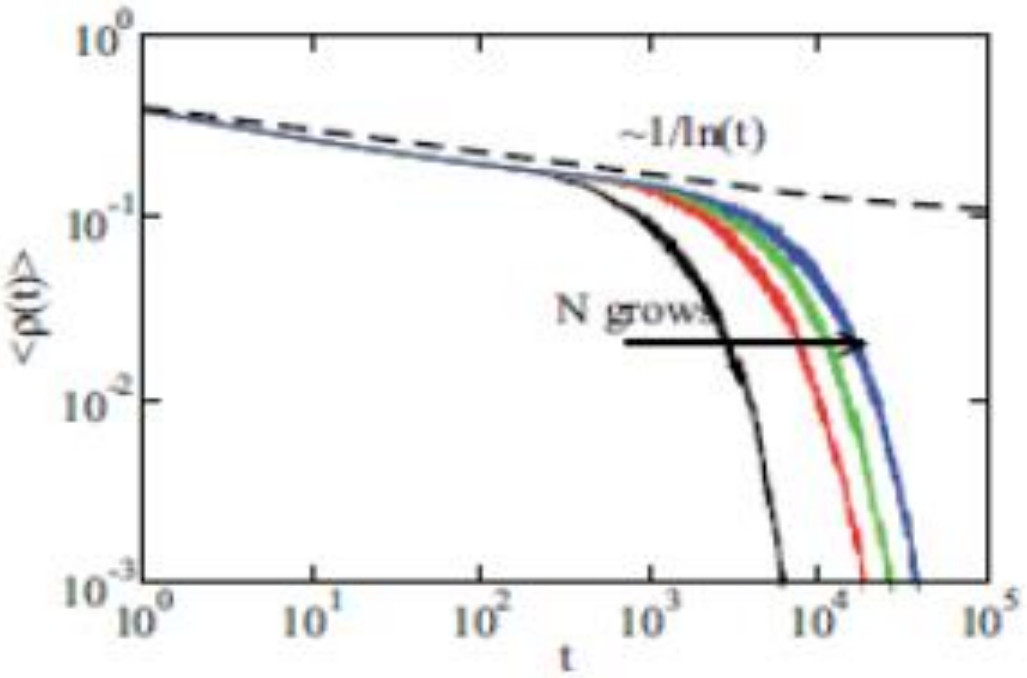
IFISC

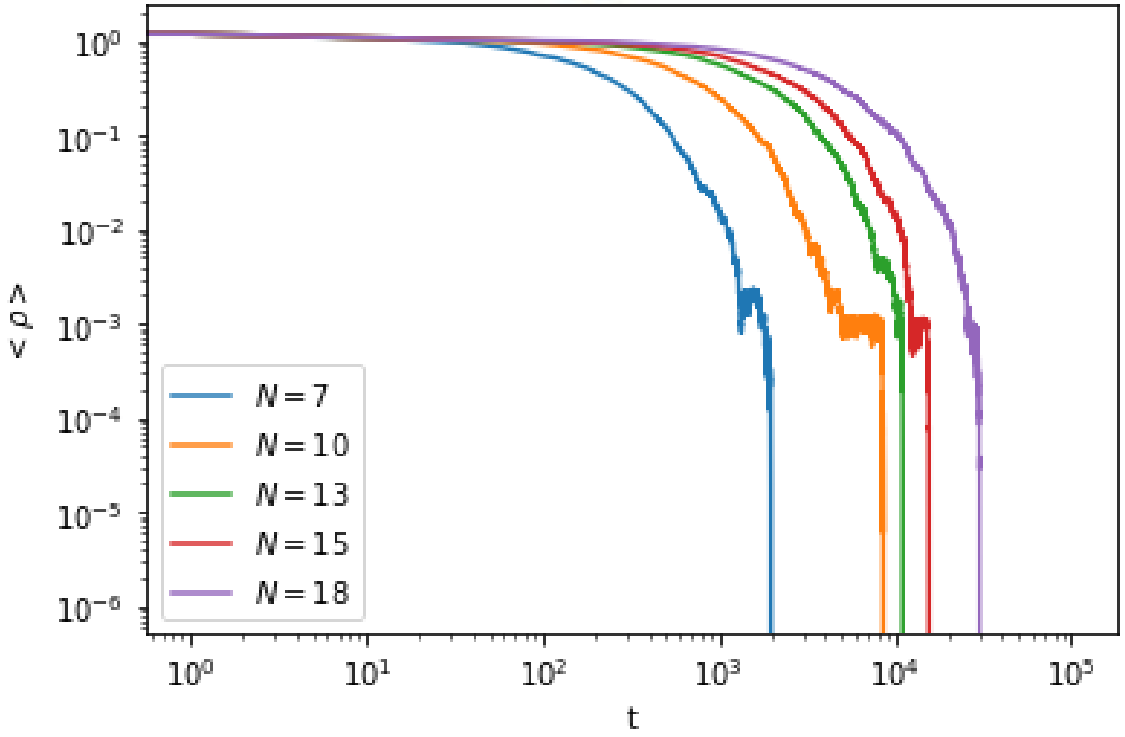
UNIT OF EXCELLENCE MARÍA DE MAEZTU

Voter Model on Regular Lattices and Schelling Model

Bousakla Mustapha

Voter Model in Regular Lattices

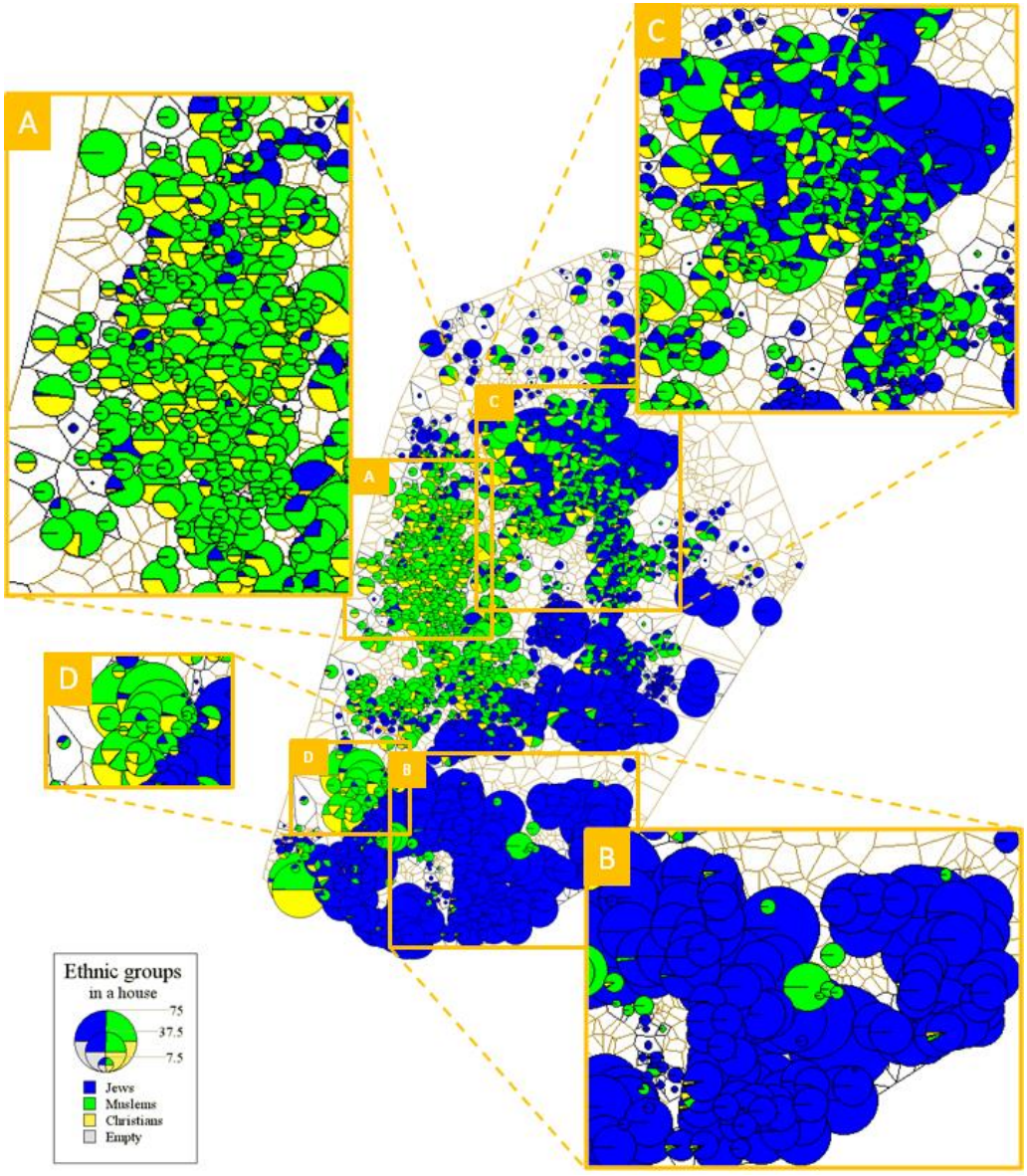




Algorithm:

- Initialize lattice.
- Build neighbours.
- Random imitation
- Compute average interface density at each time step as the ratio of different links with 2N.
- As the dimension of the lattice is increased, the density shows increasing decaying times.
- The systems takes longer to reach the absorbing state.

- The Schelling Model simulates segregational social behaviours.

