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,

This paper presents a framework for exploring the space of memory-one strategies in the Iterated Prisoner's Dilemma (IPD), and identifying the best response strategy to a variety of situations. It is demonstrated how best response memory-one strategies can be found explicitly by considering a multidimensional optimisation of a ratio of two quadratic functions.

This paper offers a strong contribution on three fronts:

- It presents a compact method of identifying the best memory-one strategy against a given set of opponents in tournaments and evolutionary settings.
- It presents a well designed framework that allows the comparison of an optimal memory one strategy, and a more complex strategy that has a larger memory.
- It presents a identification of conditions for which defection is known to be a best response; thus identifying environments where cooperation can not occur.

The results of this work contribute to the discussion regarding the effectiveness of extortionate strategies in the IPD, it highlights the importance of adaptability in multi player interactions and the limitations of short memory. The results are novel not only from the point of view of game theory as a field but but also a mathematical novelty of solving quadratic ratio optimisation problems where the quadratics are non concave.

This work has been carried out with the highest standard of reproducibility: the source code for generating data and for the analysis are not only well described but they are also all open source, archived and made available online.

Thank you for taking the time to consider our work,

The Authors.