

Other Regarding Behavior:  
Intro to Cooperation & Game Theory

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Taylor Lange

# Agenda

1. My Background
  2. Simple Game Theory
  3. Social Dilemmas
  4. Reciprocal Solutions
  5. Online Game
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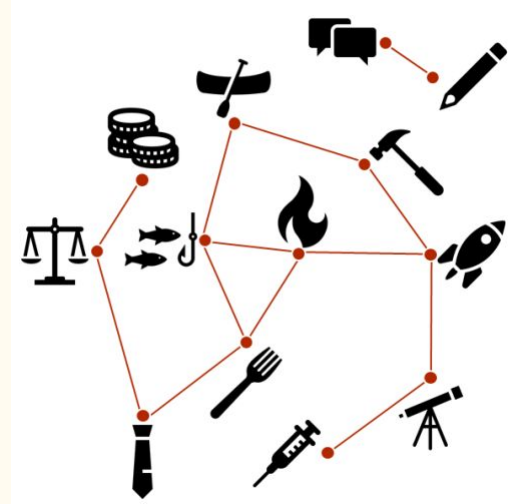
# First About Me

# First About Me

- Evolutionary Social Scientist

# First About Me

- Evolutionary Social Scientist
  - Cultural Evolution



# First About Me

- Evolutionary Social Scientist
  - Cultural Evolution
  - Cooperation Science



# First About Me

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  - Network Science



# First About Me

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- Previous Work



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  - Beliefs about Climate Change in the Evangelical Church

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- Evolutionary Social Scientist
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- Current Work: Food Buying Clubs



# First About Me

- Evolutionary Social Scientist
  - Cultural Evolution
  - Cooperation Science
  - Network Science
- Previous Work:
  - Beliefs about Climate Change in the Evangelical Church
- Current Work: Food Buying Clubs
  - Cooperation
  - Preferences
  - Evolution



# Neoclassical Assumptions

1. Unbounded Rationality
  2. Temporal Stability
-

# Neoclassical Assumptions

1. *Unbounded Rationality*
2. *Temporal Stability*
3. **Exclusive Self-Interest**

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# Game Theory

# Game Theory

“Game Theory can be defined as the study of mathematical models of conflict and cooperation between intelligent, rational decision makers”

- Roger Myerson

*Game Theory: Analysis of Conflict*

# Game Theory

2 Categories



# Game Theory

## 2 Categories

1. Cooperative - Agents make decisions based on contracts

# Game Theory

## 2 Categories

1. Cooperative - Agents make decisions based on contracts
2. Non-cooperative - Agents make decisions unbounded by prior agreements

# Game Theory

## 2 Categories

1. Cooperative - Agents make decisions based on contracts
2. **Non-cooperative - Agents make decisions unbounded by prior agreements**