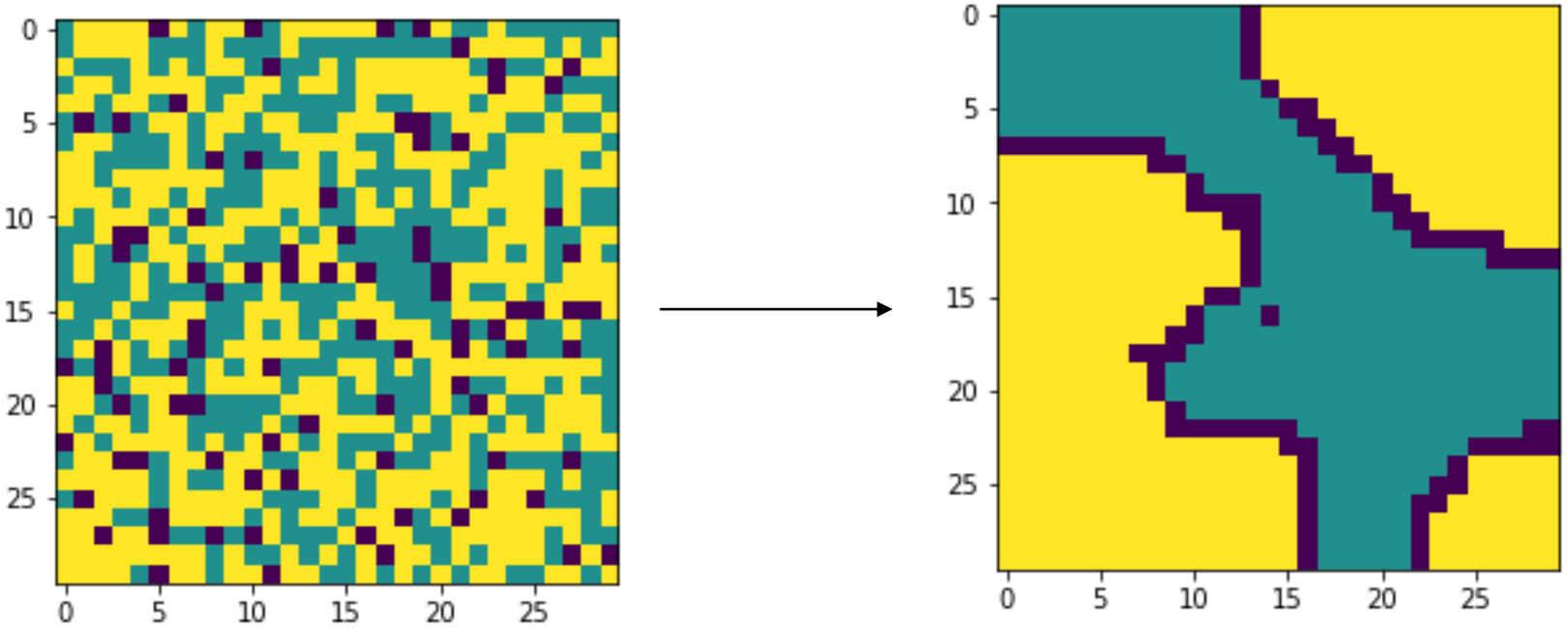


Yaffo (Tel Aviv), 1995

- We aim to simulate how the threshold/tolerance levels affect the level of segregation.
- Von Neuman segregation coefficient: at each time step every agent looks at his neighbouring agents and computes the ratio of similar neighbours. If it is higher than a certain threshold, he is happy and does not move.
- In the algorithm it is simply:

$$\text{segregation} = \frac{\sum_{i=0}^{N} \text{similarity}(i)}{N}$$

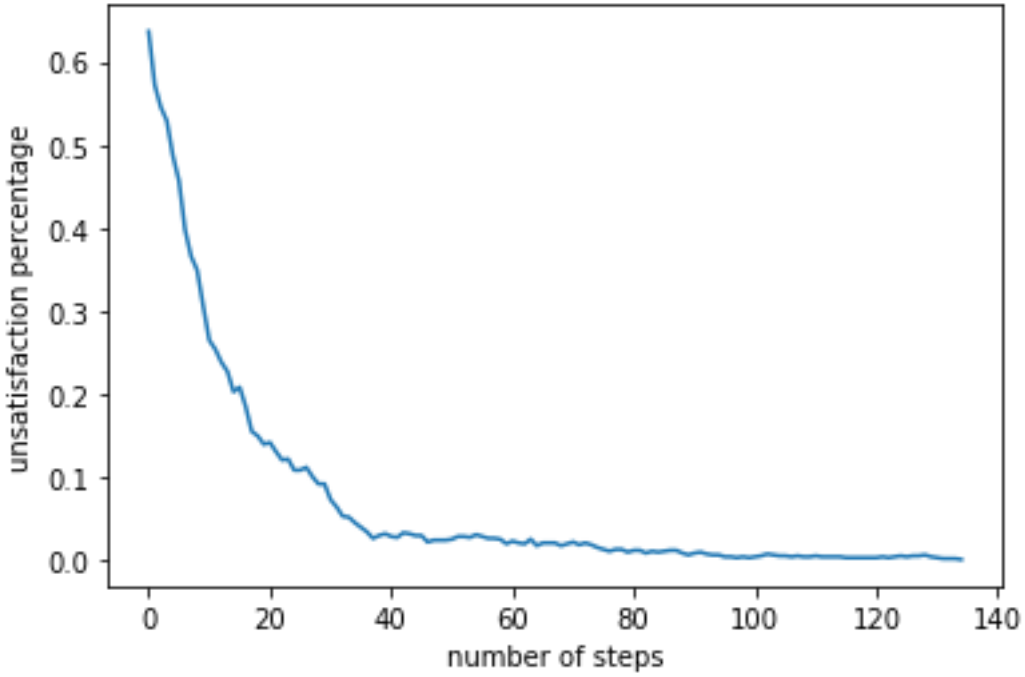
- 1) Create a lattice with randomly distributed 0 and 1.
- 2) Analise vicinity of each agent.
- 3) Compare to tolerance threshold.
- 4) Move unsatisfied to empty positions.

