

[Talk 3] Conditions for reciprocal cooperation with finite memories

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Direct reciprocity is a mechanism for the evolution of cooperation based on repeated interactions. When individuals meet repeatedly, they can use conditional strategies to enforce cooperative outcomes that would not be feasible in one-shot social dilemmas. Direct reciprocity requires that individuals keep track of their past interactions and find the right response. However, there are natural bounds on strategic complexity: Humans find it difficult to remember past interactions accurately, especially over long timespans. Given these limitations, it is natural to ask how complex strategies need to be for cooperation to evolve. Here, we study stochastic game dynamics to systematically check the performance of strategies with a finite memory. When strategies can take into account the own and the co-players previous move, the deterministic rule of win-stay, lose-shift works best for small costs of cooperation †. When the previous two steps are available, we find by complete enumeration that a combination of tit-for-tat (TFT) and anti-TFT corrects error in a way that is not exploited by the co-player and suppresses the neutral drift to unconditional cooperation ‡.

† S. K. Baek, H.-C. Jeong, C. Hilbe, and M. A. Nowak, *Sci. Rep.* 6, 25676 (2016).

‡ S. D. Yi, S. K. Baek, and J.-K. Choi, Combination with anti-tit-for-tat remedies problems of tit-for-tat (submitted).