The Role of Mimicry in Social Evolution

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1 Introduction

In agent based simulation, there is a growing literature on the approach of bounded rationality [1]. The following two hypotheses form the basis of our analysis: (1) Each agent interacts only with his neighbors, (2) Each agent behaves by imitation of neighbors. In this imperfect world, how the society gropes its way towards equilibrium? The purpose of this study is to investigate the role of mimicry in social evolution. In this research, we examined how conventions evolve in a society that begins in an amorphous state where there is no established custom, and individuals rely on hearsay to determine what to do. Specific conditions as to which conventions are most likely to emerge are also clarified with computer simulations.

2 The Social Model of Evolution

In order to describe the interactions among agents, we adopt local matching model[2]. Agents are not assumed to be so rational or knowledgeable as to correctly guess or anticipate the other agent's strategies. They adapt other agents' successful strategies as guides for their own choices. We consider two types of learning strategies: complete mimicry and partial mimicry of an opponent. Each agent interacts with the agents on all eight adjacent squares and imitates the strategy of any better performing one. Possible combinations of interactions are classified into several types based on the payoff structures that describe interactions. They are given the following special names in game theory: (a) the dilemma game, (b) the coordination game, (c) the mixed-motivation game.

3 Simulation Results

(a) Dilemma Game
The evolutionary model with the complete mimicry strategy is fast but it is very unstable and the stability of social evolution depends on the parameters. On the contrary, the social evolution with the partial mimicry strategy is very stable. The evolutionary process with the partial mimicry strategy doesn't depend on a combination of parameters. However, many generations are required to reach this desirable state compared with the model with the former.

(b) Coordination Game
In both the cases of complete mimicry and partial mimicry strategies, each agent is able to acquire a high payoff. The difference of them is the behavior of agents: though the agents who belongs to the same colony can acquire the high payoff mutually, the agents who exists in an edge of the colony can not get high payoff because of interacting with the agent who belongs to another colony. On the other hand, in the partial mimicry strategy, only two colonies existed at last. Almost agents take the same strategy and only one agent takes a different strategy.

(c) Mixed-Motivation Game
Significant differences were observed between the complete mimicry strategy and the partial mimicry strategy. As a result, in the evolution with the complete mimicry strategy, there are many agents who persist with either strategy, and then, they can not acquire the payoff at high level. On the other hand, the evolution with the partial mimicry strategy, whatever value we set for parameter, each agent can acquire a higher payoff. Consequently, in this type of game, we can say that evolution with the partial mimicry strategy leads to a more efficient society than with the former.

References

[1] Rubinstein A., *Modeling Bounded Rationality*, The MIT Press, 1998.

[2] Uno K. and Namatame A., *Evolutionary Behaviors Emerged through Strategic Interactions in the Large*, proceedings of GECCO, pp.1414-1421, 1999.