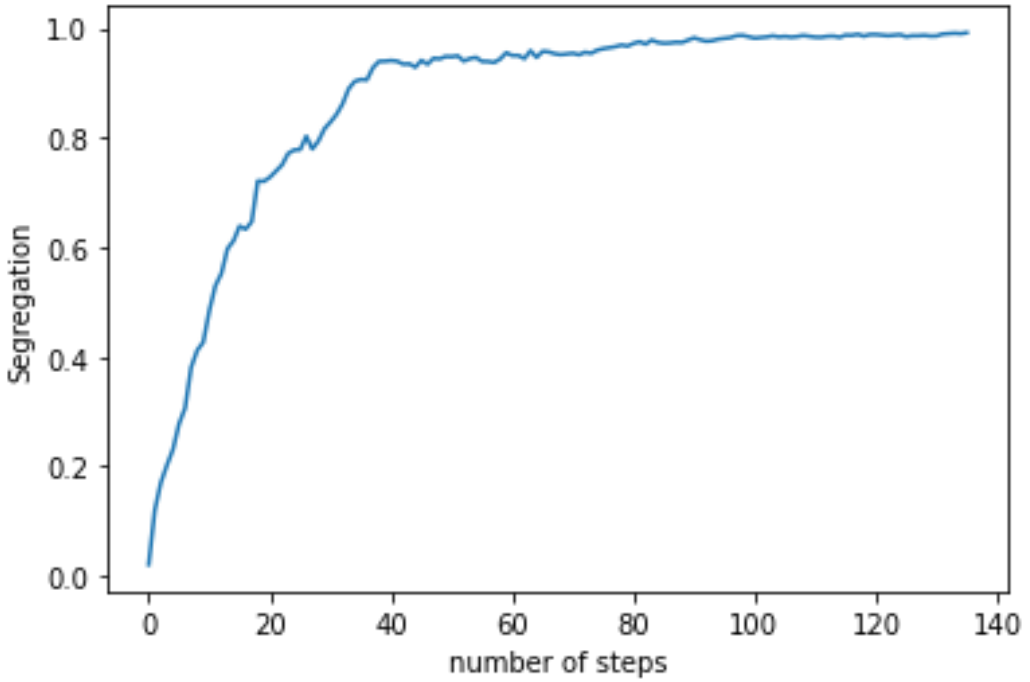


The parameters are: threshold 0.7, p_0=0.4, p_1=0.5, N=30.

Schelling Model Algorithm

- The parameters are: threshold 0.7, p_0=0.4, p_1=0.5, N=30.

