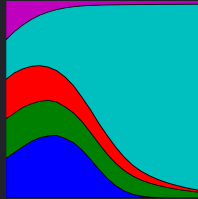


# Evolution of cooperation among individuals with limited payoff memory

ICSD 2022

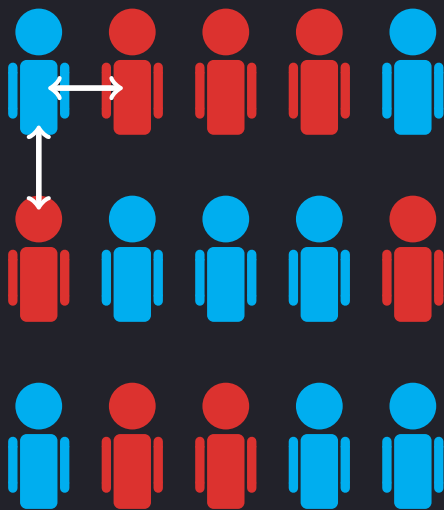
Nikoleta Glynatsi, Christian Hilbe, Alex McAvoy



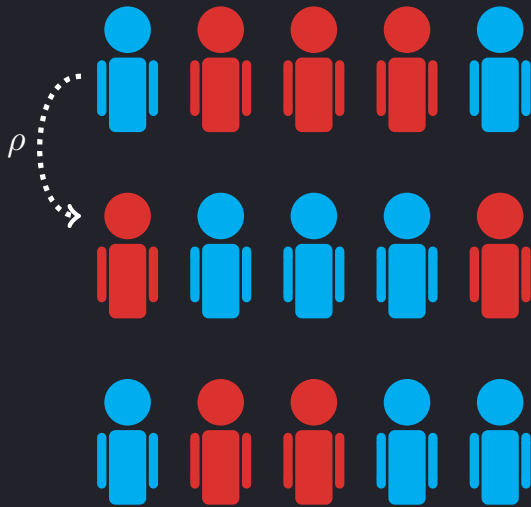
$$\begin{pmatrix} b-c & -c \\ b & 0 \end{pmatrix}$$

How do we model the evolution of cooperation?







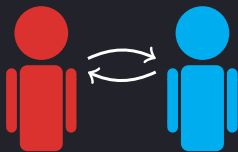


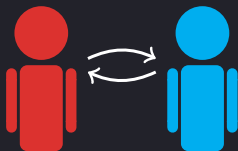


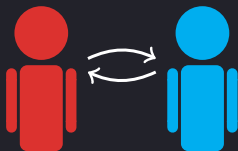


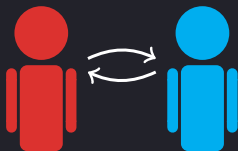
$$\rho = \frac{1}{1 + e^{-\beta(\pi_A - \pi_B)}}$$









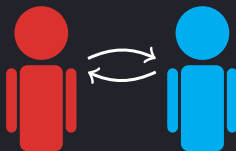


...



...





$(y, p, q)$



...

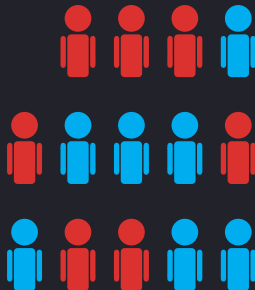


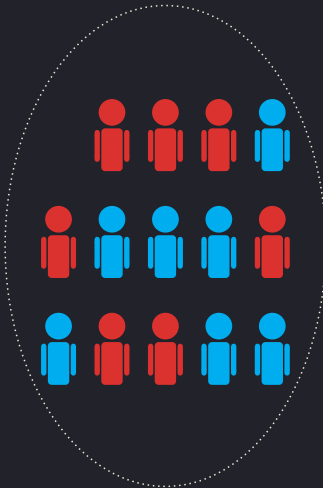
...





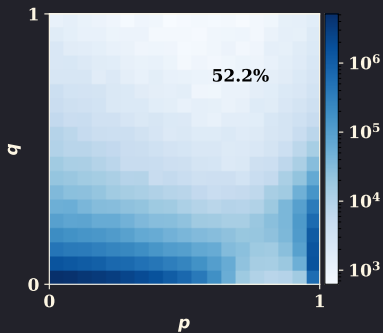
$\pi_A$  and  $\pi_B$ ?



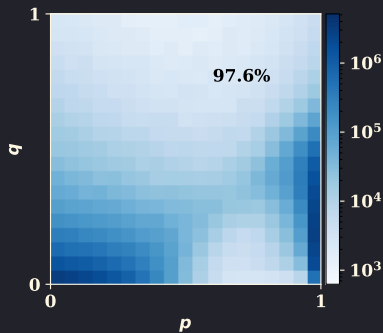


$$\pi_{\text{B}} = (k-1) \begin{array}{c} \text{blue} \\ \text{red} \end{array} + (N-k) \begin{array}{c} \text{blue} \\ \text{blue} \end{array}$$

## Perfect Memory Payoffs



Low benefit ( $c = 1, b = 3$ )



High benefit ( $c = 1, b = 10$ )

