Ultimatum Game in Complex Networks

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Network Science

Ultimatum Game

Proposer offers p

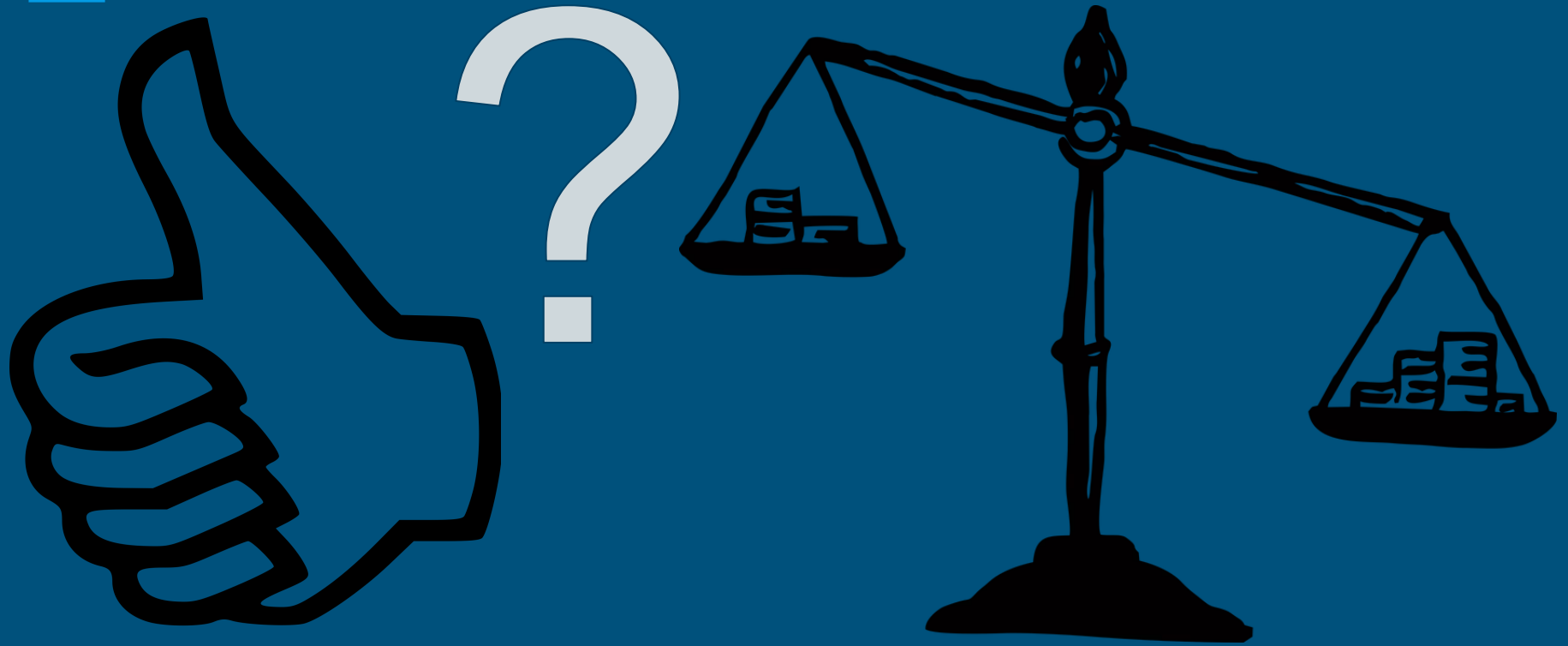
