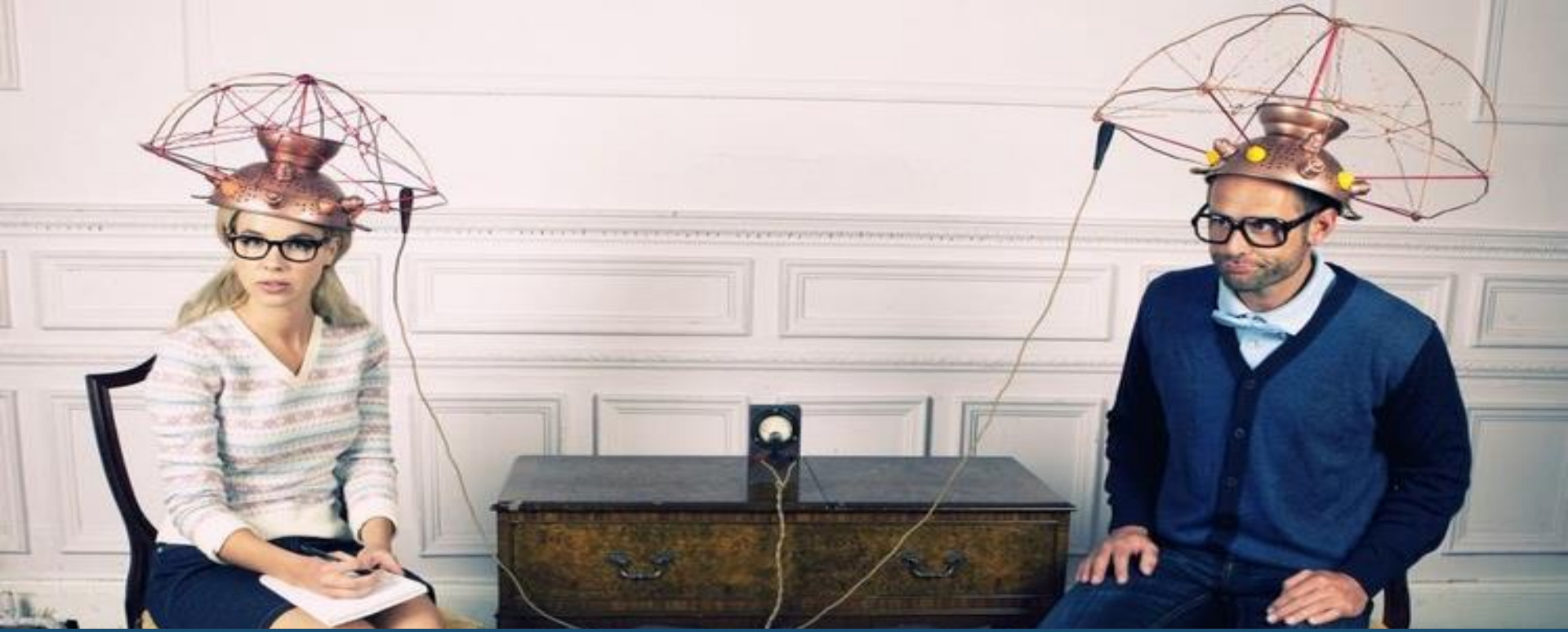

Experimental Economics
Cooperation

Ernesto Reuben

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THE PROBLEM OF COOPERATION

Real-world problems of cooperation

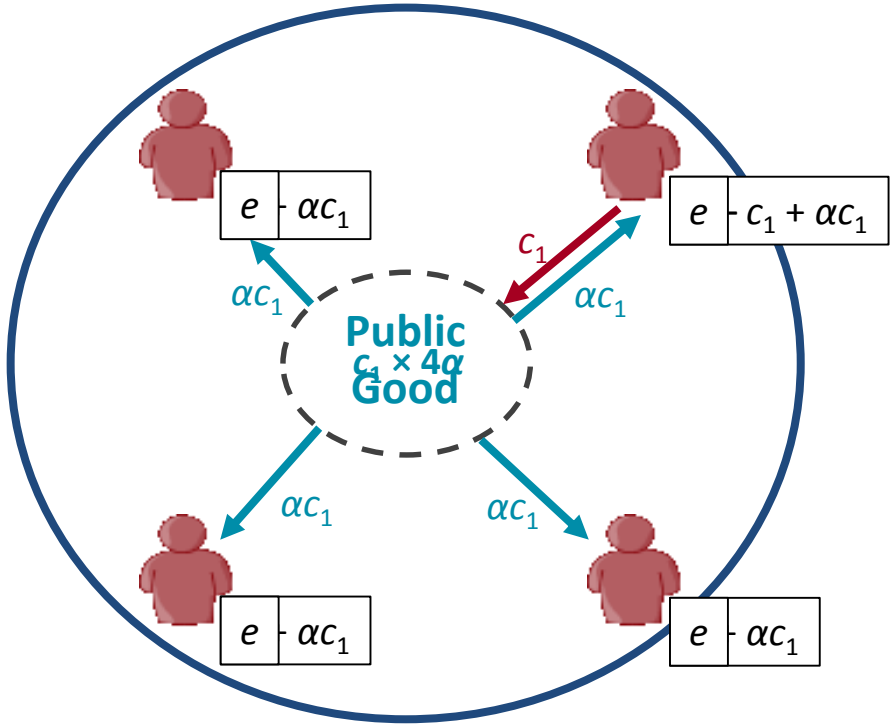
- Cooperative hunting and warfare, teamwork in firms, charities and gift-giving, environmental protection, economic public goods (e.g., paying taxes, fishing, security), political collective action (e.g., voting, lobbying, revolutions), etc.

