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Title: Reciprocity and Retaliation in Social Games with Adaptive Agents

Abstract: Game theory has been useful for understanding risk-taking and cooperative behavior. However, in studies of the neural basis of decision-making during games of conflict, subjects typically play against opponents with predetermined strategies. The present study introduces a neurobiologically plausible model of action selection and neuromodulation, which adapts to its opponent's strategy and environmental conditions. The model is based on the assumption that dopaminergic and serotonergic systems track expected rewards and costs, respectively. The model controlled both simulated and robotic agents playing Hawk-Dove and Chicken games against subjects. When playing against an aggressive version of the model, there was a significant shift in the subjects' strategy from Win-Stay-Lose-Shift to Tit-For-Tat. Subjects became retaliatory when confronted with agents that tended towards risky behavior. These results highlight the important interactions between subjects and agents utilizing adaptive behavior. Moreover, they reveal neuromodulatory mechanisms that give rise to cooperative and competitive behaviors.