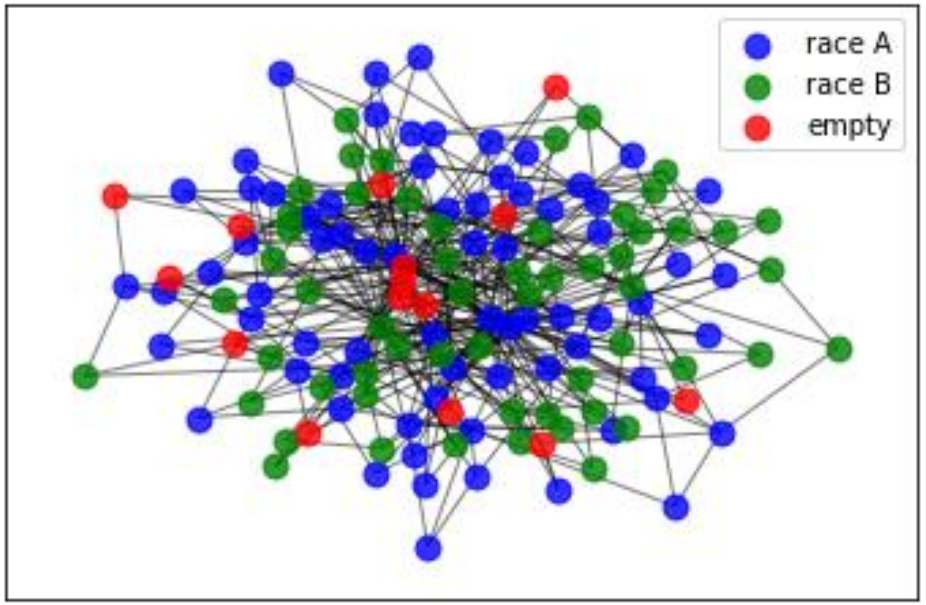


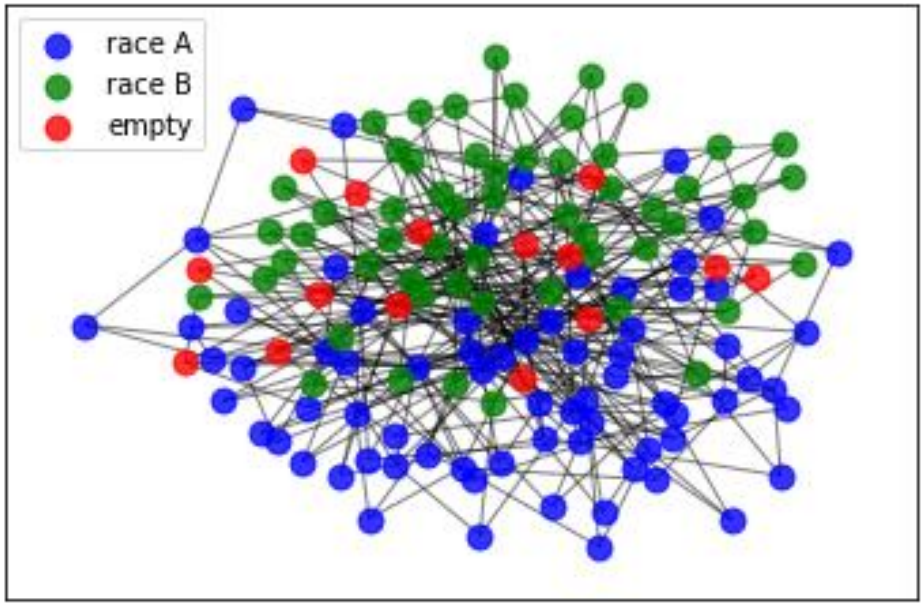


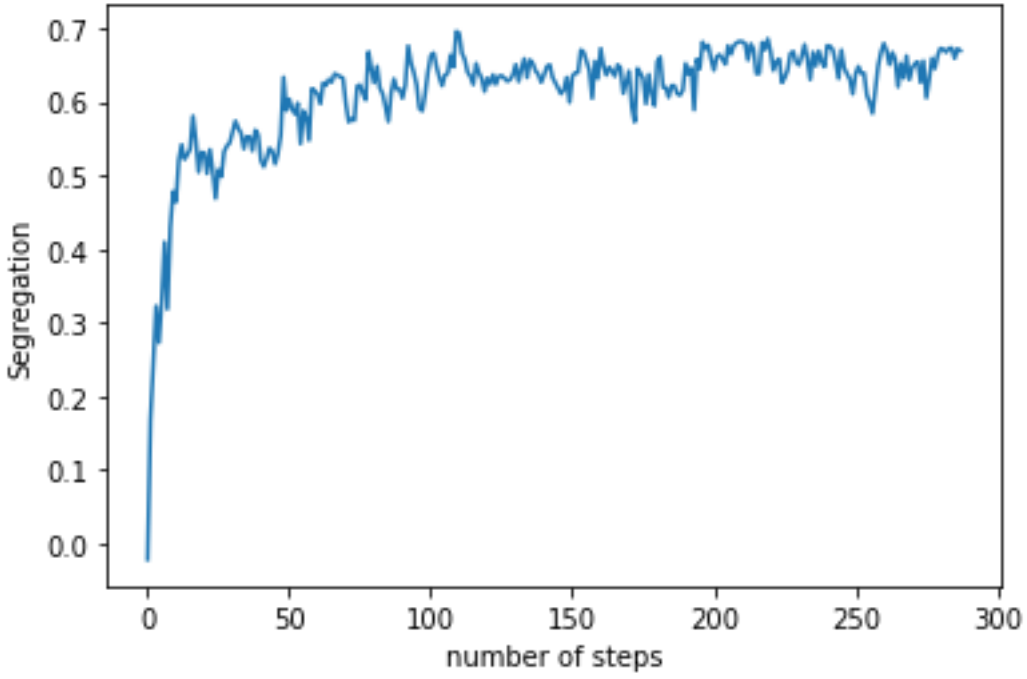
- The low tolerance enhances segregation and drastically increments the number of steps to reach the equilibrium/happiness state.
- High tolerances imply only a few steps to reach happiness.