Classical literature: **Samuelson (1954)**, **Olson (1965)**, **Hardin (1968)**

THE LINEAR PUBLIC GOOD GAME

- Each group member $i \in \{1, \ldots, n\}$ decides how much of her endowment to contribute to the public good $c_i \in [0, e_i]$. Any contribution benefits i by α_i.
- i's profit:

  $\boldsymbol{\pi_i = e_i - c_i + \alpha_i \sum_j c_j}$



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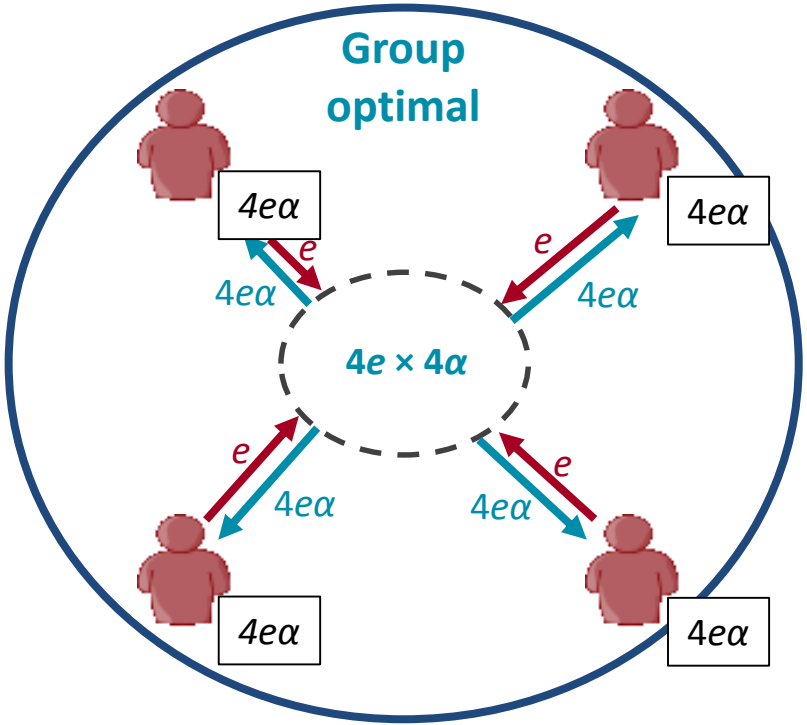
- if $\sum_j \alpha_j > 1$