Game Theory

# Prisoner's Dilemma

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# Game Theory

## Prisoner's Dilemma

Player 1

Player 2

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# Game Theory

## Prisoner's Dilemma

	Player 1	
	Cooperate	Defect
Player 2	Cooperate	
	Defect	

---

# Game Theory

## Prisoner's Dilemma

		Player 1	
		Cooperate	Defect
Player 2	Cooperate		
	Defect		

---

# Game Theory

## Prisoner's Dilemma

		Player 1	
		Cooperate	Defect
Player 2	Cooperate	3, 3	
	Defect		

---



# Game Theory

## Prisoner's Dilemma

		Player 1	
		Cooperate	Defect
Player 2	Cooperate	3 , 3	4 , 0
	Defect	0 , 4	

---

# Game Theory

## Prisoner's Dilemma

		Player 1	
		Cooperate	Defect
Player 2	Cooperate	3 , 3	4 , 0
	Defect	0 , 4	1 , 1

---

# Game Theory

## Prisoner's Dilemma

Player 1 - Expected Payoffs

	C	D
C	3, 3	4, 0
D	0, 4	1, 1

---

# Game Theory

## Prisoner's Dilemma

Player 1 - Expected Payoffs

- Cooperate:  
 $3(.5) + 0(.5) = 1.5$

	C	D
C	3, 3	4, 0
D	0, 4	1, 1

---

# Game Theory

## Prisoner's Dilemma

### Player 1 - Expected Payoffs

- Cooperate:  
 $3(.5) + 0(.5) = 1.5$
- Defect:  
 $4(.5) + 1(.5) = 2.5$

	C	D
C	3, 3	4, 0
D	0, 4	1, 1

---

# Game Theory

## Prisoner's Dilemma

### Player 1 - Expected Payoffs

- Cooperate:  
 $3(.5) + 0(.5) = 1.5$
- Defect:  
 $4(.5) + 1(.5) = 2.5$

	C	D
C	3, 3	4, 0
D	0, 4	1, 1

---

# Game Theory

## Prisoner's Dilemma

Group - Payoffs

	C	D
C	3, 3	4, 0
D	0, 4	1, 1

---

# Game Theory

## Prisoner's Dilemma

### Group - Payoffs

- Cooperate - Cooperate
  - $3 + 3 = 6$

	C	D
C	3, 3	4, 0
D	0, 4	1, 1

---



# Game Theory

## Prisoner's Dilemma

### Group - Payoffs

- Cooperate - Cooperate
  - $3 + 3 = 6$
- Cooperate - Defect
  - $4 + 0 = 4$

	C	D
C	3, 3	4, 0
D	0, 4	1, 1

---

# Game Theory

## Prisoner's Dilemma

### Group - Payoffs

- Cooperate - Cooperate
  - $3 + 3 = 6$
- Cooperate - Defect
  - $4 + 0 = 4$
- Defect - Defect
  - $1 + 1 = 2$

	C	D
C	3, 3	4, 0
D	0, 4	1, 1

# Game Theory

## Prisoner's Dilemma

### Group - Payoffs

- Cooperate - Cooperate
  - $3 + 3 = 6$
- Cooperate - Defect
  - $4 + 0 = 4$
- Defect - Defect
  - $1 + 1 = 2$

	C	D
C	3, 3	4, 0
D	0, 4	1, 1

---

# Optimums

Individual:

Group:

# Optimums

Individual:

Group:

Cooperation  $<$  Defection

# Optimums

Individual:

Cooperation  $<$  Defection

Group:

Cooperation  $>$  Defection

# Optimums

Individual:

Group:

Cooperation  $<$  Defection

Cooperation  $>$  Defection

**Social Dilemma:** A situation where the decision that optimizes the individual is in opposition to the decision that optimizes the group

