



# Evolving Communication in Agent-based Models

A FINAL PROJECT CONDUCTED BY ADRIAN ZERMIN

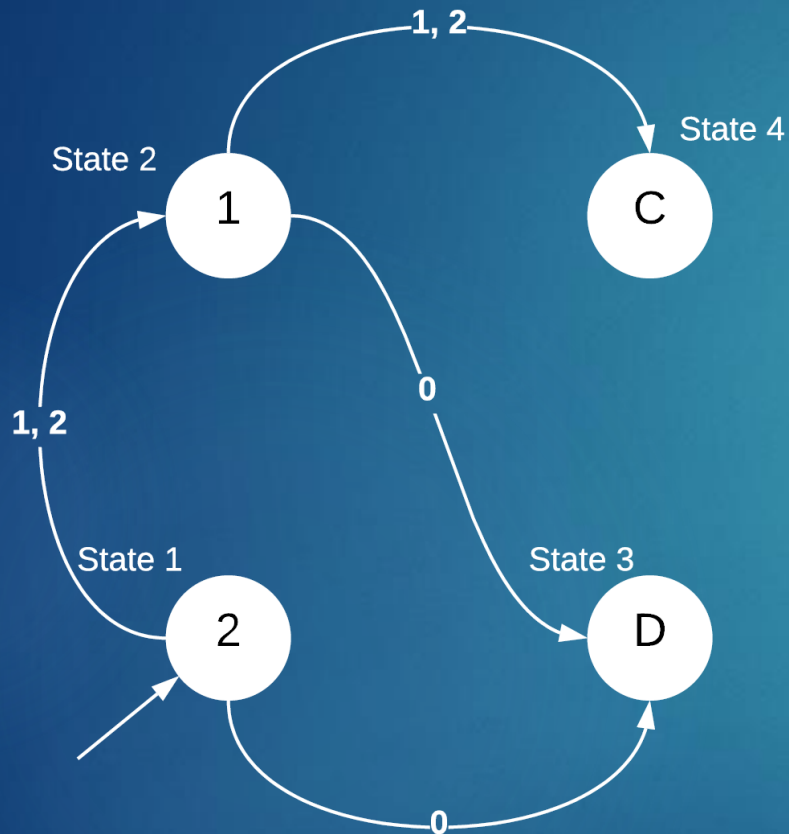
# The Model

- ▶ Goal: Investigate **emergent communication**
- ▶ Agents play one-shot **simultaneous move games**
  - ▶ **Prisoners Dilemma:**

	Cooperate	Defect
Cooperate	3, 3	0, 5
Defect	5, 0	1, 1

- ▶ Agents communicate by exchanging **tokens** before playing
- ▶ Agents adapt through a **genetic algorithm**


# Agents



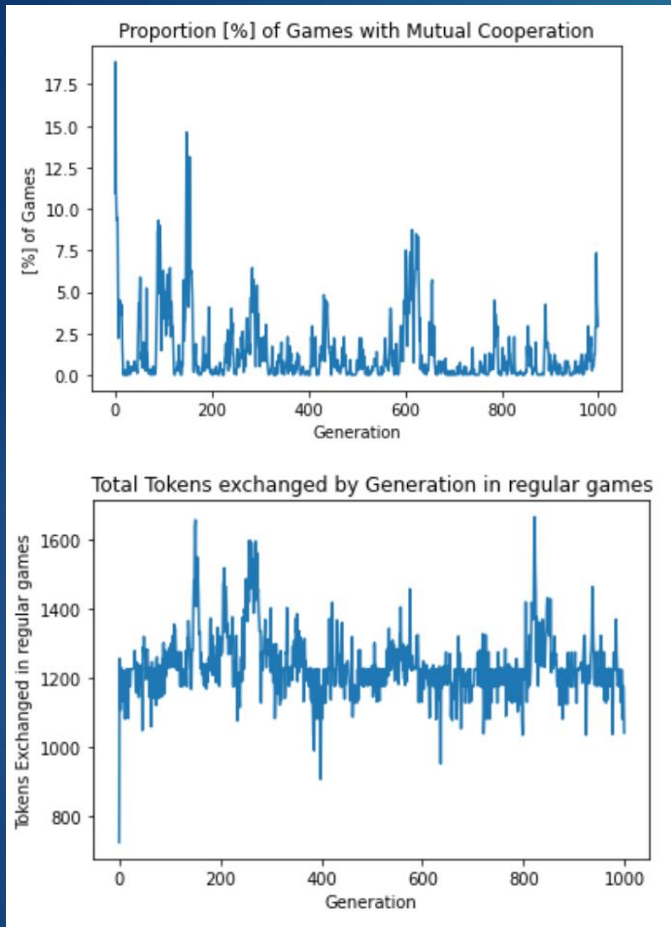
- Agents are represented by Moore Machines with  $c$  states
- States are linked to actions, either pick a final move or send out a token and communicate
- Transitions are based on the tokens received by their opponents
- The initial state is marked

