

**Cover letter: Recognising and evaluating the effectiveness of extortion in the Iterated Prisoner's Dilemma**

To whom it may concern,

In 2012, Press and Dyson published a paper in PNAS entitled: "Iterated Prisoner's Dilemma contains strategies that dominate any evolutionary opponent". This work has obtained a lot of interest as it seemed to indicate an evolutionary advantage to extortionate behaviour. Essentially putting in doubt a large amount of work showing how and why cooperative behaviour emerges in complex systems.

There have been numerous follow ups to this work showing that perhaps the findings were not as robust as originally claimed. One such example is the work of Adami and Hintze: "Evolutionary instability of zero-determinant strategies demonstrates that winning is not everything" which in 2013 was published in Nature Communications and showed that whilst extortionate behaviours will better any given agent this advantage does not extend in an evolutionary way.

The work we present here, extends these observations by reversing them. We consider a large set of more than 200 behaviours obtained through open scientific processes and available to all to use and using a linear algebraic approach to determine if a strategy is behaving in an extortionate way. Some of these strategies are classic strategies from the literature whilst others are more up to date and are the result of machine learning and reinforcement learning techniques. This allows us to obtain experimental evidence detailing that whilst extortionate behaviour can be advantageous, it needs to be combined with adaptability to be evolutionarily beneficial.

We present this work for publication in Nature Communications as it not only extends a number of papers published in this journal, presents strong novel findings relating to the mechanisms for which behaviours can emerge in complex systems but also makes available a number of tools and data according to best open scientific principles.

Sincerely,

The authors