Cooperation is  
Ephemeral & Vulnerable



# Stabilizing Cooperation

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# Stabilizing Cooperation

1. Norms & Institutions

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# Stabilizing Cooperation

1. Norms & Institutions
2. Kin Selection



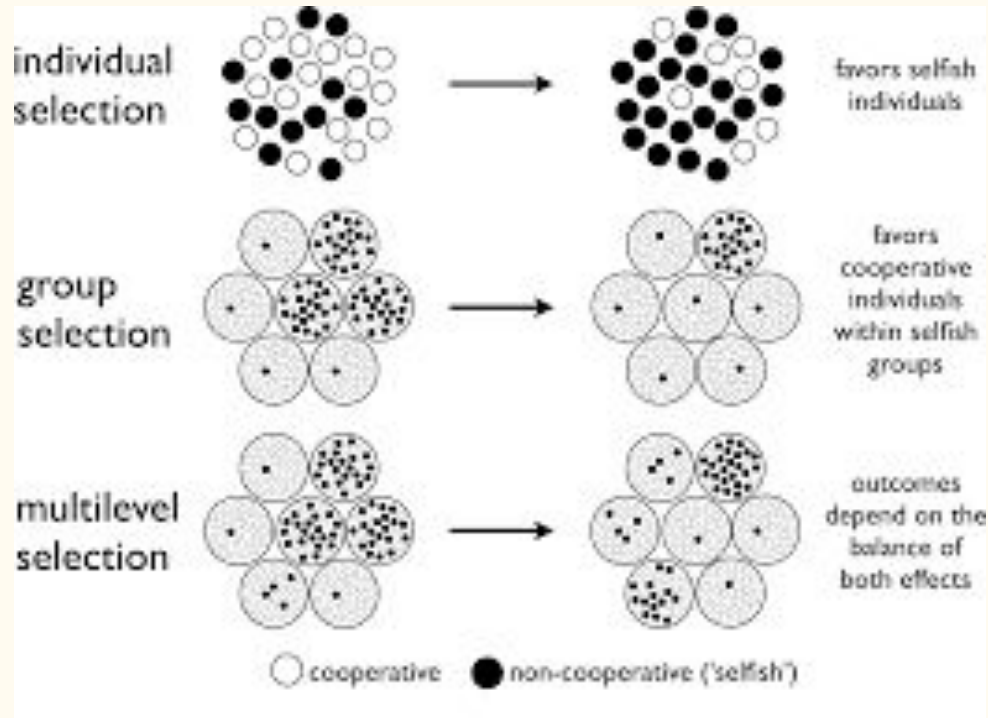
# Stabilizing Cooperation

1. Norms & Institutions
2. Kin Selection
3. Group Selection

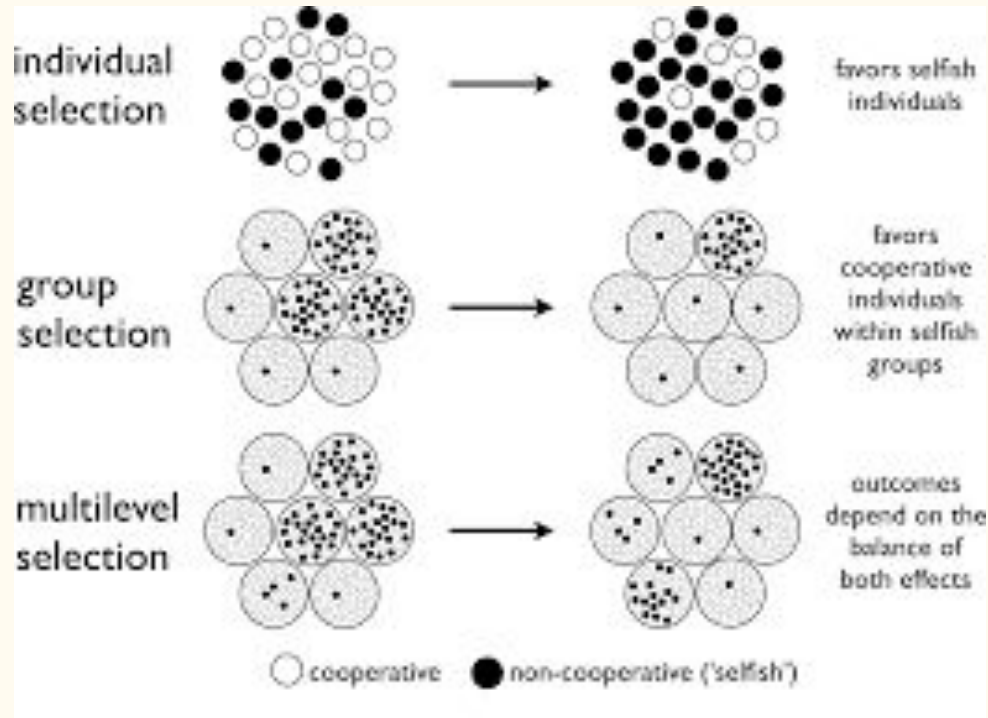


# Group Selection

# Group Selection



# Group Selection



“Selfishness beats altruism within groups, Altruistic Groups beat selfish groups. Everything else is commentary”

- D.S. Wilson & E. O. Wilson, 2007

# Stabilizing Cooperation

1. Norms & Institutions
  2. Kin Selection
  3. Group Selection
-



# Stabilizing Cooperation

1. Norms & Institutions
  2. Kin Selection
  3. Group Selection
  4. Reciprocity
-

# Stabilizing Cooperation

1. Norms & Institutions
  2. Kin Selection
  3. Group Selection
  4. Reciprocity
-

# Reciprocity

# Reciprocity

- Doing unto others as they have done unto you

# Reciprocity

- Doing unto others as they have done unto you
- Positive Reciprocity:

