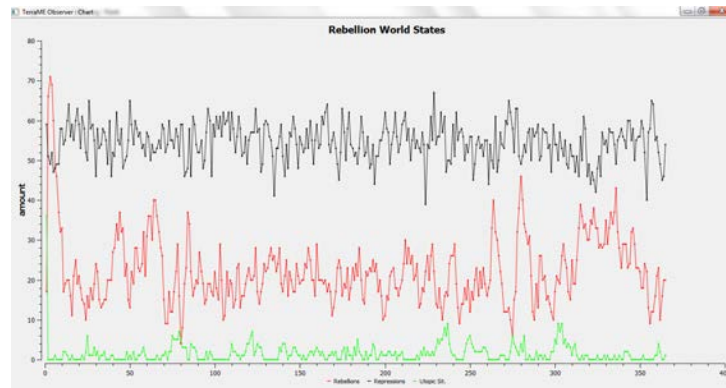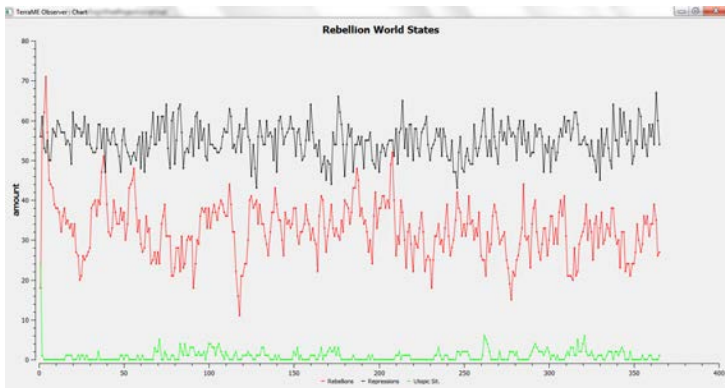- Effect on amount of world states, for values 5, 10 and 20
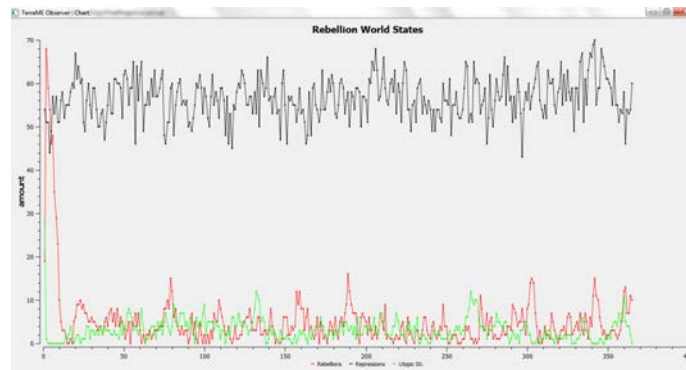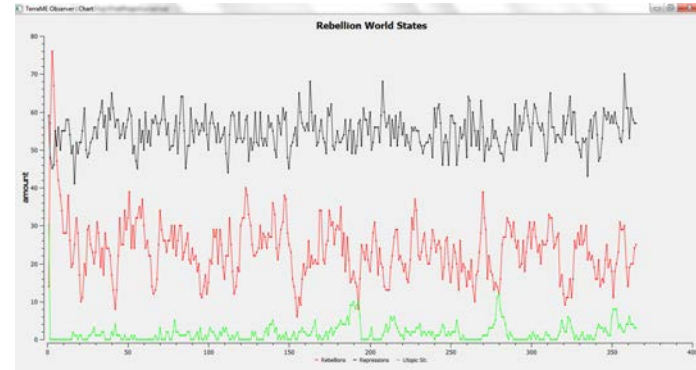
Parameters: Goverment Legitimacy

