The effects of restraint and amnesty on the adaptive rock-paper-scissors games

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In a population of competing individuals, better management of shared resources can be considered as a form of altruism. Restraint and amnesty describe behaviours of altruism whereby some individuals forgoes certain benefits from their victims while others imposes less cost on their opponents, respectively. However, individuals that exhibit restraint may suffer to less-restrained individuals that give up less benefits. Similarly, individuals that exhibit amnesty may suffer to less-amnestied individuals that imposes more cost. This poses a challenge of understanding how restraint and amnestic behaviours can emerge in populations. While many studies have focused on two-strategy games to explain the evolution of altruism, we explore here a newly developed adaptive three-strategy game of rock-paper-scissors (RPS). This adaptive RPS game allows us to investigate how restraint and amnesty influence the game's outcome with coevolving traits. We focus on examining the impact of the rock becoming more or less restrained towards the scissors, and the scissors becoming more or less amnestied towards the rock. Results show that being less altruistic (i.e., more restrained, and less amnestied) is generally a good choice, except when the system loses stability. Additionally, strategies in the adaptive RPS game can adapt more flexibly, achieving a better balance between being generous (restrained) and holding back (anmestied) when compared to the fixed strategies in traditional evolutionary games. The adaptive RPS game further demonstrates greater resilience, as all strategies coexist and are less prone to extinction. Thus, adaptability emerges as a crucial factor facilitating restraint and amnesty in these strategic interactions.

References

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