THE LINEAR PUBLIC GOOD GAME

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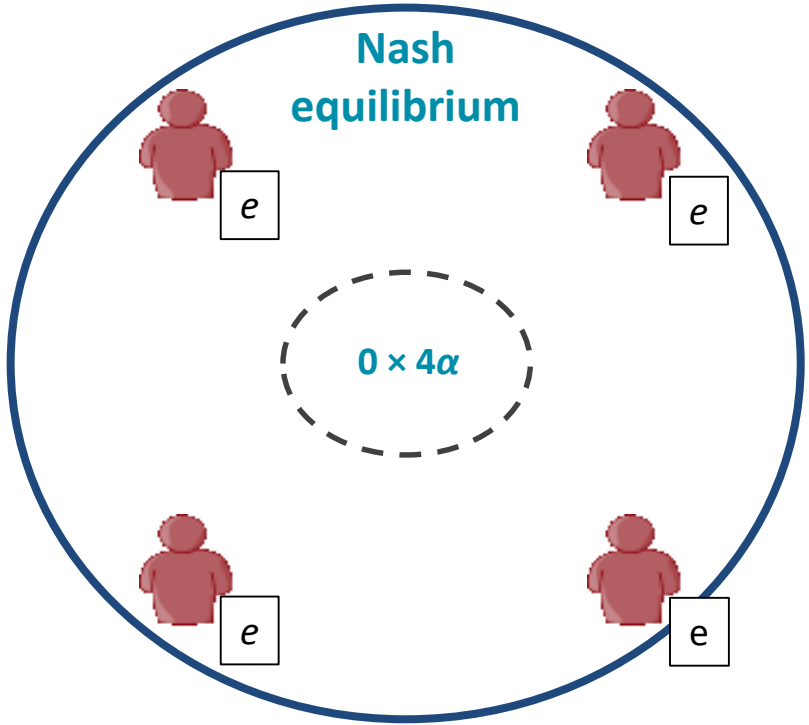
- i's profit:
  $\pi_i = e_i - c_i + \alpha_i \sum_j c_j$
- if $\sum_i \alpha_i > 1$
- if $\alpha_i < 1 \; \forall i$



THE LINEAR PUBLIC GOOD GAME

Standard result

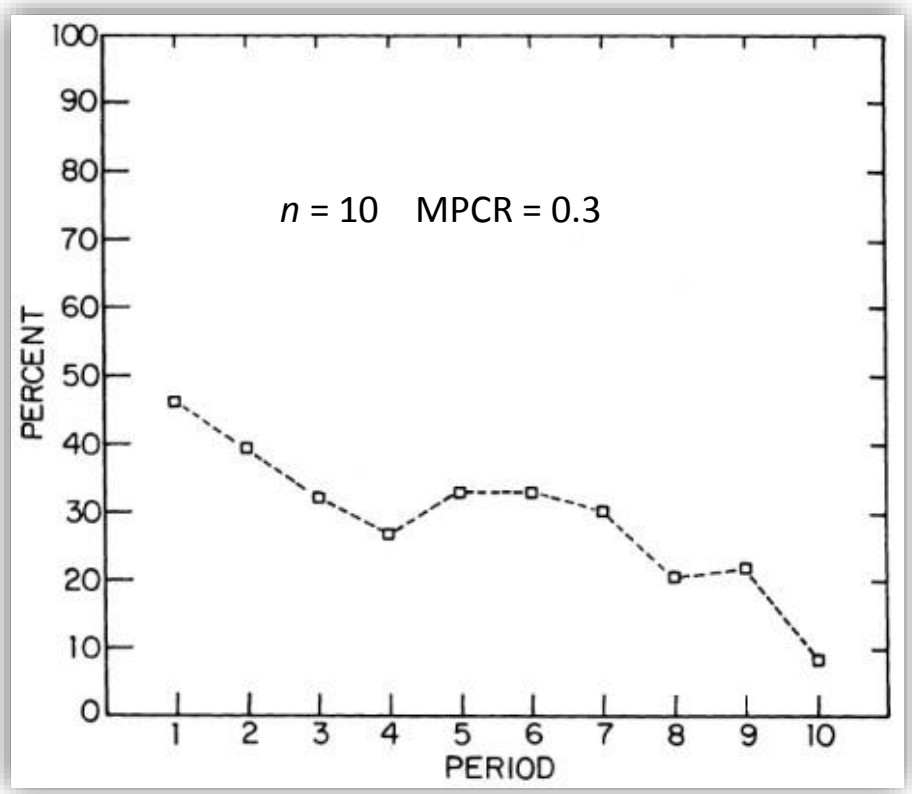
- Initial cooperation of 40-60%
- Cooperation declines with repetition

