Cover Letter: Stability of defection, optimisation of strategies and the limits of memory in the Prisoner's Dilemma.

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To the editors,

The Prisoner's Dilemma has been used for decades to explain human interactions and the emergence of cooperation amongst us. A paper published in 2012 [3] stated that the best action one can take when playing a Prisoner's Dilemma game is to manipulate their opponent and ensure victory whilst not needing to remember much of their past interactions. A rapidly expanding literature following [3] questioned these results and have since then established that memory-one strategies must be forgiving to be evolutionarily stable [1] and that longer-memory strategies have a certain advantage over short memory strategies [2].

This manuscript presents further evidence downplaying the findings of [3]. It reinforces the discussion that the best action is adaptability not manipulation and that short memory can be limiting. This is done by exploring the full space of memory-one strategies, and more specifically, the best responses of memory-one strategies. We introduce a well designed framework which allow us to identify the best response memory-one strategy against a given set of opponents and to compare an optimal memory-one strategy and a more complex strategy which has a larger memory. It is also used to identify conditions for which defection is stable; thus identifying environments where cooperation will not occur.

The framework which is introduced in this manuscript can be used for the continued understanding of best responses in the Prisoner's Dilemma and the emergence (or not) of cooperative behaviour in complex dynamics, and thus we believe that our paper would be a great addition to the journal.

The Authors.

Declarations

The authors did not have any prior discussions with a Scientific Reports Editorial Board Member about the work described in the manuscript.

Potential Reviewers

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