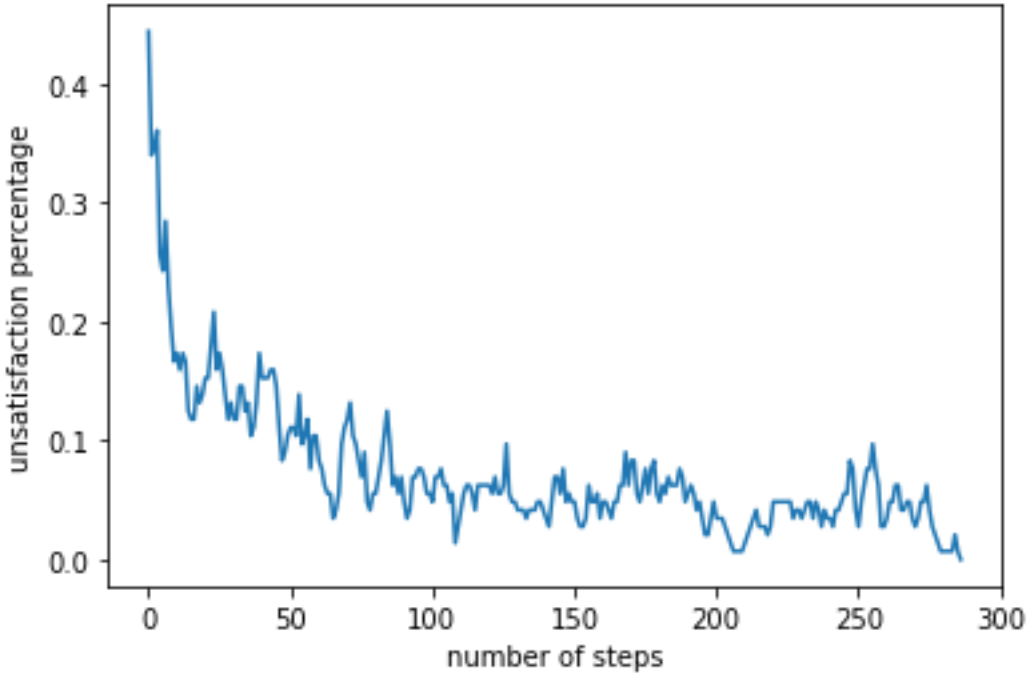
Schelling Model on a scale-free network

Parameters: threshold 0.6, p_0=0.5, p_1=0.4, N=12.



