

# A Conformist Mechanism to Promote Collaboration Emergence

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**Abstract.** As for the impact of the characters of nodes in complex network on collaborate level, this paper puts forward an iterated game model based on conformist mechanism. In this new model, the nodes update strategies not only accord to their payoffs but also to their group, which ensures that nodes in the same group adopt the same strategies based on intelligent materials. Simulation results reveal that the collaborated level of the networks based on conformist mechanism is higher than the networks based on normal mechanism. The collaboration level is related to the group number. The collaboration level is higher when the group number is few. In addition, the average payoffs increase linearly with the penalty gene increasing instead of rising alternatively. As a result, the new model enhances the collaboration level and the average payoffs in complex network.

**Keywords:** Conformist Mechanism, Iterated Game, Collaboration Emergence, Complex Network, Intelligent Materials.

## 1 Introduction

It is considered that natural selection inclines to selfish and strong individual according to the traditional evolutionary game theory. But more comprehensive collaboration exists in the nature. More kinetic mechanism was considered in order to study collaboration strategies emergence. The possibility of fleeing betrays each other was provided by iterated game. Because by means of some retaliatory measures or mechanisms, the individual can avoid the opposite side adopt betrayal strategies when iterated gaming. So it is beneficial to the emergence and maintenance of collaboration strategies. Santos and Pacheco found that the scale-free networks are benefit to the emergence and maintenance of collaboration strategies [1]. In addition, they also discussed the snow model game based on scale-free networks [2]. It was found by Vainstein and Arenzon that the potential disruption under the sparse grids can enforce the density of collaboration [3]. A game model without reciprocity mechanism was studied by Riolo.etc. The game individual decides to cooperate or not according to the similarity of opponent and itself. Collaboration can be found in this model, but a harsh condition was supposed. In this condition, the game individual usually

cooperates with its similarity. The game would degrade to prisoner difficulty game model once the condition was loosed.

The conformist mechanism, which takes into account the influence of gaming result involving majority psychology, was presented. While the nodes update their strategies, the self payoffs were considered as well as the strategies that were adopted by most nodes of group in networks. The conception of conformist mechanism was introduced in the beginning of this paper. And a game model which was favorable to promote collaboration emergence was proposed. And then the discussion of simulation result was conducted. It was shown in the result that new model can effectively promote the collaboration emergence of nodes in networks. Beside, compare to the other models, conformist mechanism can avoid the average payoffs rise alternatively. It is also can be found that there are proportional relation between average payoffs and penalty gene.

## 2 Conformist Mechanism

When game model adopted update strategies, instead of the affect of group the self payoffs or characteristics of networks were usually considered. But the formation of networks group was determined by characteristics of nodes. When most of nodes in group adopt one kind of strategy, a node which belongs to the group will adopt strategy that most nodes do, though the opposite one benefits it. This is the conformist mechanism theory.

The Zachry network was chosen to study. The number of club member did not increase in a period of time [6]. But subtle changes would occur among relationship of club members, as the interest confliction exists between two clubs which centered on schoolmaster and club. So we can classify the networks by beneficial characteristics of members. The differences between networks groups mentioned above and society with flexible networks can be found according to analyzing by clustering algorithm. In previous studies some characteristics of nodes were ignored and only an individual was taken into accounted. In this paper some characteristics, such as the economic interest of nodes, were considered when the networks were set up. And cluster analyses to nodes in networks were conducted according to these characteristics. Then nodes in networks were divided into different groups.

The game model was set up according to conformist mechanism:

(1) Set up the payoff matrix. In order to simplify the number of parameters in payoff matrix, the matrix used by Nowak and May was adopted  $A = \begin{bmatrix} 1 & 0 \\ b & 0 \end{bmatrix}$ .

Meanwhile  $1 < b < 2$ ; strategies of nodes initiation is give each node strategy randomly.

(2) Node  $i$  games with its neighbor  $j$  in turn. If strategy C was adopted by individual  $i$  in the last round, the payoff matrix was not modified and the gaming continued. Otherwise the payoff matrix was modified before next round. Make  $b = b - Q$ , where  $Q$  is called the penalty factor. The payoff  $S(l_{ji})$  of each  $l_{ji}$  which is the neighbor of individual  $i$  was recorded. Among neighbors the one  $l_{jmax}$  with maximal payoff  $\max(S(l_{ji}))$  was selected (If there are neighbors with equal payoff, choose anyone randomly), after the gaming among individual  $i$  and its neighbors. Then the strategy of individual  $i$  was replaced by the neighbor  $l_{jmax}$ .