Responder accepts

Proposer receives 1-p
Responder receives p

Responder rejects

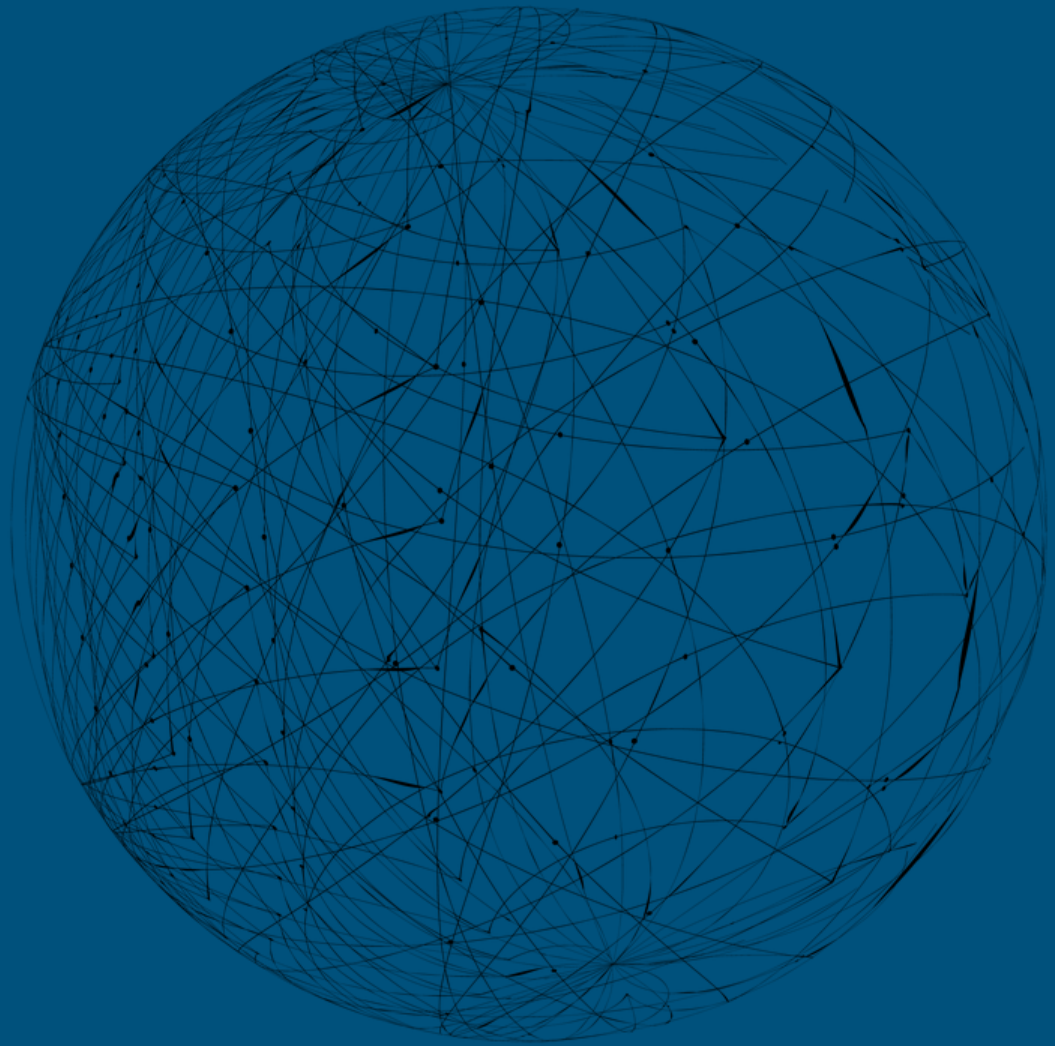
Proposer receives 0
Responder receives 0