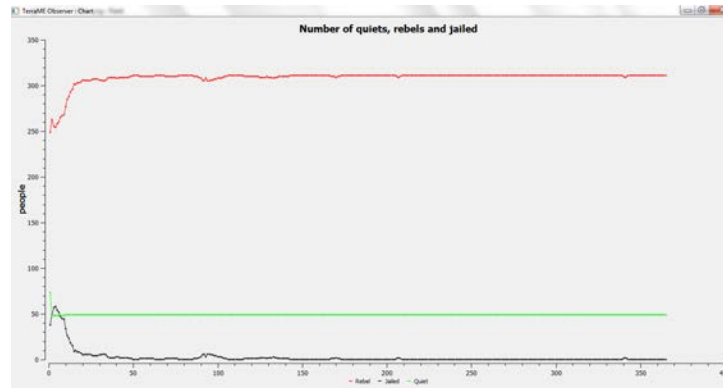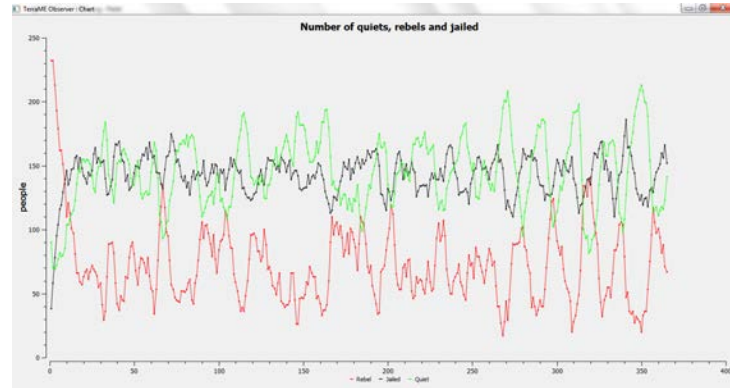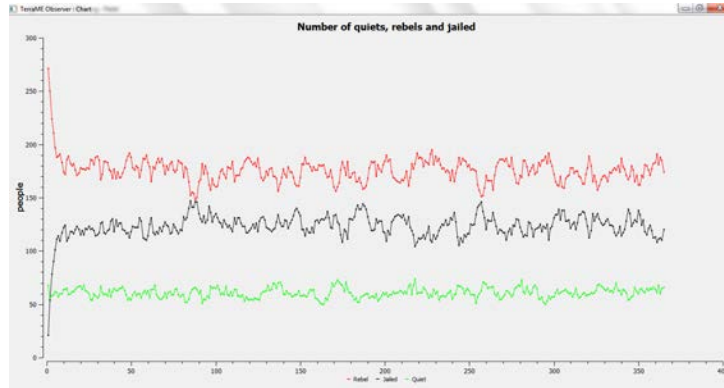- Effect on amount of agents, for values 0.05, 0.25, 0.50 and 0.80
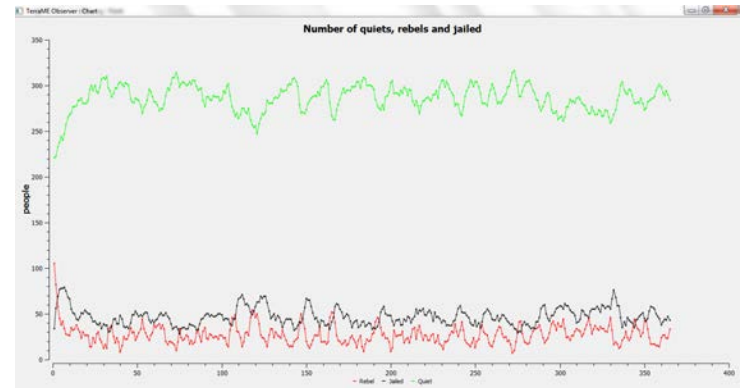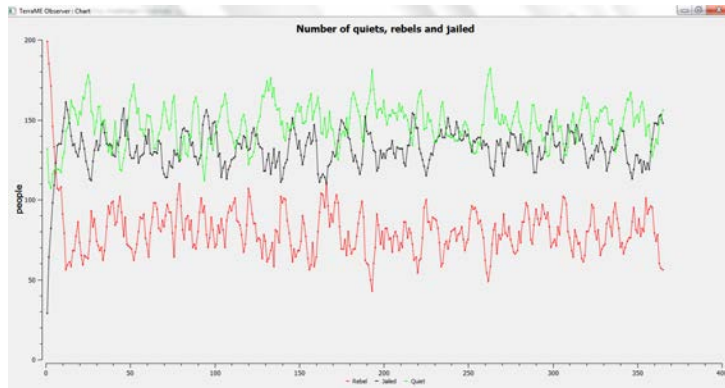
Parameters: Goverment Legitimacy

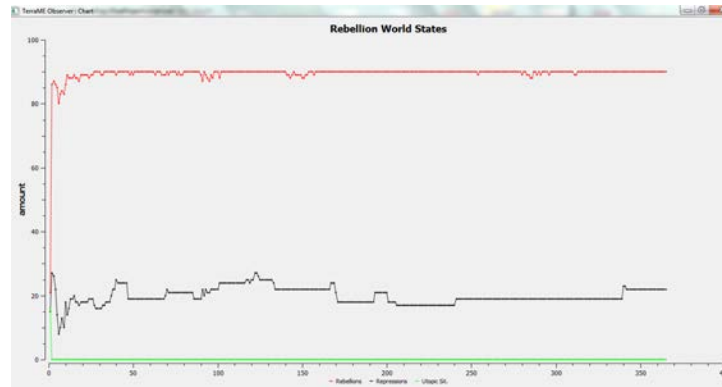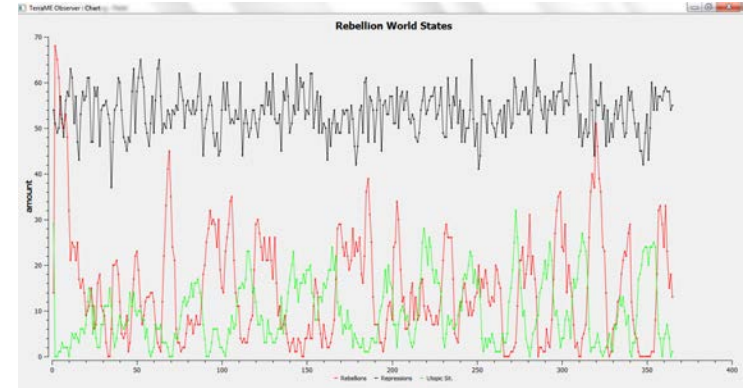- Effect on amount of world states, for values 0.05, 0.25, 0.50 and 0.80
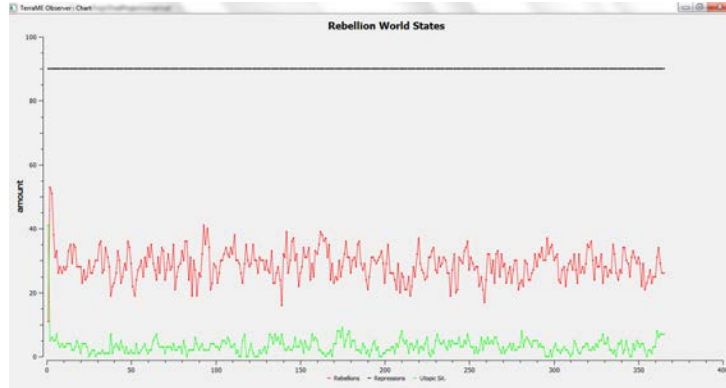
Parameters: Neighborhood size

- 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.