Opinion Dynamics

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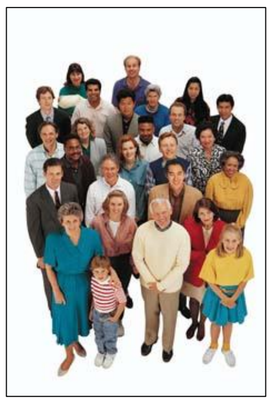
1. Introduction



Many societies exhibit cultural **fragmentation**. This is despite individuals trying to reach **agreement** with those they meet. The model proposed by Axelrod [1] is one which captures this dichotomy. It contains the idea that individuals which are more similar are more likely to interact, **homophily.** The mechanism where people become more similar after interaction is termed **social influence.**

Axelrod's model is interesting because for different parameter choices the opinions of all the individuals will either become all the same, **consensus**, or a frozen fragmented state. A phase transition is observed between these two types of frozen state.

2. Axelrod Model

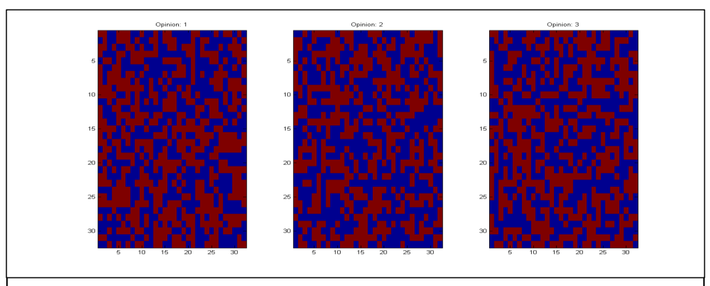
Each individual has **F opinions** and each opinion is from a **choice of q**.

Example

With F = 3 and q = 2 one individual may have the following opinions: (1, 2 , 1)

Network of individuals

There are a fixed number of individuals on a square lattice. Each individual has **four neighbours** (with periodic boundary conditions on the lattice). **Initially** all the opinions are chosen at **random**.



1024 agents with 3 opinions and 2 choices for each. Snapshot of t = 1 for all 3 opinions for all agents.

Simulation

- Select an individual at **random**: i

  For example with opinions (1, 2, 1)
- Select one of their neighbours at **random**: j

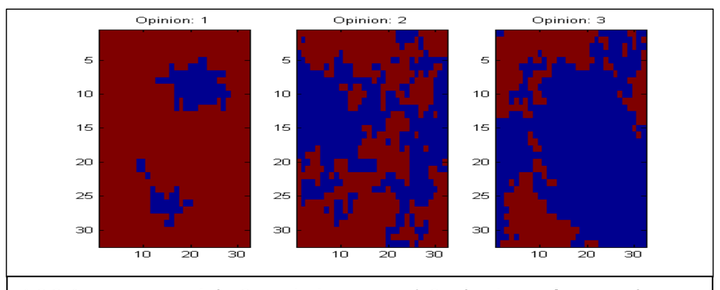
  For example with opinions (1, 1, 2)
- Calculate how **similar** they are:

  (number opinions the same) / F

  In our example 1 / 3
- They **interact** with a **probability** directly related to their similarity

  In our example 33%
- The first individual **copies one of the opinions (chosen at random)** of the second individual

  opinions of i become (1, 2, 2)



1024 agents with 3 opinions and 2 choices for each. Snapshot of t = 900 000 for all 3 opinions for all agents.

3.Linked Opinions

We provide an extension to the Axelrod model. Opinions are no longer independent of each other. A pair of linked opinions are included in the model.

New simulation

- If two opinions are linked and one of them is the same between the individuals then this influences which opinion gets changed.

Example

Once it has been decided that the interaction will take place. E.g. the states are

Individual i opinions (1, 2, 1)

Individual j opinions (1, 1, 2)

(Linked opinions highlighted in red)
The first opinion is:

- one of a linked pair and
- the same for individuals i and j

So the respective linked opinion (the second one) is changed with certainty

Opinions of i become (1, 1, 1)

This is an example of a case where:

- two individuals are talking
- they can share opinions on more than one topic (e.g. Religion, Politics and television preferences)
- but because they agree on one opinion (e.g. Religion)
- then they topic which is shared (e.g. Politics) is unambiguously decided.