Ultimatum Game



Method

- Erdős–Rényi graphs
- Scale-free networks
- 3 types of players
- 2 update Rules



NetworkX

Network Analysis in Python

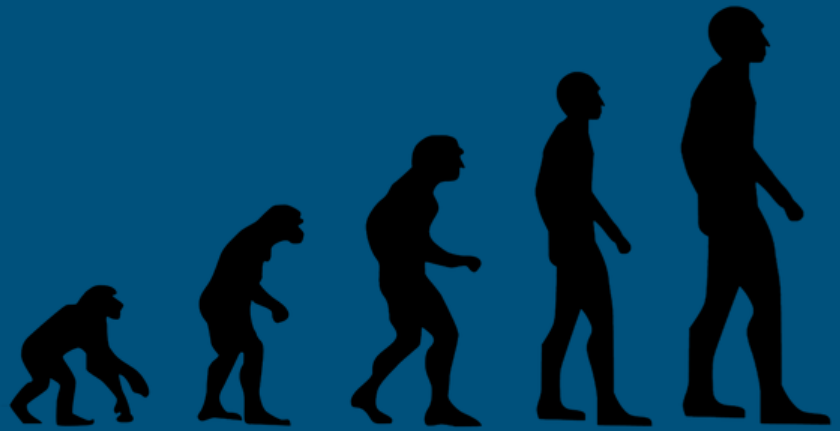
Types of Players

- Empathetic
- Pragmatic
- Independent

Update Rules

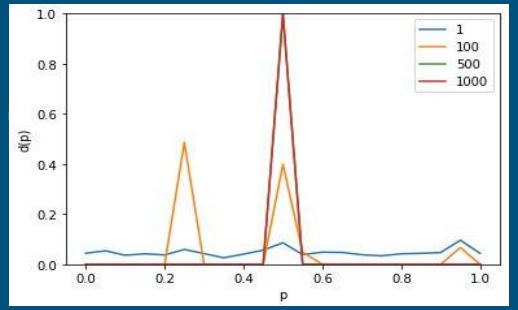
- Natural Selection
- Social Penalty

$$P_{ij} = \frac{\Pi_j - \Pi_i}{2\max\{k_i, k_j\}}$$

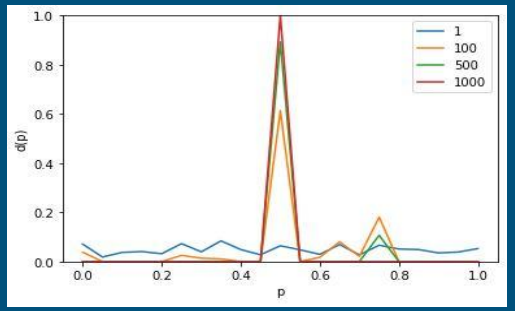


Natural Selection

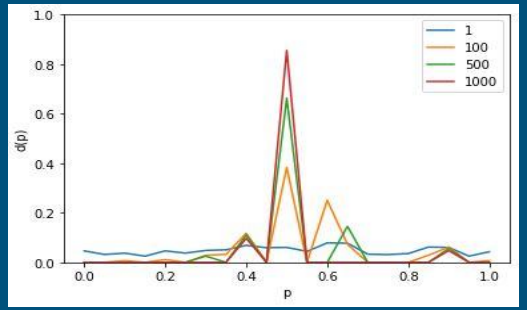
Scale Free



Empathetic

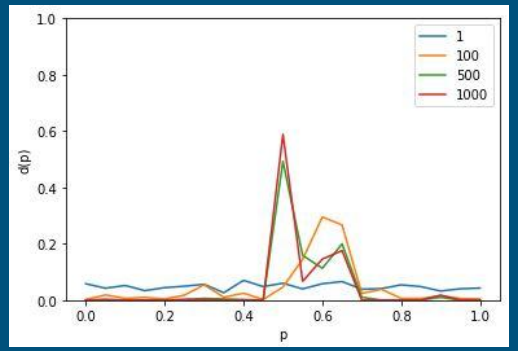


Pragmatic

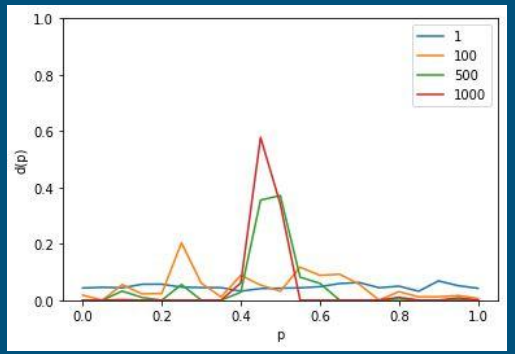


Independent

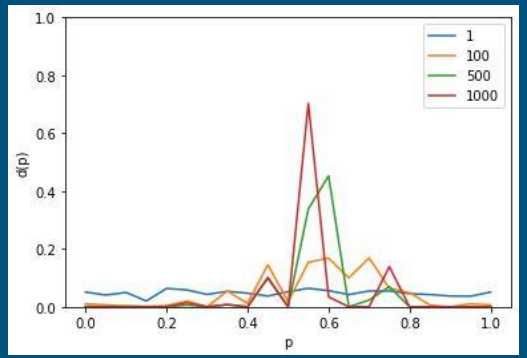
Erdős–Rényi



