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Evolutionary Dynamics of Signaling Games

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Problems

- ➔ The dilemma under communication: signaling in a honest way does not seem to be the optimal choice all the time. Should it naturally emerge? Where exactly does its emergence come from?
- ➔ Studying large populations of signalers becomes increasingly difficult.

Solutions:

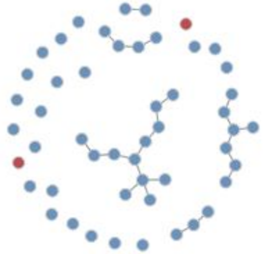
- ➔ Handicap Principle
- ➔ Reputation
- ➔ Networks

Questions

I. How can signaling evolve?

II. Can we assess how much time an evolutionary system is expected to spend in each signaling equilibria?

III. What’s the role of (dynamical) structured populations in the emergence of signaling systems?

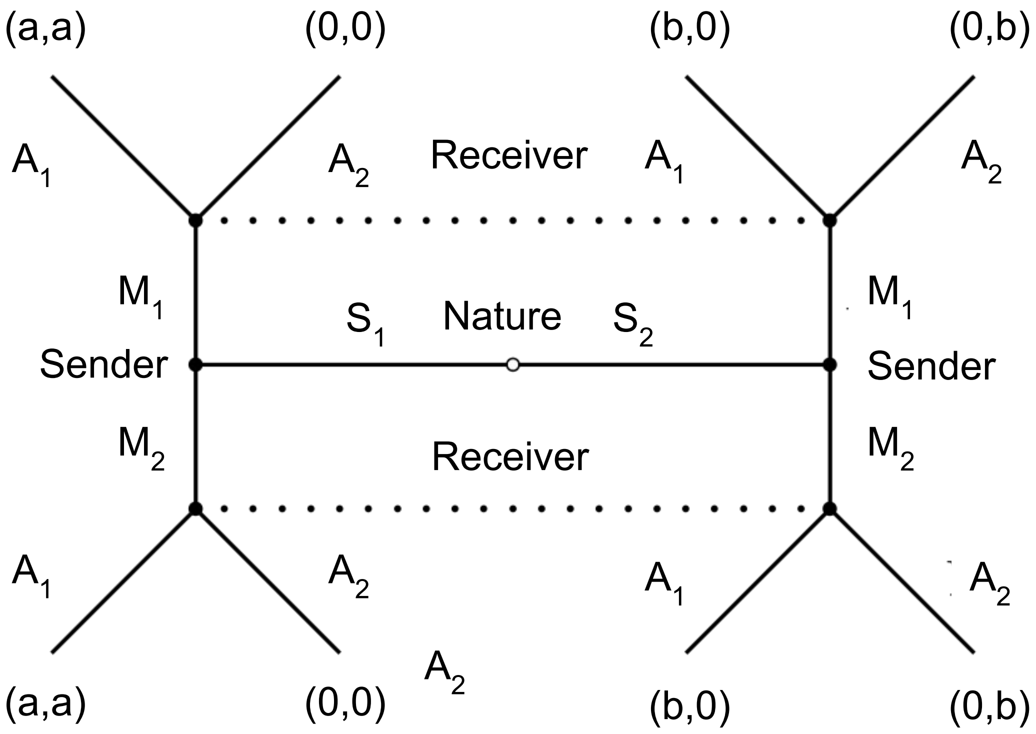


Framework

- ➔ Signaling Game: conflicting interests, cheap-talk, symmetric version
- ➔ Finite Populations with stochastic update rule, using Fermi distribution from statistical mechanics
- ➔ Small Mutation Limit
- ➔ Active Linking

Framework

→ Signaling Game in its extensive form.



Framework

➔Signaling Game: conflicting interests, cheap-talk.

	S_1	S_2
A_1	(a,a)	(0,b)
A_2	(0,0)	(b,0)

$a,b > 0$

S_1 : Coinciding Interests
S_2 : Conflicting Interests

Framework

➔ Signaling Game: conflicting interests, cheap-talk, symmetric version.

	SS	SD
SS	(2a+b, 2a+b)/4	(2a, 2a+2b)/4
SD	(2a+2b, 2a)/4	(2a+b, 2a+b)/4

a,b＞0

SS : Signaling System
SD : Signaling Dishonestly

Framework

➔Finite Populations with stochastic update rule, using Fermi distribution from statistical mechanics.

$$p(A \rightarrow B) = \frac{1}{1 + e^{-\beta(\Pi_B(k) - \Pi_A(k))}}$$

Framework

➔Small Mutation limit $\mu \rightarrow 0$:

Systems will spend most of the time in monomorphic populations (players acting collectively the same way), and a small amount in transient ones;

Transitions between monomorphic states A and B are computable.

$$\rho_{A,B} = \left[\sum_{i=0}^{Z-1} \left(\prod_{k=1}^{i} e^{-\beta(\Pi_B(k) - \Pi_A(k))} \right) \right]^{-1}$$

Framework

➔Small Mutation limit $\mu \rightarrow 0$:

Transition matrix of the approximate Markov Process.

$$M = \begin{bmatrix} 1-\eta(\rho_{1,2}+\ldots+\rho_{1,n_s}) & \eta\rho_{1,2} & \ldots & \eta\rho_{1,n_s} \\ \eta\rho_{2,1} & 1-\eta(\rho_{2,1}+\rho_{2,3}\ldots+\rho_{2,n_s}) & \ldots & \eta\rho_{2,n_s} \\ \ldots & \ldots & \ldots & \ldots \\ \ldots & \ldots & \ldots & 1-\eta(\rho_{n_s,1}+\ldots+\rho_{n_s,n_s-1}) \end{bmatrix}$$

Framework

➔Active Linking

Players have propensity to form links with each other α_A ;

Links have a probability to vanish γ_{AB} ;

Limit of the equilibrium network $T_a \ll T_s$;

Payoffs obtained by players are altered, bringing new dynamics.

$$\pi_{AB}' = \frac{\alpha_A \alpha_B}{\alpha_A \alpha_B + \gamma_{AB}} \pi_{AB}$$

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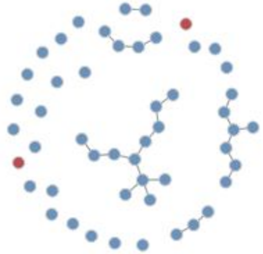

Work Plan

- ➔ Revision of literature;
- ➔ Development of the analytic framework;
- ➔ Obtain the first results: transition probabilities and stationary distributions between monomorphic states;
- ➔ Extension of the framework to active linking;
- ➔ Discussion and comparative analysis of results;
- ➔ Thesis writing and submission

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