References

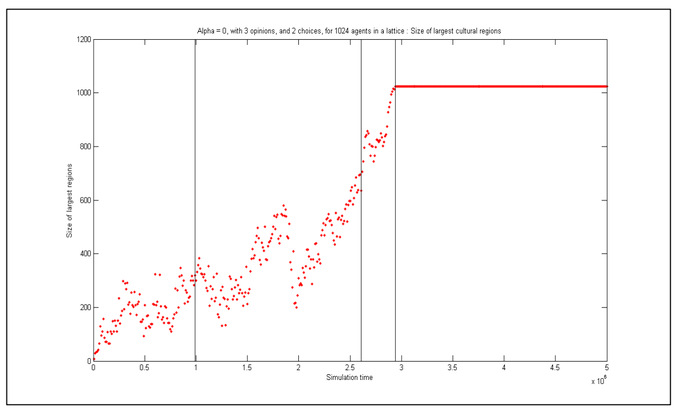
[1] R. Axelrod (1997) The dissemination of culture. *Journal of Conflict Resolution,* 41(2): 203-226.

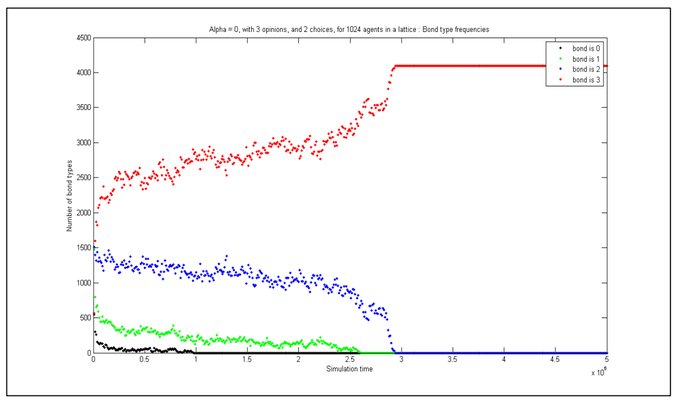
[2] L. De Sanctis, T. Galla (2009) Effects of noise and confidence thresholds in nominal and metric Axelrod dynamics of social influence. *Physical Review E.* Vol 79.

[3] F. Vazquez, S. Redner (2007) Non-monoticity and Divergent Time Scale in Axelrod Model Dynamics, *Europhysics Letters,* Vol 78: 18001-18007.

4. Results

Dynamics of a single simulation

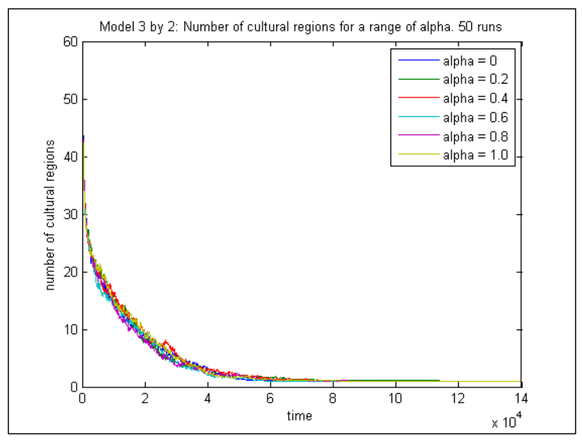


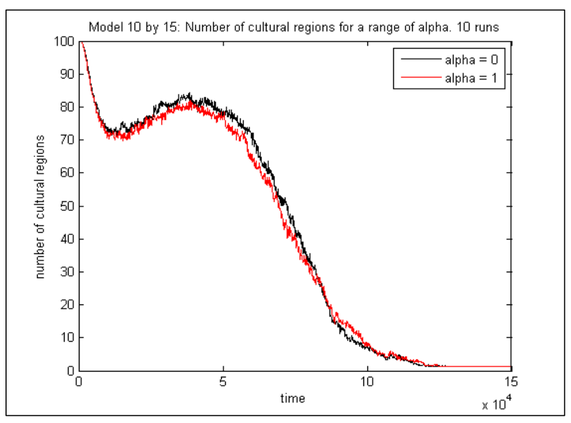


Preliminary results

1. **Non-monotonic behaviour**, also observed in results by Vazquez [3] .

2. Axelrod is resilient to linked opinions as shown by the same dynamics for both Axelrod (alpha = 0) and linked opinions (alpha = 1).





5. Further Work

The extension to this work is to model:

- simulations on larger networks of individuals
- interaction probability dependent on related opinions
- related opinions with different strengths of influence
- agents with memory of old friends in a network of moving agents