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

To whom it may concern,

We present strong and novel results indicating that extortionate behaviours are not as robust as adaptable behaviours, extending and improving on fundamental recent results in evolutionary game theory including highly-cited manuscripts appearing in Nature Communications. All research software designed for the work and all data is made available for all to use according to the very best open scientific principles.

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 which puts 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 where 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 never not lose against any agent in expectation, this advantage does not extend in an evolutionary way.

The work we present here extends these observations by reversing them. We analyze more than 200 strategies/behaviours from the literature and many original contributors, obtained through open scientific processes and available to all to use. A linear algebraic approach is used to determine if a strategy is behaving in an extortionate way. Some of these strategies are classic strategies from the literature whilst others have been recently developed using 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.

Sincerely,

The authors