

Nonequilibrium phase transition in the coevolution of networks and opinions

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This project of the modelling and simulating social systems class will be interested in the dynamics of opinion formation. The goal of this work is to replicate the findings of Holmes and Newman in their article *Nonequilibrium phase transition in the coevolution of networks and opinions* [1], published in 2006. In a second phase, we will attempt to refine the model proposed in the article. Below, we briefly describe the model presented in the article and the main finding.

It is observed that real social networks tend to be divided into groups of like-minded individuals but how does communities of like-minded people emerge? The central question of this project is: “does *dynamics control the structure of a network* or does *the structure control the dynamics* ?” This interrogation results in a three case scenario proportional to Φ , which is the central parameter determining the mobility of the individuals in the network.

In the model, individuals are vertices of a graph and edges represent connections. Each individual is assigned an opinion from a set of possible ones. The dynamics of the system is discretized. At each step, a random individual is picked. Then, either

- (a) an edge is moved to lie between the selected individual and another individual which has the same opinion, or
- (b) the opinion of a neighbour is changed to agree with the one of the selected individual.

Figure 1 describes mechanisms (a) and (b). The probability of step (a) or step (b) is described by a single parameter (Φ for (a) and $1 - \Phi$ for (b)). The model produces a phase transition between regimes in which one process or the other dominates the dynamics.

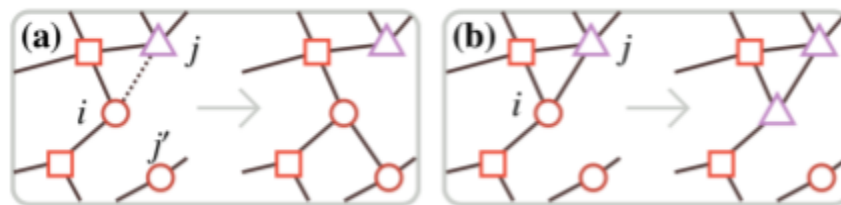


FIG 1. The two different mechanisms that drives the network dynamics.

When Φ tends to 1, it encourages a good mobility and the creation of small communities of like-minded individuals. When Φ tends to 0, it favors the change of opinion and results in the creation of a big uniform community. The study of the behavior of the system depending on the value of the parameter Φ is at the core of this work.