Reputation allows the co-evolution of cooperation and social rewarding

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1. Background

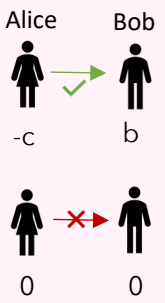
- Incentives like rewards promote cooperation.
- This incentive mechanism has faces certain problems - (second order free riding & antisocial incentives)

2. Questions

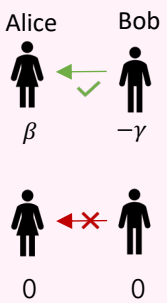
- Do rewards lead to the evolution of cooperation when recipients can gain reputation for their rewarding behaviour?

3. Model – The two-player interaction

Stage 1: (Alice's decision)



Stage 2: (Bob's decision)



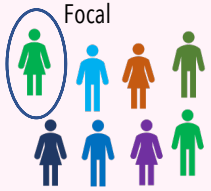
Bob's rewarding strategies	If Alice cooperates	If Alice defects
Never	✗	✗
Social	✓	✗
Antisocial	✗	✓
Always	✓	✓

Alice has **information** about Bob's strategy with probability λ

Alice's strategies	Knows Bob's strategy: Never	Social	Antisocial	Always	Does not know Bob's strategy
Cooperator	✓	✓	✓	✓	✓
Opportunistic Cooperator	✗	✓	✗	✗	✓
Opportunistic Defector	✗	✓	✗	✗	✗
Defector	✗	✗	✗	✗	✗

4. Model – Evolution of Strategies

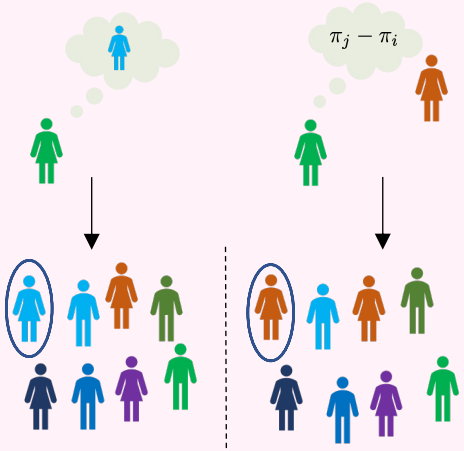
At every time step:



Interaction in populations ⟹ Payoffs averaged over all random interactions.

With probability μ: (Random exploration)

With probability 1 - μ: (Imitation)



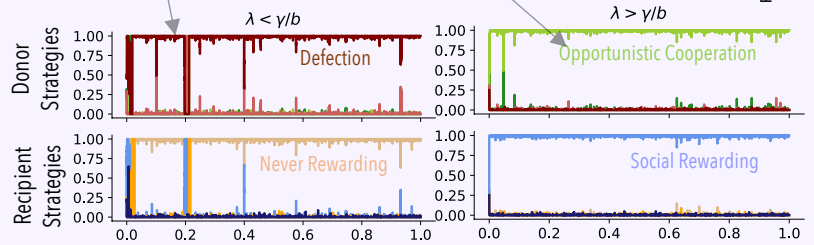
How to study such dynamics?

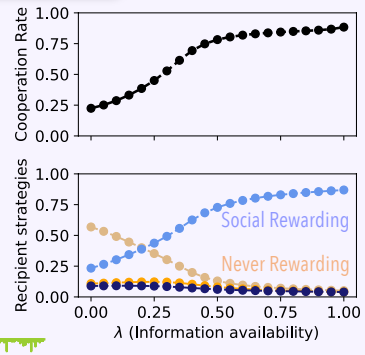
- Equilibria strategies (Nash equilibria)
- Simulations
- When explorations are rare, numerically exact solutions are feasible.

5. Results – Well mixed population

Pure Nash equilibria of the game:

$\lambda < \gamma/b$ (Low Information)	$\lambda > \gamma/b$ (High Information)
1. (Defection, Never)	1. (Defection, Never) 2. (Opportunistic Cooperation, Social)

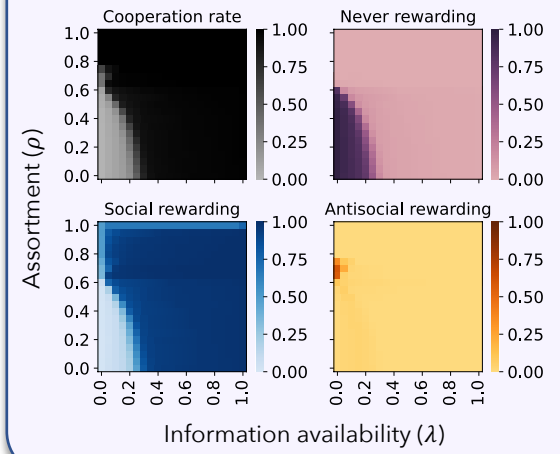




Antisocial rewarding –

a) Not an equilibrium
b) Does not evolve

6. Results – Assorted population



7. Conclusions

1. When information is low, evolution favours **never rewarding & defection**

2. When information is sufficient, evolution favours **social rewarding & cooperation.**

3. Under assortment, antisocial rewarding can be favoured **but** in general, assortment assists **social rewarding & cooperation.**