The Prisoner's Dilemma: Strategy Dynamics Related to Memory and Selfishness

Seelenfreund, Cory (School: New Rochelle High School)

Understanding whether selfish or altruistic behavior benefits an individual more remains challenging using traditional approaches like studying human samples. The prisoner's dilemma, a game theoretic concept exploring cooperation and competition, offers a way to address this question. While current research expands the dilemma to various social concepts, debates remain about its most effective mechanisms and the benefits of altruism and selfishness within it. This study uses the dilemma to explore these questions through packages in Python code. In step 1, three strategies that involve the memory of prior interactions—reactive-1, reactive-2 and reactive-3—were compared in simple interactions, where results showed that the shorter memory of reactive-1 outperformed the longer memory of reactive-3. These results demonstrate that complexity does not guarantee success both within the dilemma and in real life. To determine the effects of complex memory on decision-making, step 2 explored complex interactions using a variety of strategies including reactive where, contrasting to step 1, complex strategies with a longer memory length performed best. Finally, in step 3, the thought experiment was applied through combinations of developed strategies with varying levels of altruism to explore the question of altruism vs selfishness. Results showed that instead of a purely altruistic or selfish strategy, one that involved a perfect blend of both traits performed best. Human behavior is extremely complex, but these findings demonstrate that game theoretic processes can be applied to find trends which can reveal more about the complexity of human interactions.

Awards Won: