

9.916
Altruism and Cooperation

Today's Lecture

I give everyone \$10
Anonymous pairs
Chance to send \$0-\$10
Anything you send, x3
How much do you send?

Puzzle of altruism:

How could it evolve? free-riders should out-compete altruists
“the central theoretical problem of sociobiology”

Puzzles of human altruism:

Why is human behavior cooperative / altruistic?
(a) developmental origins: genetic or learned?
(b) how maintained in practice?
(c) what proximal mechanisms?

Altruism & Cooperation

- Coordination:** *Nash equilibrium = cooperate or defect*
joint effort → maximum collective & individual payoff
no/less payoff for defection
- Cooperation:** *Nash equilibrium = defect*
joint effort → maximum collective/other's payoff
higher individual payoff for defection
- Altruism:** *Nash equilibrium = defect*
joint effort → increase other's payoff
cost to individual

Altruism Games

What makes a “game”?

Each P's payoff depends on the actions of other Ps

What makes an “altruism game”?

Nash equilibrium is *anti-social*

- give minimum
- accept minimum
- don't punish

Human behaviour is *pro-social*

- give more than minimum
- refuse minimum
- punish

But not perfectly!

Often **don't** achieve:

- equal split
- maximum collective payoff

Altruism in 2 Player Games

Dictator (I) PI \$10 $\xrightarrow{?}$ P2

altruism / fairness

Altruism in 2 Player Games

Dictator (1) PI \$10 $\xrightarrow{?}$ P2

Ultimatum (1) PI \$10 $\xrightarrow{?}$ P2 (2) Accept / Reject

altruism / fairness
anticipated rejection

fairness
2p punishment

Altruism in 2 Player Games

Dictator (I) **PI** \$10 $\xrightarrow{?}$ P2

Ultimatum (I) **PI** \$10 $\xrightarrow{?}$ P2 (2) Accept / Reject

Trust (I) **PI** \$10 $\xrightarrow[\times 3]{?}$ P2 (2) P2 $\xrightarrow{?}$ **PI**

trustingness

trustworthiness
fairness

Altruism in 2 Player Games

Dictator (I) PI \$10 $\xrightarrow{?}$ P2

Ultimatum (I) PI \$10 $\xrightarrow{?}$ P2 (2) Accept / Reject

Trust (I) PI \$10 $\xrightarrow[\times 3]{?}$ P2 (2) P2 $\xrightarrow{?}$ PI

Gift (I) PI \$10 $\xrightarrow[\times 3]{?}$ P2

altruism / fairness

Altruism in 2 Player Games

Dictator (1) **PI** \$10 $\xrightarrow{?}$ **P2**

Ultimatum (1) **PI** \$10 $\xrightarrow{?}$ **P2** (2) **Accept / Reject**

Trust (1) **PI** \$10 $\xrightarrow{\frac{?}{x3}}$ **P2** (2) **P2** $\xrightarrow{?}$ **PI**

Gift (1) **PI** \$10 $\xrightarrow{\frac{?}{x3}}$ **P2**

PD (1) **PI** \$10 $\xrightarrow{\frac{?}{x3}}$ **P2** }
 (2) **P2** \$10 $\xrightarrow{\frac{?}{x3}}$ **PI** }

cooperation

Core Dilemma of Cooperation

Standard Solution:
Positive assortment
Cooperators benefit other cooperators
↓
Natural selection for cooperation

favours cooperating:

- closely related
- long future
- low noise
- quantifiable exchange

Benefit of receiving
cooperation

Probability of
benefiting cooperator

$$\beta b > c$$

Cost to
cooperator

r - probability of sharing cooperation by descent

ω - probability of continuing interaction

ϕ - probability of accurate reputation

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Note 1: Simulations

- Axelrod's (1980) computer tournaments
- repeated prisoner's dilemma
- round 1: 14 entries
- round 2: 62 entries
- round 3: ecological simulation
- winner: tit-for-tat
cooperates first, then tit-for-tat

Example 1: cleaner fish

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Example 2: Cooperation in the trenches

