

Revisiting "The Evolution of Reciprocity in Sizable Groups": Continuous Reciprocity in the Repeated N-Person Prisoner's Dilemma

Masanori Takezawa & Michael E. Price

Abstract: For many years in evolutionary science, the consensus view has been that while reciprocal altruism can evolve in dyadic interactions, it is unlikely to evolve in sizable groups. This view had been based on studies which have assumed cooperation to be discrete rather than continuous (i.e., individuals can either fully cooperate or else fully defect, but they cannot continuously vary their level of cooperation). In real world cooperation, however, cooperation is often continuous. In this paper, we re-examine the evolution of reciprocity in sizable groups by presenting a model of the n -person prisoner's dilemma that assumes continuous rather than discrete cooperation. This model shows that continuous reciprocity has a dramatically wider basin of attraction than discrete reciprocity, and that this basin's size increases with efficiency of cooperation (marginal per capita return). Further, we find that assortative interaction interacts synergistically with continuous reciprocity to a much greater extent than it does with discrete reciprocity. These results suggest that previous models may have underestimated reciprocity's adaptiveness in groups. However, we also find that the invasion of continuous reciprocators into a population of unconditional defectors becomes realistic only within a narrow parameter space in which the efficiency of cooperation is close to its maximum bound. Therefore our model suggests that continuous reciprocity can evolve in large groups more easily than discrete reciprocity only under unusual circumstances.