MR3926915 91A22
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The evolution of collaboration in symmetric 2×2-games with imperfect recognition of types. (English summary)

Games Econom. Behav. **114** (2019), 118–127.

This paper looks at the evolution (or non-evolution) of a collaborative type versus a status quo type in (mixtures of) two player, two strategy symmetric games. As in the previous literature [S. D. Angus and J. Newton, "Emergence of shared intentionality is coupled to the advance of cumulative culture", PLoS Comput. Biol., posted October 30, 2015, doi:10.1371/journal.pcbi.1004587; J. Newton, Games Econom. Behav. **104** (2017), 517–534; MR3681061], when collaborative types are matched together, they may jointly adjust their strategies and obtain Pareto improvements over the status quo. The paper presents several novelties relative to the existing literature.

As in [J. Newton , op. cit.], the present paper considers collaboration relative to status quo strategies. Unlike Newton's paper, which uses Nash equilibrium strategies as a status quo, this paper uses maximin strategies as a status quo. This has the benefit that maximin is determined at an individual level, in contrast to Nash equilibrium, which is a social phenomenon in that a player's equilibrium strategy depends on those of other players.

In contrast to the two cited papers, a collaborative type may inaccurately assess the type of his opponent. For example, Alice may have the ability to collaborate, and may erroneously think that Bob also has the ability. This creates the possibility of attempting to collaborate and failing. Alice may then see a large animal and say "Hey Bob, let's hunt that animal!", thinking that Bob will fulfill his role in a hunt. When Bob fails to adequately carry out this role, it may turn out that Alice would have been better off not hunting at all. This can work against the evolution of collaboration and differs from previously discussed mechanisms (e.g., group selection, free riding, positive assortativity with negative externalities of collaboration) by which collaboration may fail to evolve.

The paper provides a comprehensive study of the evolution of collaboration in symmetric two player, two strategy games. The effect of collaboration in mixtures of these games is analyzed and it is shown that the state at which every individual in the population is the collaborative type is asymptotically stable if and only if the frequency of the prisoner's dilemma in the mixture of games is sufficiently low. This is because the prisoners' dilemma is the only one of these games in which non-collaborators perform better against collaborators than collaborators perform against their own kind.

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Note: This list reflects references listed in the original paper as accurately as possible with no attempt to correct errors.