Core Dilemma of Cooperation

Example 2: Cooperation in the trenches

Small battallions, stationary trenches

-> Long futures, quantifiable exchanges

Step 1: Recognise common interest in silence

It would be child's play to shell the road behind the enemy's trenches, crowded as it must be with ration wagons and water carts, into a bloodstained wilderness . . . but on the whole there is silence. After all, if you prevent your enemy from drawing his rations, his remedy is simple: he will prevent you from drawing yours. (Hay 1916, pp. 224–25)

Step 2: Be provokable; show that the silence is deliberate

the enemy soldiers took pains to show each other that they could indeed retaliate if necessary. For example, German snipers showed their prowess to the British by aiming at spots on the walls of cottages and firing until they had cut a hole (*The War the Infantry Knew* 1938, p. 98). Likewise the

Step 3: Damping?

Step 4: Passing info along

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Special case?

- dyadic
- long future
- no noise
- quantifiable exchange

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Note 2:

Natural selection \neq Genes
Reliable transmission,
fitness difference
Individual learning
Social learning

Entomological assumptions:

Behaviour determined by genes
Transmission by genes
Invasion by reproductive success

+ Behavioural plasticity

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Note 3:

Standard games:

- no kinship
- no future
- no reputation



“misfiring”
mechanisms?

Overestimate kin?
Overestimate future?
Feel observed?

e.g. by the experimenter

↓
Who would you
ask for a high cost
favour?

Creating Cooperation

Internal mechanisms:

- | | | |
|---------------------------|---|---|
| Cooperate pre-emptively | } | - induce reciprocal cooperation |
| Cooperate when visible | | - avoid punishment |
| Cooperate responsively | | - create & protect reputation |
| Cooperate conditionally | | - motivated to reciprocate |
| Cooperate when needed | | - strong reciprocity norm |
| | | - inequity aversion / empathy |
| Cooperate unconditionally | | - prosociality: motivated to help,
no expectation of punishment or
reward |

Creating Cooperation

- Look for:
- *different bw children & chimps*
 - *early emerging*
 - *culturally universal*

Transmission:
Genetic?
Cultural?

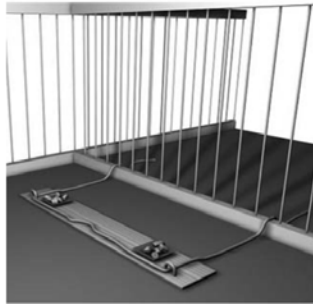
- Look for:
- *similar bw children & chimps*
 - *late emerging*
 - *culturally variable*

Internal mechanisms:

- induce reciprocal cooperation
- avoid punishment
- create & protect reputation
- motivated to reciprocate
- strong reciprocity norm
- inequity aversion / empathy
- prosociality: motivated to help, no expectation of punishment or reward

Prosociality

Chimps coordinate for goals:



Depends on history
with partner:

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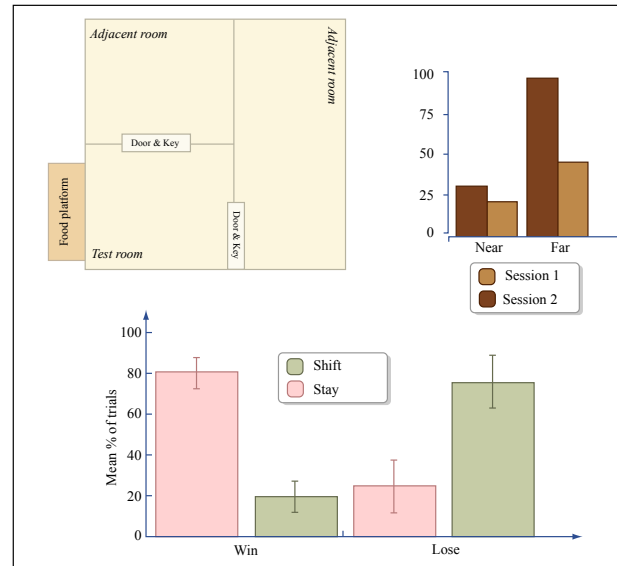


