

Evolution of cooperation among individuals with limited payoff memory

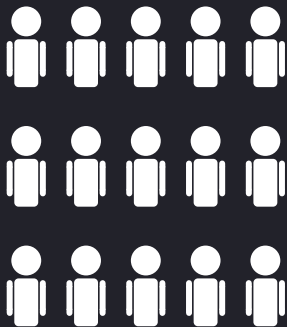
Dynamics of Social Behavior

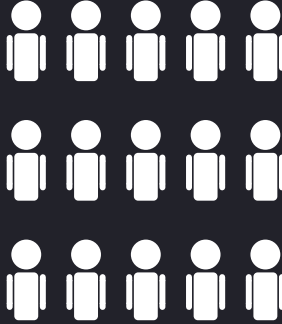


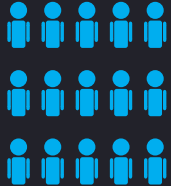
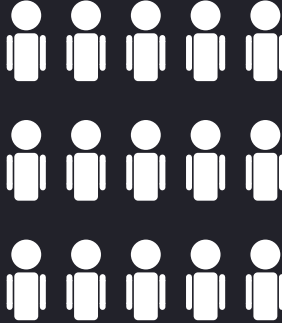


$$\begin{pmatrix} b - c & -c \\ b & 0 \end{pmatrix}$$

Does cooperation evolve?



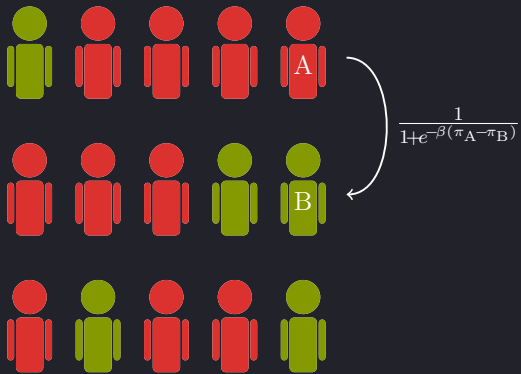


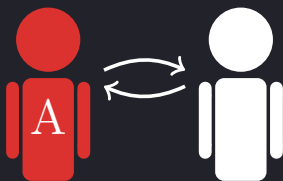




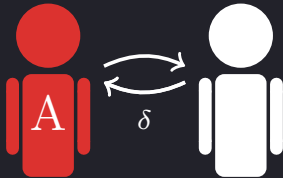












$$(y^A, p^A, q^A)$$

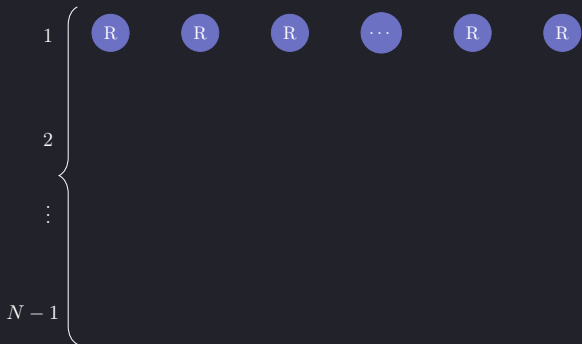


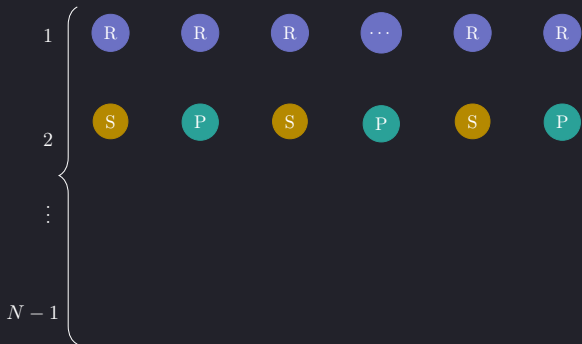
$$(y^A, p^A, q^A) \quad (y^\Gamma, p^\Gamma, q^\Gamma)$$