Available tokens =  $\{0, 1, 2\}$   
Number of states = 4

# Genetic Algorithm

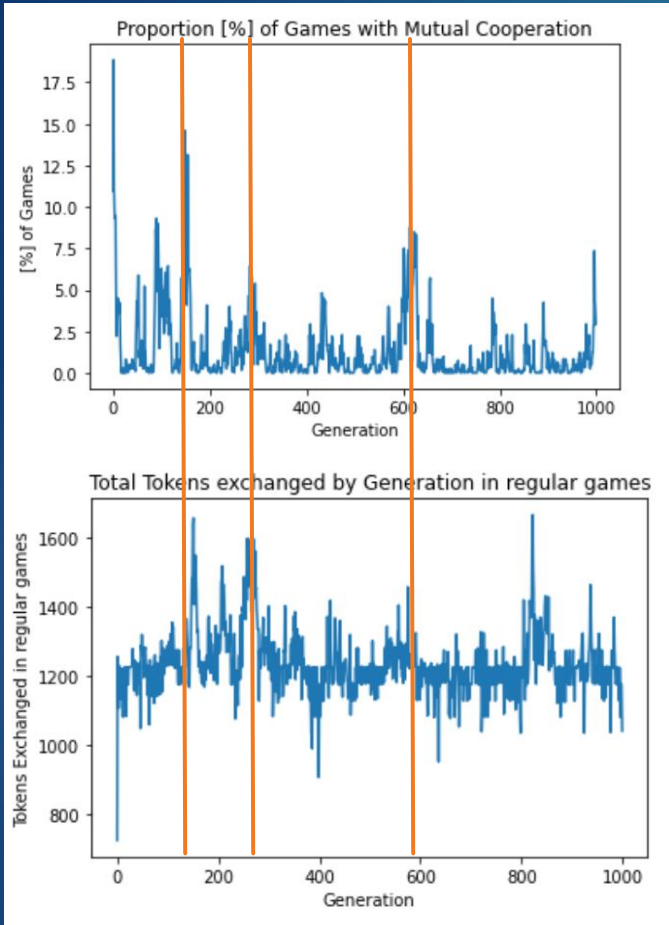
1. Randomly initialize a population of  $n$  agents
  2. Perform a round-robin tournament where every agent plays every other agent in a Prisoners' Dilemma
  3. Randomly select 2 agents from the population (with substitution)
  4. Select the agent with the higher payoff for reproduction
  5. Selected agent is mutated with a fixed probability to either:
    1. Change the action associated with a state
    2. Change the state a transition goes to
  6. Repeat until population size is  $n$  again
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# Results



- System defined by outbreaks out cooperation

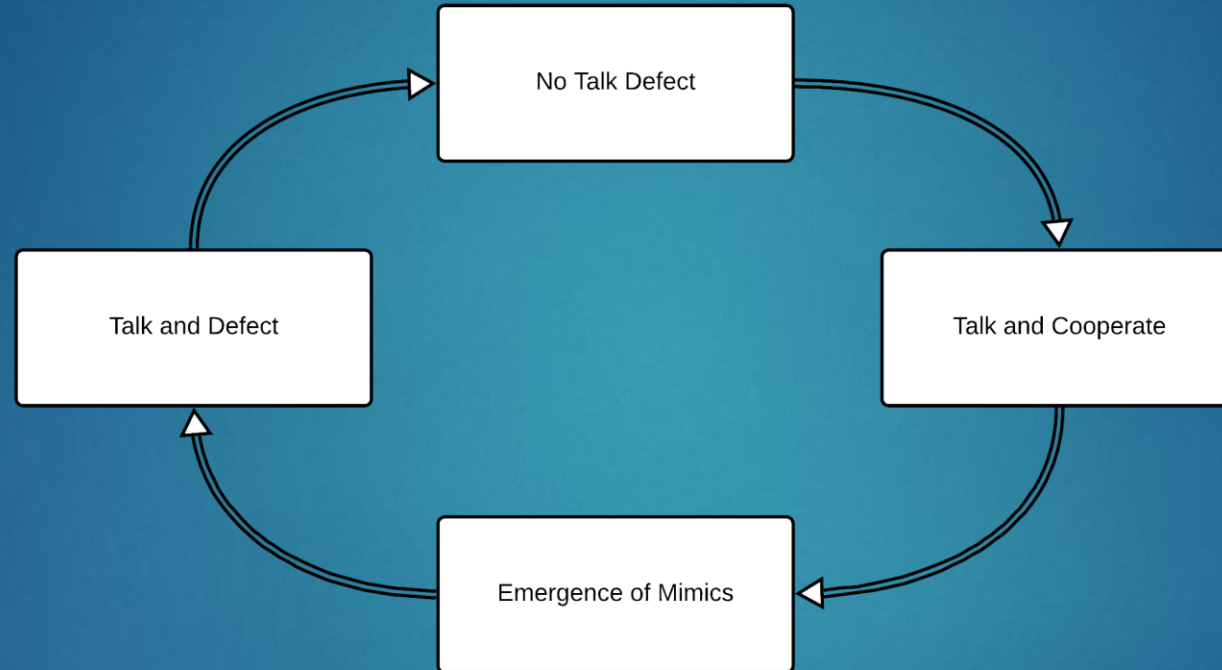
# Results



- System defined by outbreaks out cooperation
- Communication is fostering cooperative outcomes
- Cooperative outcomes aren't stable



# Emerging strategies



# Thank you for your attention

