

Group selection and the evolution of cooperation

Niall Palfreyman, Weiheinstephane-Triesdorf University of Applied Sciences, 3.11.2025.

Structured Abstract

Paper type: Empirical.

Background(s): Evolutionary biology.

Approach: Game dynamics.

Context: Wilson & Wilson (2007) argue that group selection drives the evolution of cooperative behaviours, yet over the past century, many have claimed that group selection is irrelevant to evolution.

Problem: We observe examples of cooperation in the biological world, but it is often difficult to be certain that these 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). In this work, we simulate computationally (Nowak 2006) a mutating population of Prisoner's Dilemma (PD) processes that are selectively punished for exhibiting the cooperative behaviour of *forgiveness* (with probability q), unless this forgiveness is *reciprocated* (with probability p) by neighbours, in which case, selection rewards the combined interaction of forgiveness with reciprocation. We discuss whether group selection is essential to the evolution of cooperation within this system.

Results: In a mutating PD population that initially contains only defectors, cooperation evolves by the following route: Forgiveness remains initially low, while reciprocation rises, whereupon forgiveness also rises to the moderate value of $q = 0.65$, following which reciprocation rises to the high value $p = 0.97$.

Implications: In this simulation, cooperative behaviour arises as reciprocators construct around themselves a mutually reciprocating group within which forgiveness can thrive. This suggests that group selection is central for the evolution of cooperative behaviours, since the reciprocating group constitutes a niche that selectively rewards forgiveness and cooperation among its members.

References

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