Some stylized facts

- Positive effect of MPCR
- Positive effect of partners matching
- No effect of group size
- Negative effect of experience

Less robust

- Negative effect of heterogeneity
- No effect of number of periods
- Women contribute more and economists less
- Positive effect of framing



CONDITIONAL COOPERATION

Fischbacher & Gächter (2010)

- 140 subjects play a VCM with $n = 4$, $e = 20$, MPCR = 0.4 in two conditions
- In **choice** subjects play 10 periods with strangers matching
- In **preference** the subjects' preferences for contribution are elicited
- Incentivized elicitation of beliefs about the contribution of others in every period of **choice**

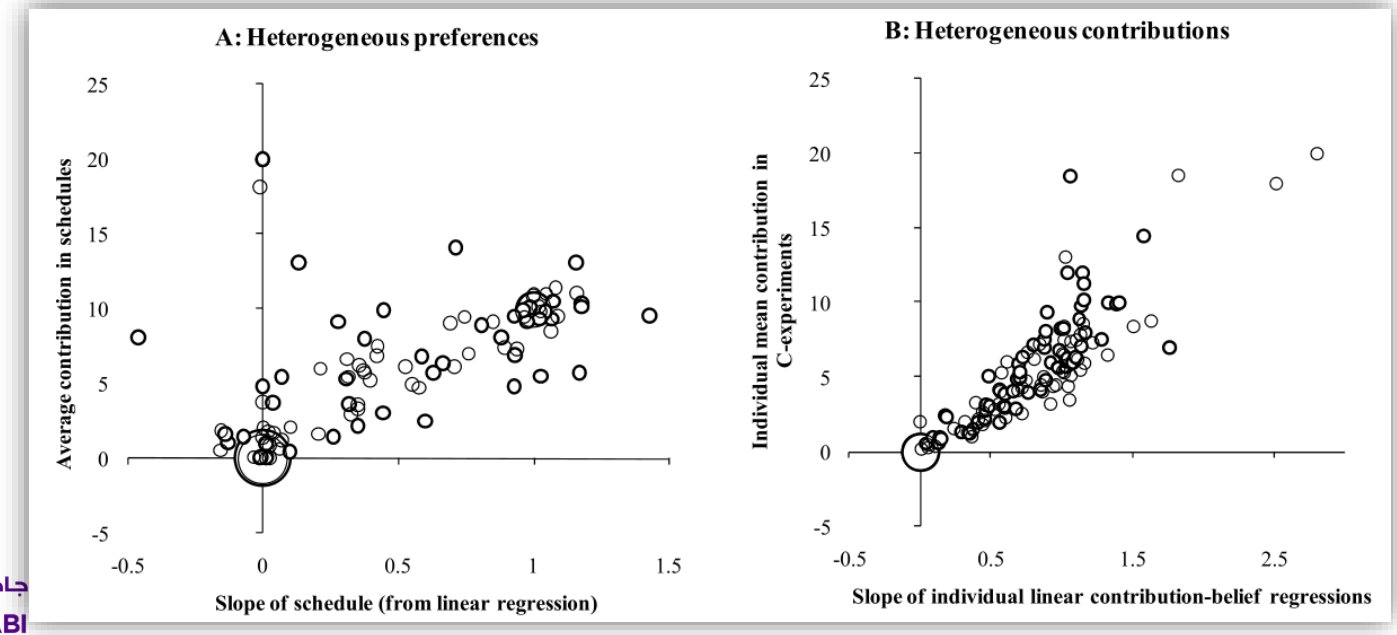
Eliciting preferences for contribution

- **Unconditional contribution** decision
- Use the strategy method to elicit **conditional contribution** schedules with respect to the mean unconditional contribution
- Pick randomly three unconditional contributions and one conditional contribution

CONDITIONAL COOPERATION

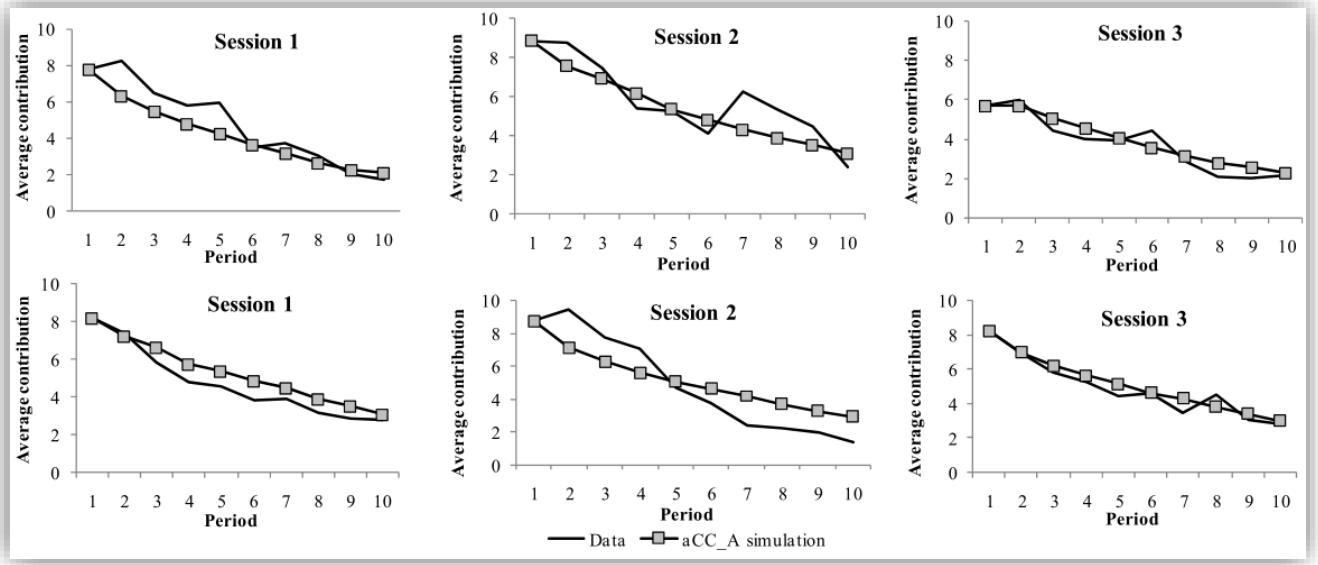
Fischbacher & Gächter (2010)

- Mostly preferences for conditional cooperation and selfishness
- Strong association between beliefs and the unconditional cooperation decision



CONDITIONAL COOPERATION

- **Fischbacher & Gächter (2010)**
- Can conditional cooperation explain the decline of contributions?
  - Use their conditional preferences, initial beliefs, and a belief-updating process to predict contributions in all periods



How do we increase cooperation?

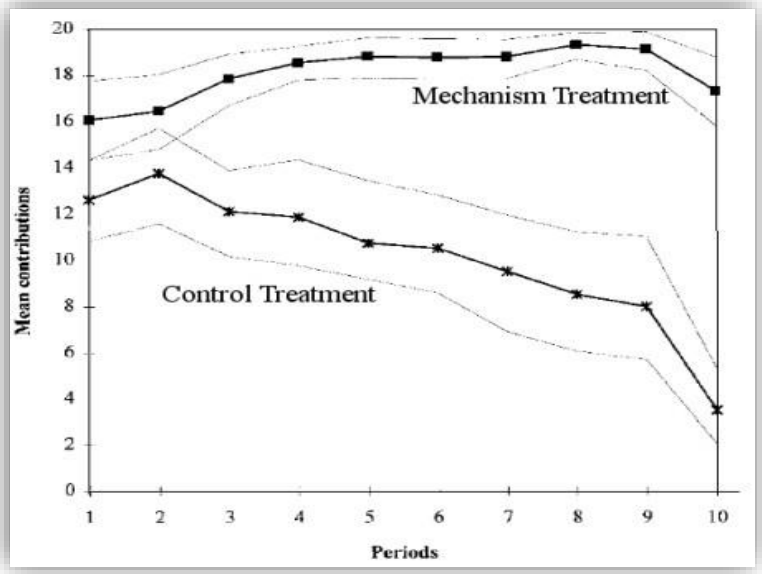
TAXES AND SUBSIDIES

Falkinger et al. (2000)

- If *i* contributes more than the average, *i* gets a bonus $\beta(c_i - \hat{c}_{-i})$
- If *i* contributes less than the average, *i* pay a tax $\beta(\hat{c}_{-i} - c_i)$
- Note that if $\beta + \alpha > 1$ then there is a dominant strategy to contribute everything

- 240 subjects play a VCM with $n = 4$, $e = 20$, 10 periods, MPCR = 0.4 with either **$\beta = 0$** or **$\beta = 0.7$**

- The mechanism clearly works and is robust to different group sizes and interior equilibria
- But how do you enforce it?

