

Effect of Modification and Expansion on Emergence of Cooperation in Demographic Multi-Level Donor-Recipient Game

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Abstract : It is known that the mean investment evolves from a very low initial value to some high level in the Continuous Prisoner's Dilemma. We examine how the cooperation level evolves from a low initial level to a high level in our Demographic Multi-level Donor-Recipient situation. In the Multi-level Donor-Recipient game, one player is selected as a Donor and the other as a Recipient randomly. The Donor has multiple cooperative moves and one defective move. A cooperative move means the Donor pays some cost for the Recipient to receive some benefit. The more cooperative move the Donor takes, the higher cost the Donor pays and the higher benefit the Recipient receives. The defective move has no effect on them. Two consecutive Multi-level Donor-Recipient games, one as a Donor and the other as a Recipient, can be viewed as a discrete version of the Continuous Prisoner's Dilemma. In the Demographic Multi-level Donor-Recipient game, players are initially distributed spatially. In each period, players play multiple Multi-level Donor-Recipient games against other players. He leaves offspring if possible and dies because of negative accumulated payoff of him or his lifespan. Cooperative moves are necessary for the survival of the whole population. There is only a low level of cooperative move besides the defective move initially available in strategies of players. A player may modify and expand his strategy by his recent experiences or practices. We distinguish several types of a player about modification and expansion. We show, by Agent-Based Simulation, that introducing only the modification increases the emergence rate of cooperation and introducing both the modification and the expansion further increases it and a high level of cooperation does emerge in our Demographic Multi-level Donor-Recipient Game.

Keywords : agent-based simulation, donor-recipient game, emergence of cooperation, spatial structure, TFT, TF2T

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