

THE POWER OF MEMORY

In interactions both social and biological can memory be advantageous?

In the 1980's, Robert Axelrod carried out a computer tournament of the iterated prisoner's dilemma. In the iterated version of the game the players interact for an infinite number of time and they have access to the full history of the matches. Axelrod's results argued for the first time how cooperation can be evolutionarily advantageous.

	1	2	3	...	<div>memory-1</div> <div>$n-1$</div>	n
player p	C	C	C	...	D	...
player q	C	C	D	...	D	...
	<div>memory size-m</div>					

In 2012 Press and Dyson studied the iterated prisoner's dilemma in a similar manner. They stated that in a two players interaction, a player with the shortest memory in effect sets the rules of the game. A player with a good memory-one strategy can force the game to be played, effectively, as memory-one. Thus, in the iterated prisoner's dilemma, memory is not advantageous.

The purpose of this work is to consider a given memory one strategy $q = (q_1, q_2, q_3, q_4)$. However whilst [?] found a way for the opponent of q to manipulate q , this work will consider an optimisation approach to identify the best response $p^* = (p_1, p_2, p_3, p_4)$ to a strategy q . In essence answering the question: what is the best memory one strategy against a given other memory one strategy.

- Both players are better of choosing Cooperation (3)
- there is always a temptation for a player to Defect (5).

C

D

C

D

$(3, 3)$

$(5, 0)$

$(0, 5)$

$(1, 1)$

(1)