Empathetic

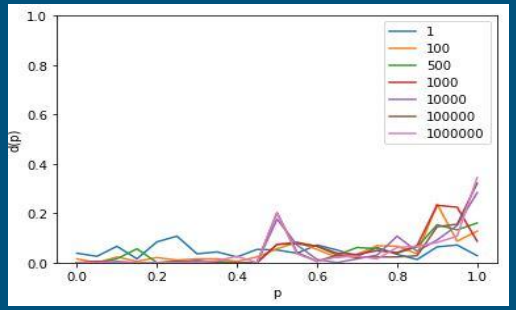


Pragmatic



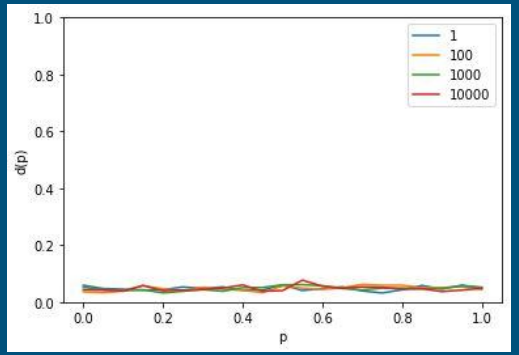
Independent

Social Penalty



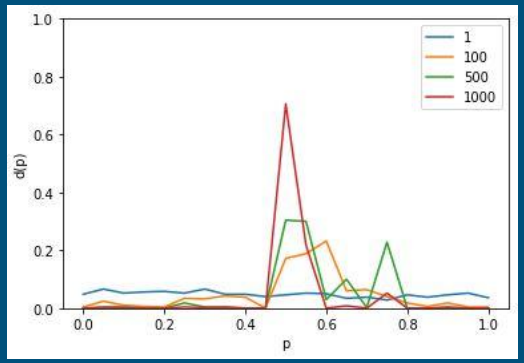
Scale Free Empathetic

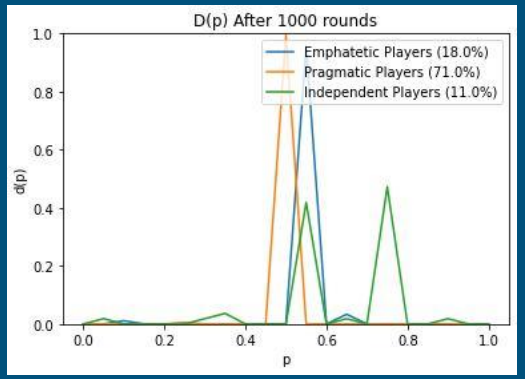
Social Penalty & Natural Selection

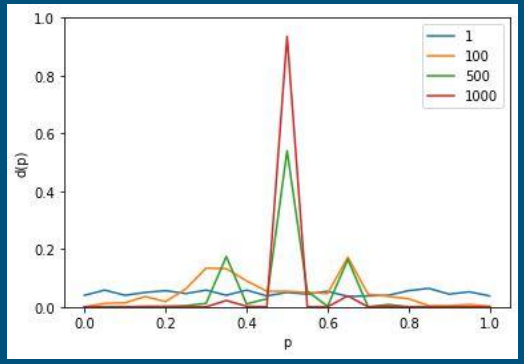


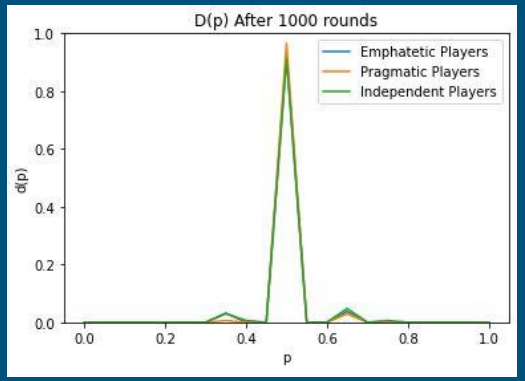
Erdős–Rényi Empathetic

Social Penalty on Networks with multiple types of Players









Erdős–Rényi

Results and Conclusion

- Heterogeneity
- Convergence to 0.5
- Nash Equilibrium

Nash Equilibrium

	Player 2	
Player 1	(1,1)	(0,5)
	(5,0)	(3,3)

Pareto Optimal

Ultimatum Game in Complex Networks

Questions?