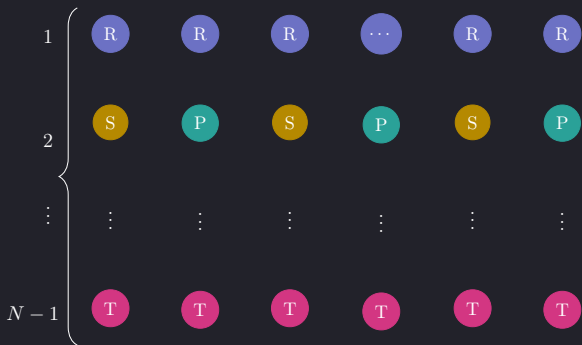


1
2
 \vdots
 $N - 1$







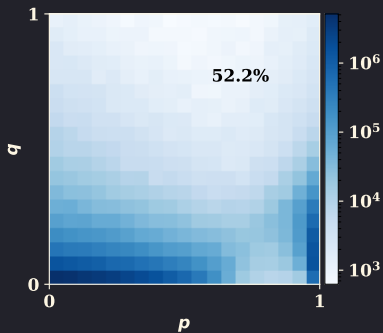


$$\pi_A = (N - k - 1) \text{ 🧑🧑 } + k \text{ 🧑👤 }$$

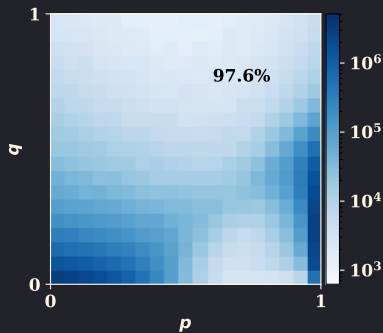
$$\pi_{\text{A}} = (N - k - 1) \text{ (red head, red body)} + k \text{ (red head, green body)}$$

$$\pi_{\text{B}} = (k - 1) \text{ (green head, red body)} + (N - k) \text{ (green head, green body)}$$

Perfect Memory Payoffs



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



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

Game stage:



- remembers last turn
- + knows opening action

Game stage:



- remembers last turn
+ knows opening action

Update stage:



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

Game stage:



- remembers last turn
- + knows opening action

Game stage:



- remembers last turn
+ knows opening action

Update stage:

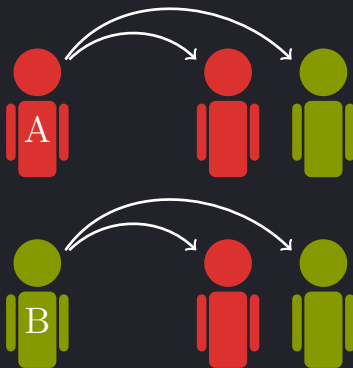


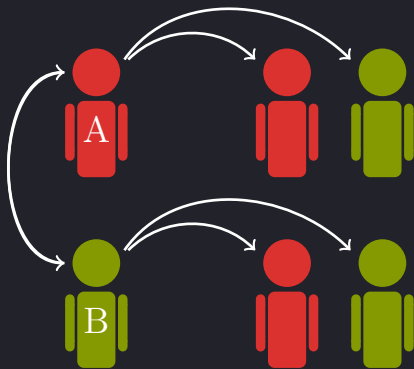
- remembers $N-1$ interactions
- remembers each last turn