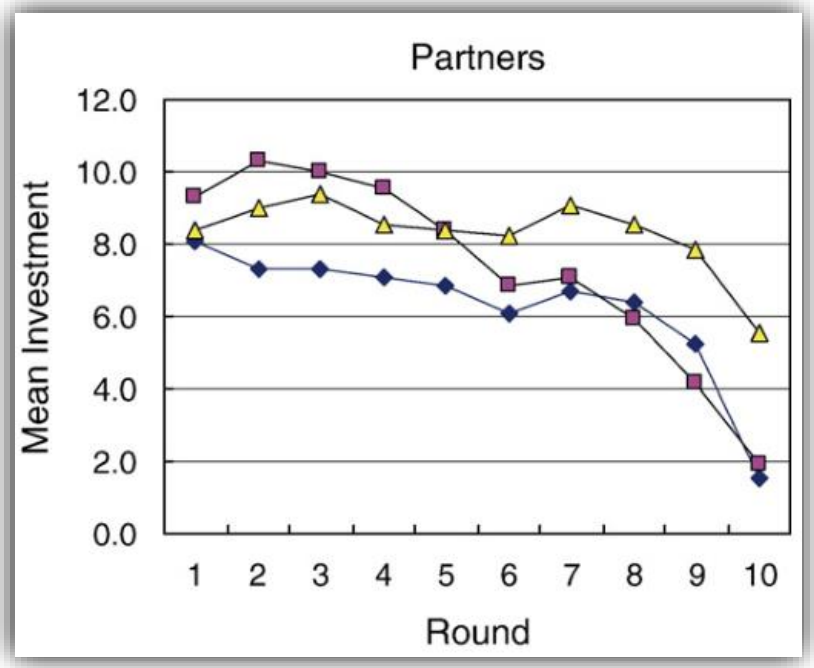


COMPETITION

Tan & Bolle (2007)

- Two groups compete in the amount of contributions to their public good
- The winner gets α = 0.67 and the loser gets α = 0.33
- 144 subjects play a VCM with *n* = 3, *e* = 12, 10 periods with either
  - **α = 0.5** and no information about relative contributions
  - **α = 0.5** and information about relative contributions
  - **α ∈ {0.33, 0.67}** and information about relative contributions

- Effect of information and of competition
- In later rounds, we see mostly an effect of competition

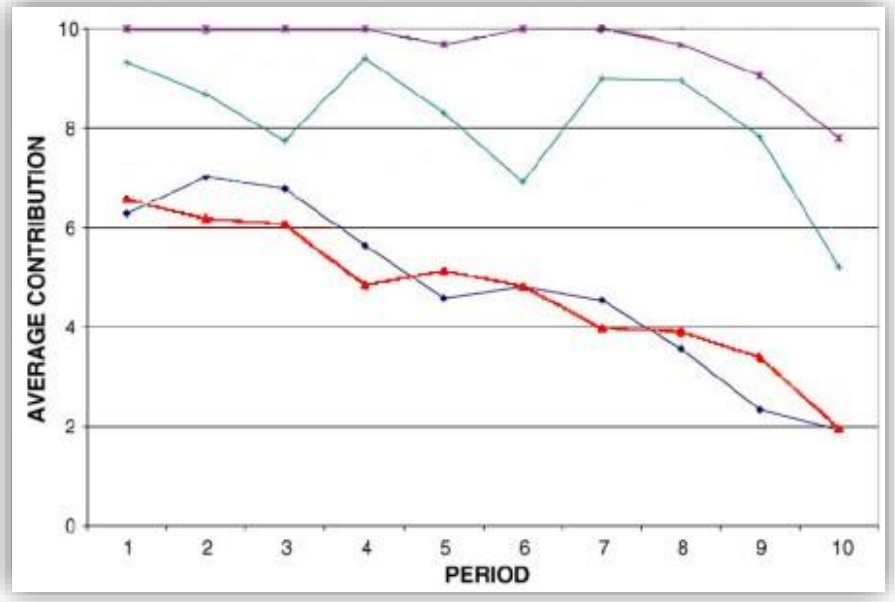


COMMUNICATION

Bochet et al. (2006)