# Reciprocity

- Doing unto others as they have done unto you
- Positive Reciprocity: You scratch my back, I'll scratch yours

# Reciprocity

- Doing unto others as they have done unto you
- Positive Reciprocity: You scratch my back, I'll scratch yours
- Punitive Reciprocity:

# Reciprocity

- Doing unto others as they have done unto you
- Positive Reciprocity: You scratch my back, I'll scratch yours
- Punitive Reciprocity: You screw me, I'll screw you



# Reciprocity

Requirements:

# Reciprocity

Requirements:

1. Repeated Interactions/Rounds

# Reciprocity

Requirements:

1. Repeated Interactions/Rounds
2. Structured Interactions

# Reciprocity

Requirements:

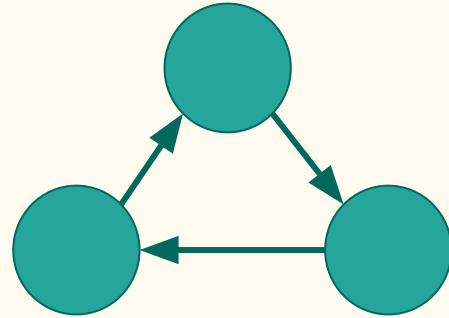
1. Repeated Interactions/Rounds
2. Structured Interactions
  - a. Persistent Partnerships



# Reciprocity

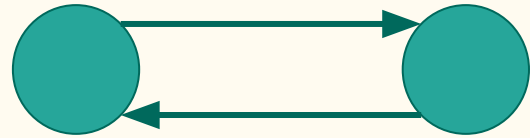
## Requirements:

1. Repeated Interactions/Rounds
2. Structured Interactions
  - a. Persistent Partnerships
  - b. Relatively Small Groups



# Reciprocity

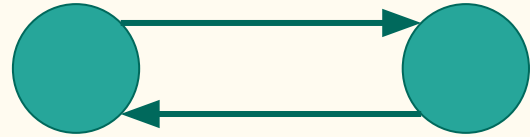
Direct Reciprocity:



# Reciprocity

Direct Reciprocity:

Repeated interactions with the same  
Partner



# Reciprocity

Direct Reciprocity:

Repeated interactions with the same  
Partner

Breaks down if endpoint is known



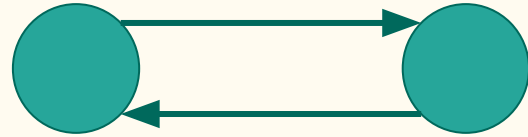


# Reciprocity

Direct Reciprocity:

Repeated interactions with the same  
Partner

Breaks down if endpoint is known  
End of Game Effects



# Reciprocity

End of Game Effects

# Reciprocity

## End of Game Effects

- Players in repeated games where the final round is known tend to stop cooperating.

# Reciprocity

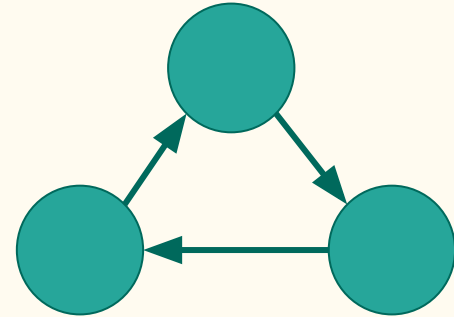
## End of Game Effects

- Players in repeated games where the final round is known tend to stop cooperating.
- Cooperation Sustains when the final round is not known.

Uncertainty about future  
interactions & reciprocity  
sustain cooperation in  
humans

# Reciprocity

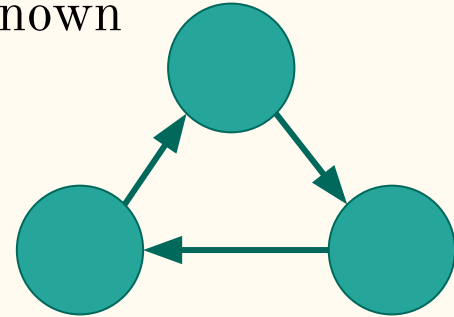
Indirect Reciprocity:



# Reciprocity

Indirect Reciprocity:

