

# Is group selection essential to the evolution of cooperation?

A computational game dynamics study in evolutionary biology  
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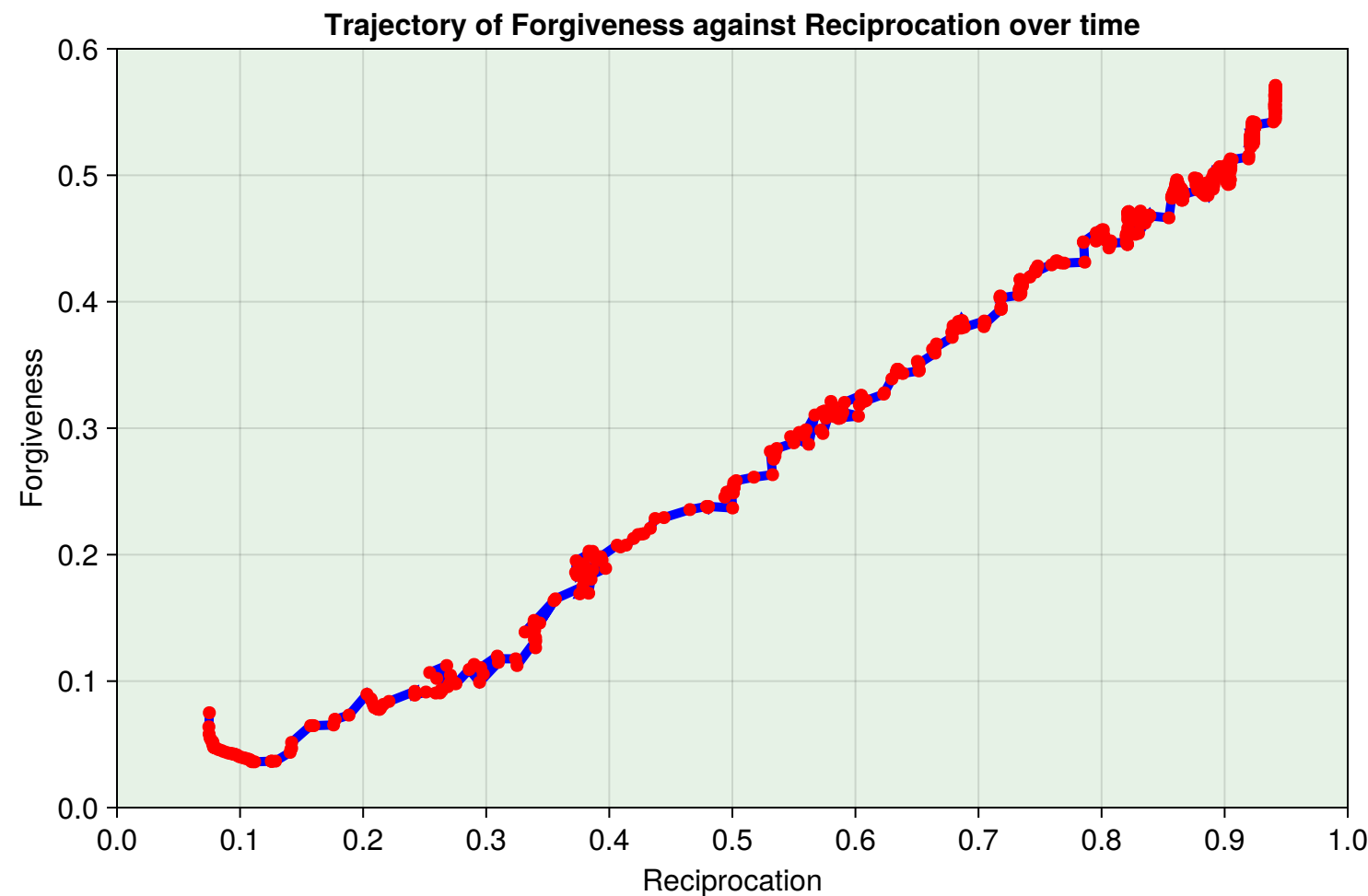
Context:  
Wilson & Wilson (2007) argue that group selection drives evolution of cooperative behaviour. However, many theorists claim group selection is irrelevant to evolution.

Problem:  
We observe cooperative behaviour in the biological world; however, in such examples, it is often unclear whether these behaviours originally evolved through group selection.

Method:  
Group selection presupposes that the subjects of evolution are niche-constructing (Laland 2024) developmental (Puentedura 2007) processes (evo-eco-devo). Here, we simulate computationally (Nowak 2006) a population of Prisoner's Dilemma (PD) processes whose strategy can mutate arbitrarily with low probability. Strategies are selectively punished for exhibiting (with probability  $q$ ) the cooperative behaviour of forgiveness, unless this forgiveness is reciprocated (with probability  $p$ ) by other players. In this case, selection rewards the mutual interaction between forgiveness and reciprocation. We discuss whether this dynamical system demonstrates that group selection is essential to the evolution of cooperation.

Results:  
In the graph, cooperation evolves in a mutating population of PD defectors. Initially, forgiving behaviour is penalised: its representation in the population falls as reciprocating rises. Subsequently, forgiving rises to  $q \approx 0.6$  and reciprocating rises towards  $p \approx 1.0$ .

Implications:  
Cooperation evolves as defectors construct around themselves a mutually reciprocating niche of players that reward forgiveness. Since this niche is selected due to its group property of reciprocating behaviour between its members, our results suggest that selection of groups is important for the evolution of cooperation.



References:

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