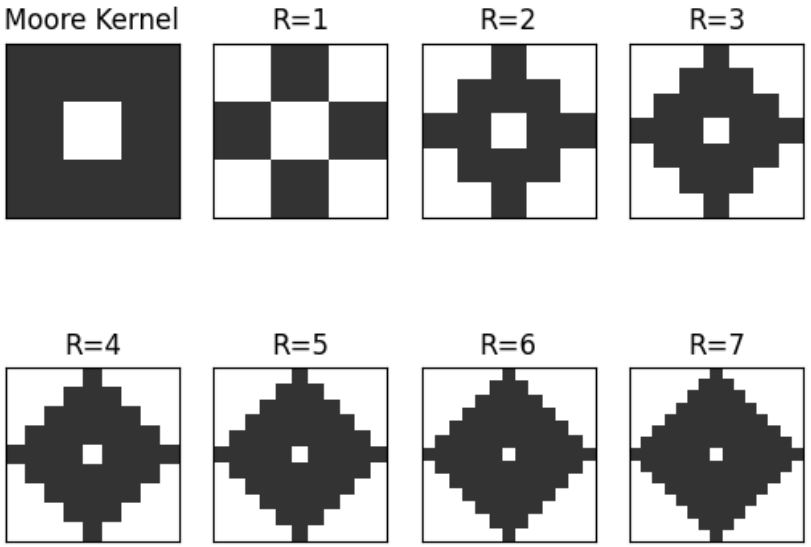






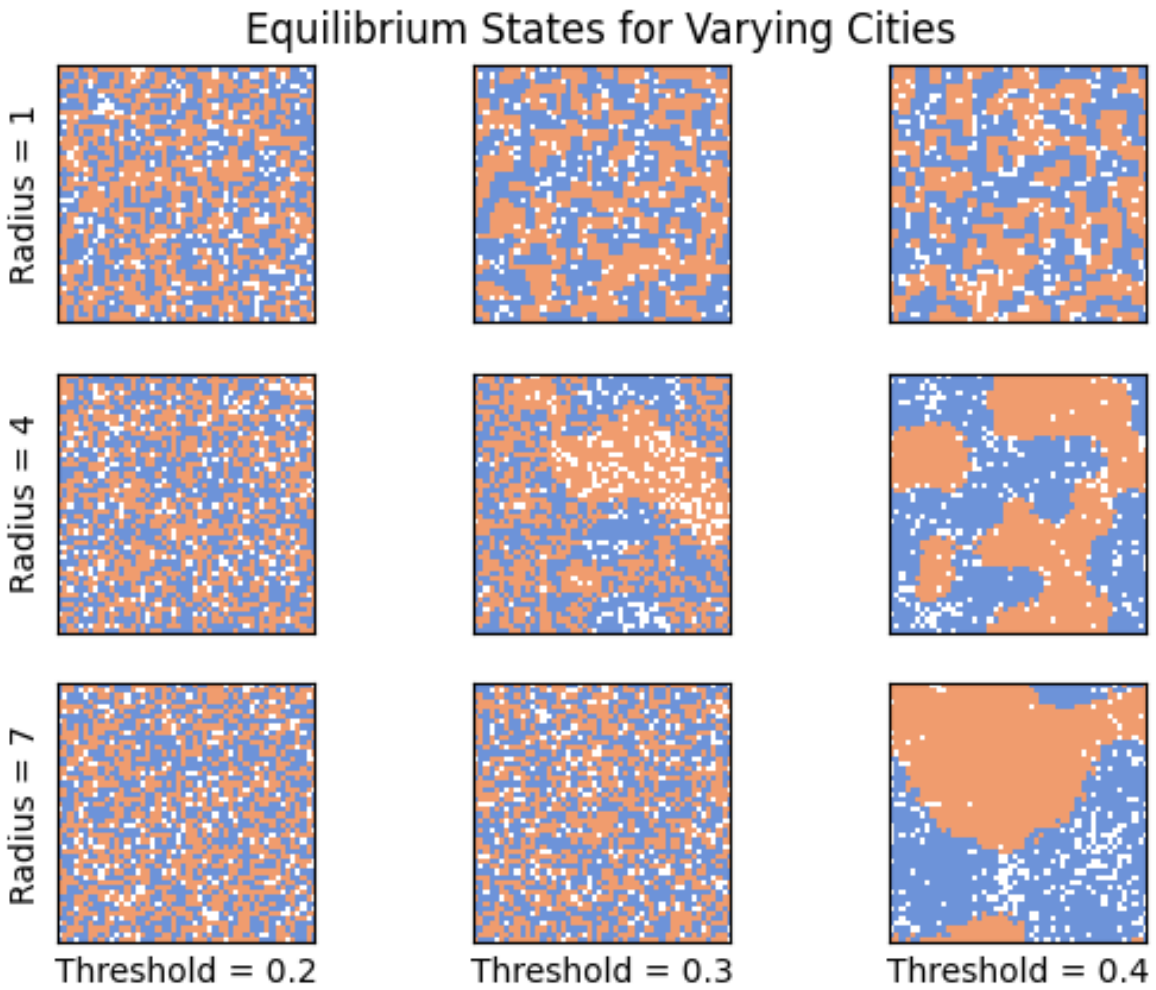
Schelling Model with a “vision” *r* parameter

- We make the concept of neighbours more flexible: a given cell is a neighbour to a given cell if the distance between them is equal or less than the set radius *r*.



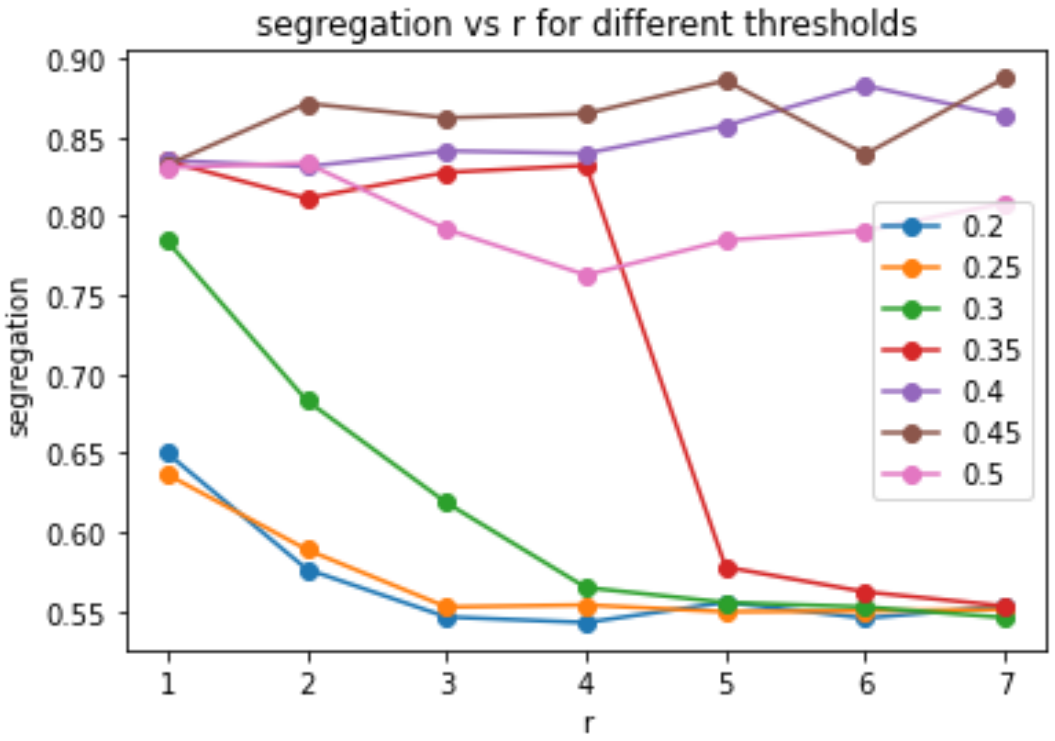
Role of 'Vision' in Neighbourhood Racial Segregation: A Variant of the Schelling Segregation Model. Alexander J. Laurie, Narendra K. Jaggi (2003)