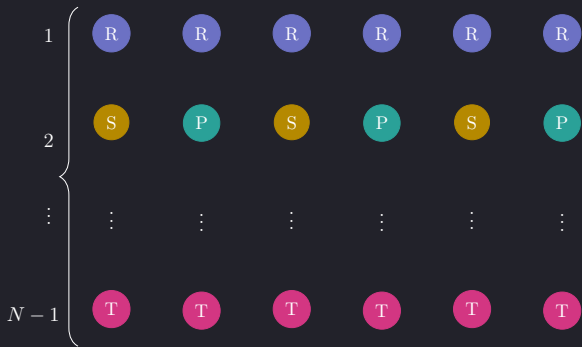




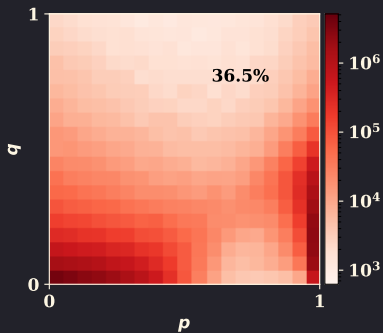




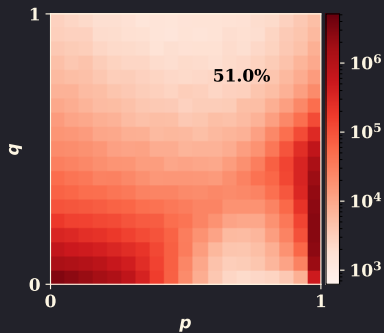




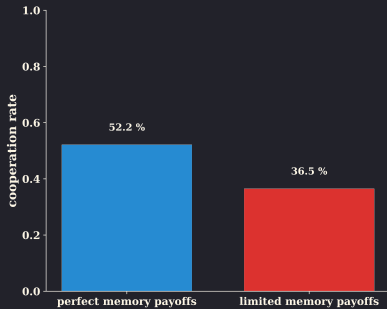
Limited Memory Payoffs



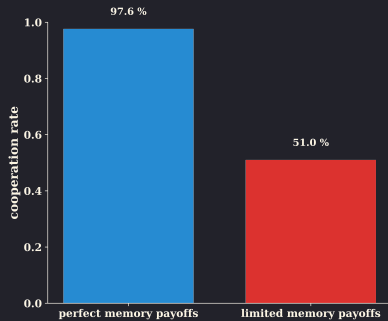
Low benefit ($c = 1, b = 3$)



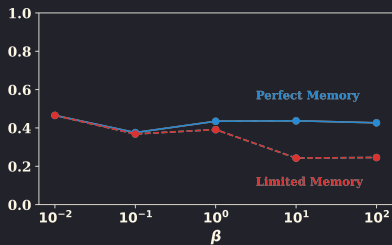
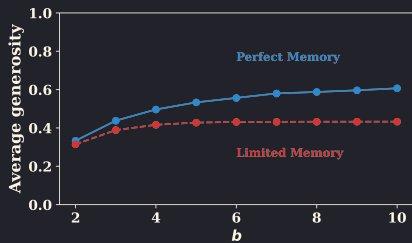
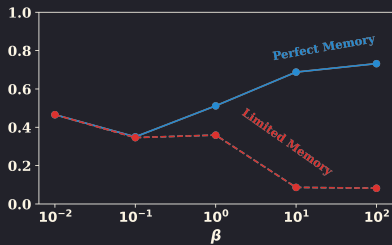
High benefit ($c = 1, b = 10$)



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



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





- remembers 1 interactions
- remembers last turn



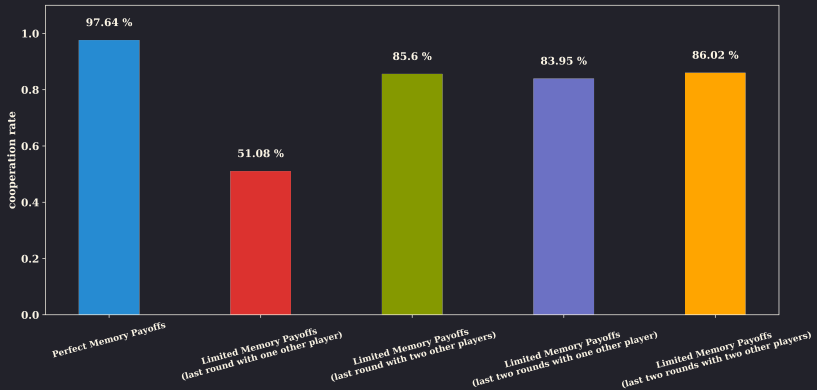
- remembers 2 interactions
- remembers last turn



- remembers 1 interactions
- remembers 2 last turn



- remembers 2 interactions
- remembers two last turn



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