Interactions stage:



- remembers last turn
- + knows opening action

Interactions stage:



- remembers last turn  
+ knows opening action

Updating stage:



- remembers  $N - 1$  interactions
- remembers each turn

Interactions stage:



- remembers last turn
- + knows opening action



Interactions stage:

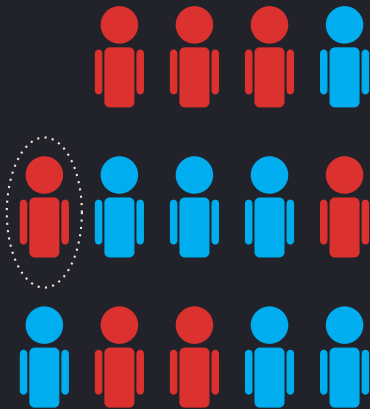


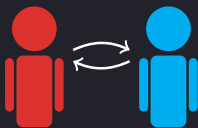
- remembers last turn
- + knows opening action

Updating stage:



- remembers  $N-1$  interactions
- remembers each last turn





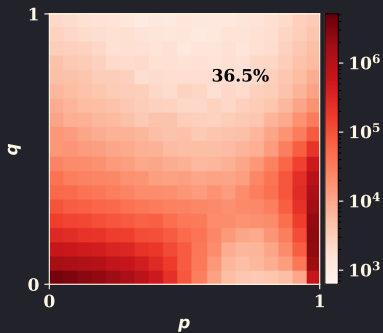
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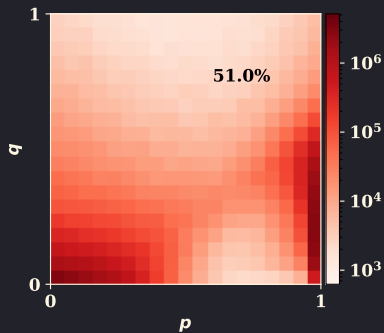
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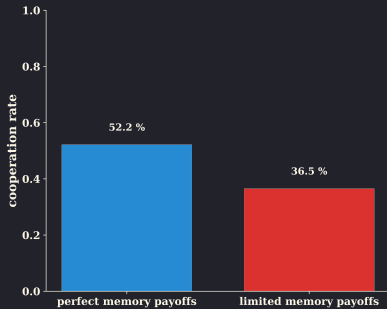
## Limited Memory Payoffs



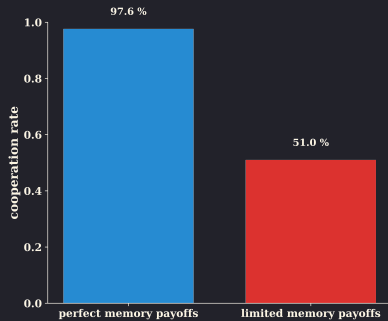
Low benefit ( $c = 1, b = 3$ )



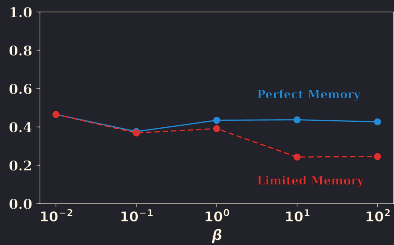
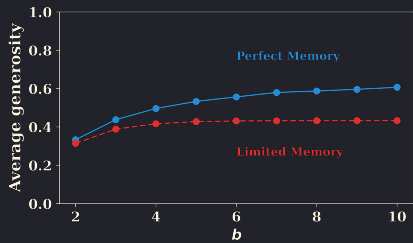
High benefit ( $c = 1, b = 10$ )



Low benefit ( $c = 1, b = 3$ )



High benefit ( $c = 1, b = 10$ )





- remembers 1 interactions
- remembers last turn



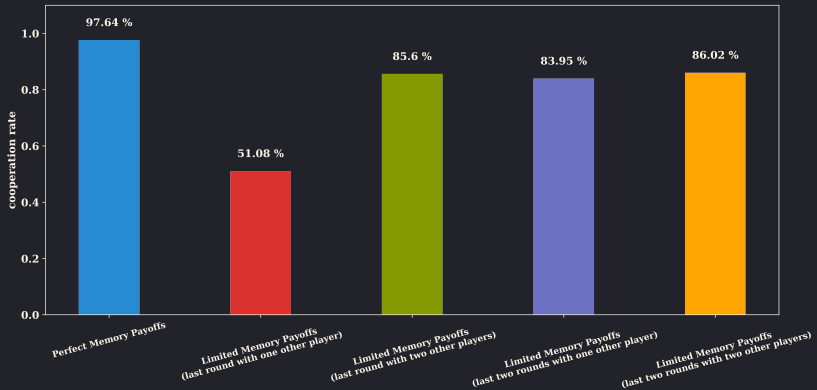
- remembers 2 interactions
- remembers last turn



- remembers 1 interactions
- remembers 2 last turn



- remembers 2 interactions
- remembers two last turn





🐦 @NikoletaGlyn

🐦 @chilbe3

🔗 Nikoletav3

<http://web.evolbio.mpg.de/social-behaviour/>