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Prosociality

Children coordinate for its own sake

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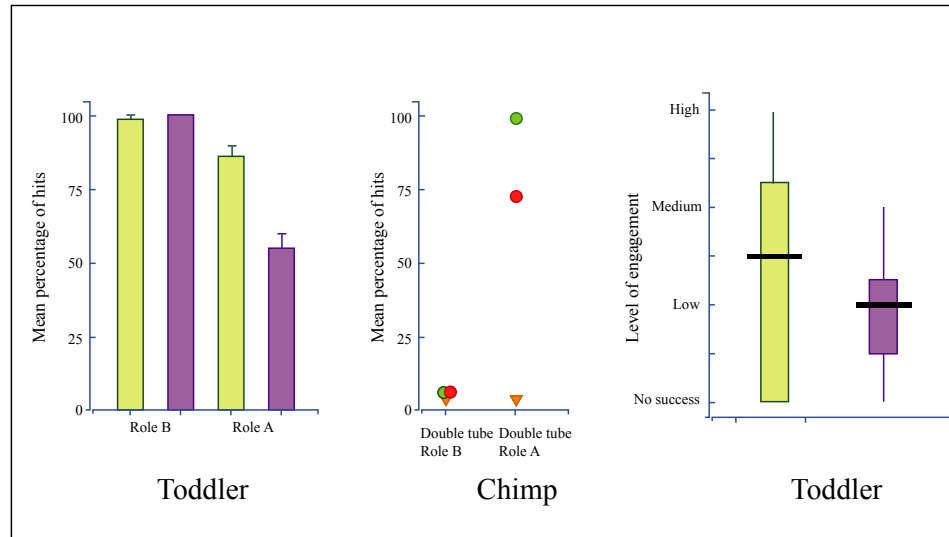
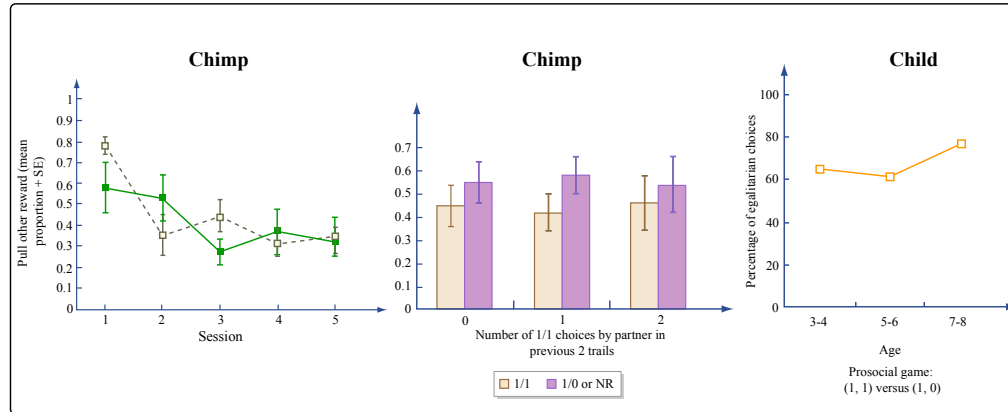


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Inequity aversion

No-cost Dictator "Game":

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Vonk et al 2008, Brosnan et al 2009, Fehr et al 2009

Figure by MIT OpenCourseWare.

Inequity aversion

Figure removed due to copyright restriction.

Altruism / Cooperation
Late emerging
But 2p requires inhibition
What about 3p?

Creating Cooperation

Transmission:

Cultural?

Genetic?

Internal mechanisms:

- induce reciprocal cooperation
- avoid punishment
- create & protect reputation

Some evidence for

- *different bw children & chimps*
- *early emerging*
- *culturally universal*

- prosociality: motivated to help, no expectation of punishment or reward

Maintaining Altruism with Punishment

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9.916 Special Topics: Social Animals
Fall 2009

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