Repeated interactions with a small pool of known  
Potential partners

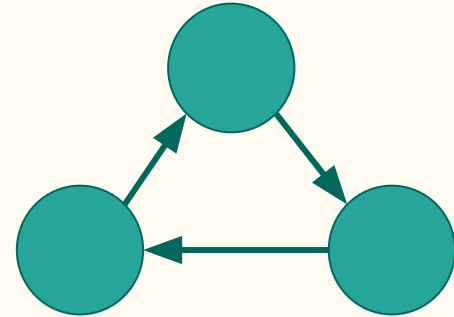


# Reciprocity

## Indirect Reciprocity:

Repeated interactions with a pool of known  
Potential partners

End Of Game Effects Hold





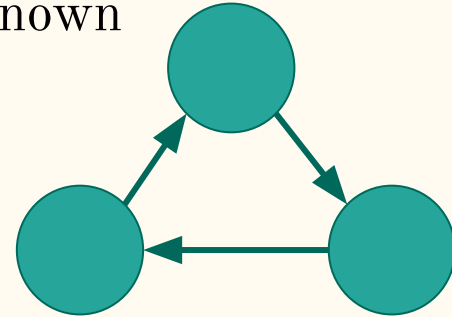
# Reciprocity

## Indirect Reciprocity:

Repeated interactions with a small pool of known  
Potential partners

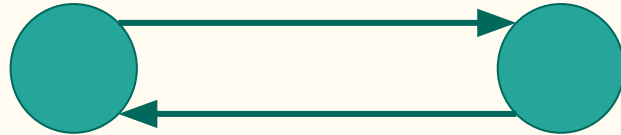
End Of Game Effects Hold

Reputation & Punishment Emerge



# Reciprocity

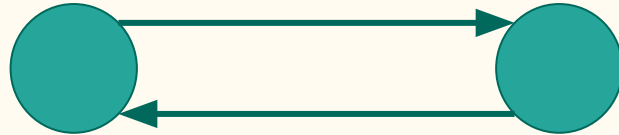
## Reputation



# Reciprocity

## Reputation

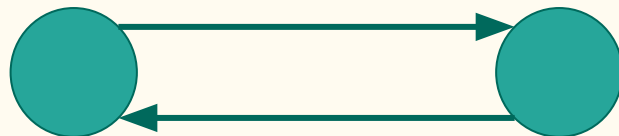
Round 1:	C	C
Round 2:	C	D
Round 3:	C	D



# Reciprocity

## Reputation

Round 1:	C	C
Round 2:	C	D
Round 3:	C	D

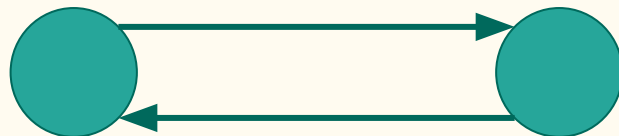


Round 4	C D	C D
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# Reciprocity

Reputation

Round 1:	C	C
Round 2:	C	D
Round 3:	C	D

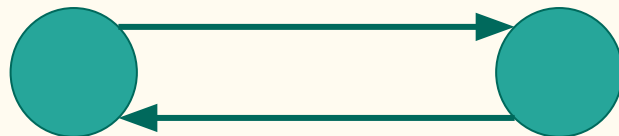


Round 4	<b>D</b>	<b>D</b>
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# Reciprocity

## Reputation & Punishment?

Round 1:	C	C
Round 2:	C	D
Round 3:	C	D

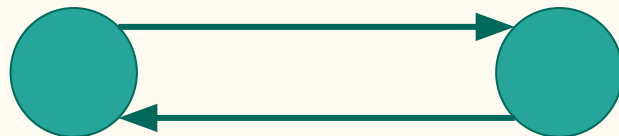


Round 4	<b>D</b>	<b>D</b>
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# Reciprocity

## Reputation & Punishment?

Round 1:	C	C
Round 2:	C	D
Round 3:	C	D



Round 4

**D**

**D**

Punish

Reputation

Small Groups & Long  
Memories Promote  
Cooperation

- Stewart & Plotkin 2016



# Nicky Case's Evolution of Trust

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