- Allow subjects to communicate but not make binding contracts
- 172 subjects play a VCM with $n = 4$, $e = 10$, 10 periods, MPCR = 0.4 with either **no communication** or communication through **face-to-face**, **chat room**, or **numeric cheap talk**

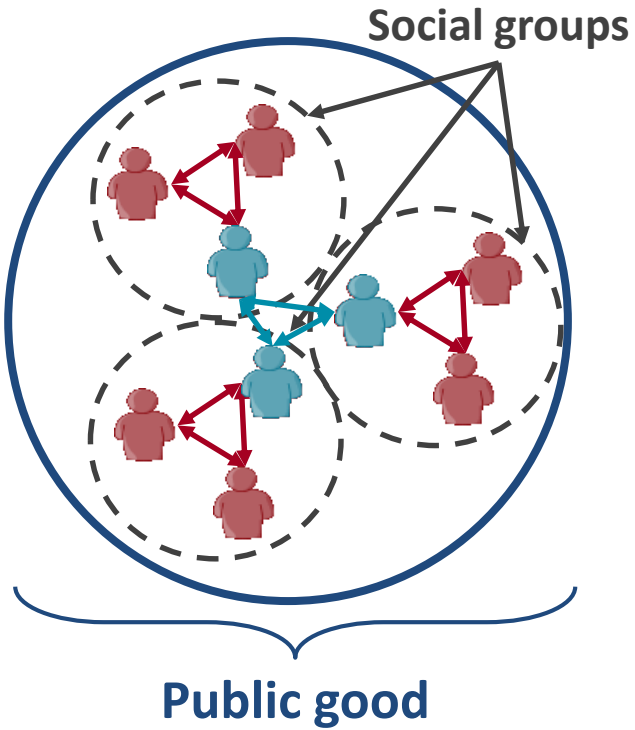
- Face to face communication dramatically increases cooperation
- Communication becomes less effective as it becomes more restricted