Vision in Schelling Model

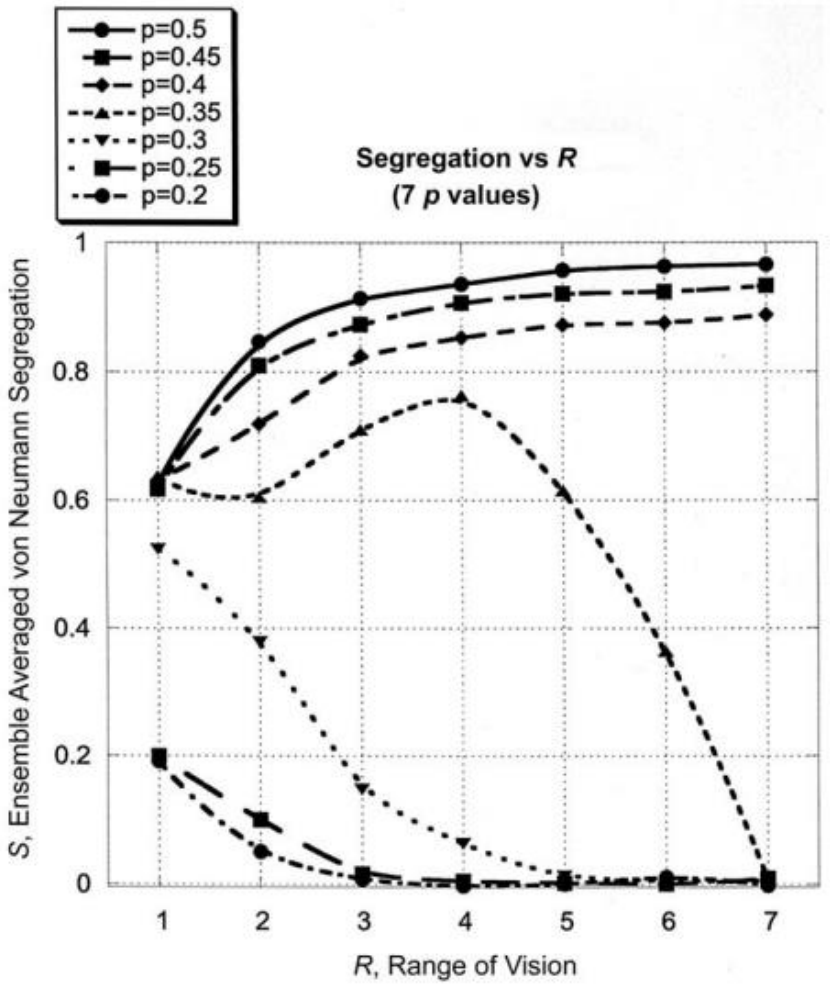


- As the threshold increases, the size of the segregated areas increases as well. And, as radius increases, the segregation becomes more extreme.

Vision Schelling Model different thresholds



Parameters: N=50, $p_0=p_1=0.45$



- There is some critical value of the threshold (0.4) above which there is no integration regardless of the neighbouring radious *r*.
- Contrary to the original Schelling model, certain values of *r* avoid segregation. Under the threshold=0.3 there is an increasing integration for increasing *r*.
- The convergence to r=1 seems to imply an unavoidable segregation even for low thresolds.

Conclusions

- The original Schelling model clearly and correctly predicts high segregation for high tolerance values.
- Low tolerance thresolds, that is a color-blinded society, enables a fast equilibrium state achievement. Thus, the number of time steps is proportional to the tolerance level.
- No topological differences for lattices and scale free netwoks: the unsatisfaction rates and the segregation coefficient follow the same tendency.
- The “vision” Schelling model predicts stable integrated societies for values of *r* that the original model does not.

References

- *Role of 'Vision' in Neighbourhood Racial Segregation: A Variant of the Schelling Segregation Model*. Alexander J. Laurie, Narendra K. Jaggi (2003)
- *Journal of Artificial Societies and Social Simulation* **15** (1) DOI: 10.18564/jasss.1873
- *Dynamic Models of Segregation*. Tomas C. Schelling. Journal of Mathematical Sociology 1971, Vol.1, pp 143-183.

THANK YOU

for your attention