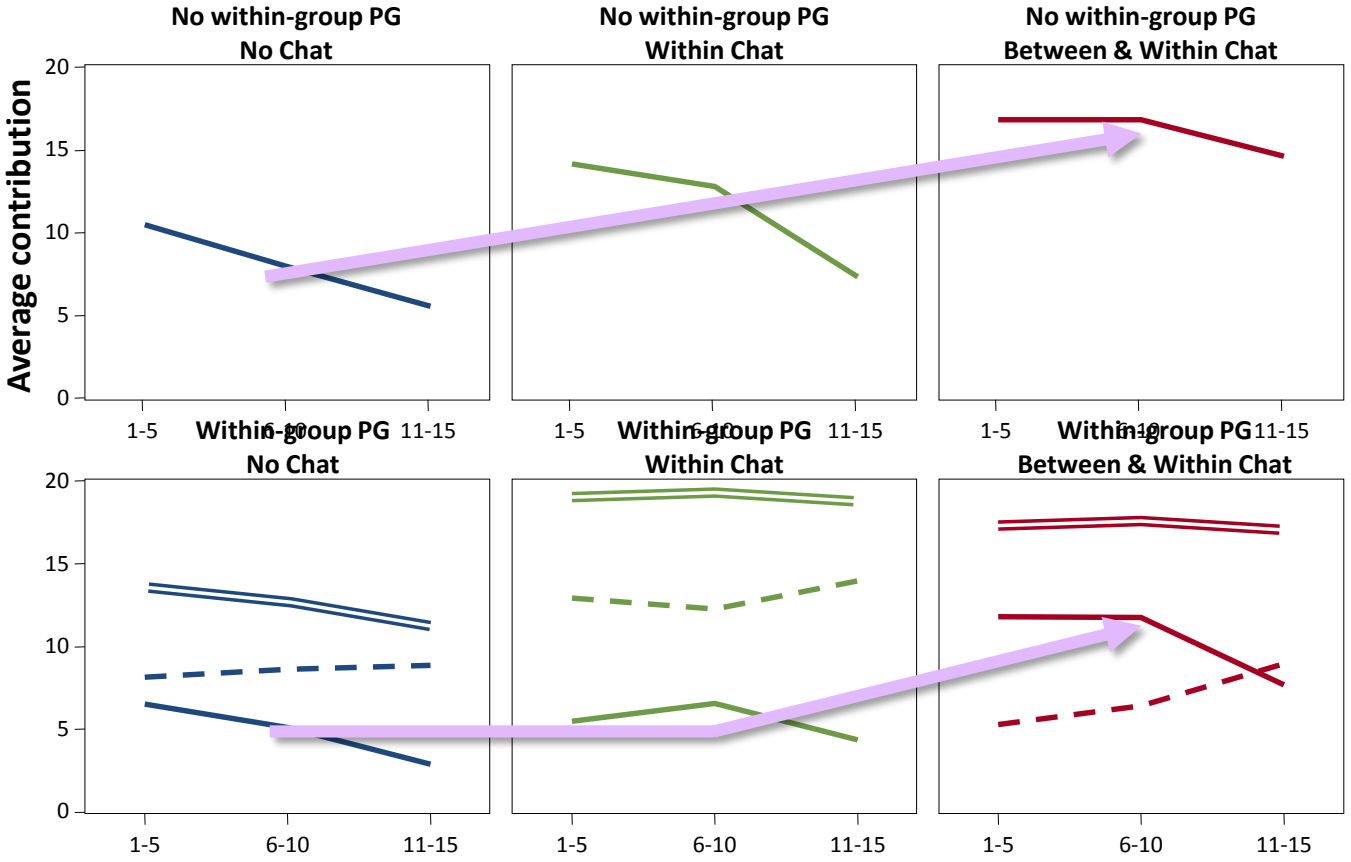
COMMUNICATION AND SOCIAL STRUCTURE

Angelovski & Reuben (2018)

- What if a public good involves multiple social groups?
  - Communication and information about individual contributions are transmitted mostly within groups
- 432 subjects play a VCM with n = 9, e = 20, MPCR = 0.3, 15 periods, chat before periods 1, 6, and 11 with either **no communication**, **within-group communication**, or **within- and between-group communication**
- Availability or not of a second **within-group** public good (VCM with n = 3 and MPCR = 0.6)



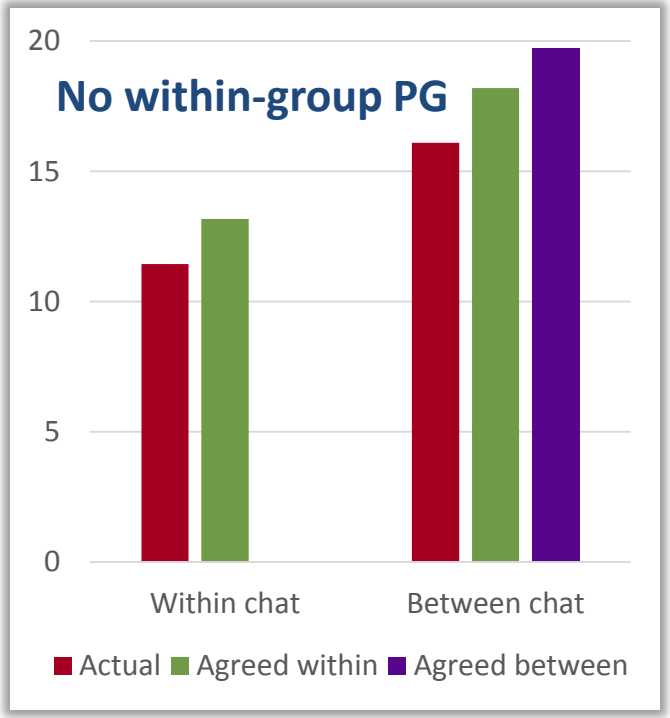
COMMUNICATION AND SOCIAL STRUCTURE

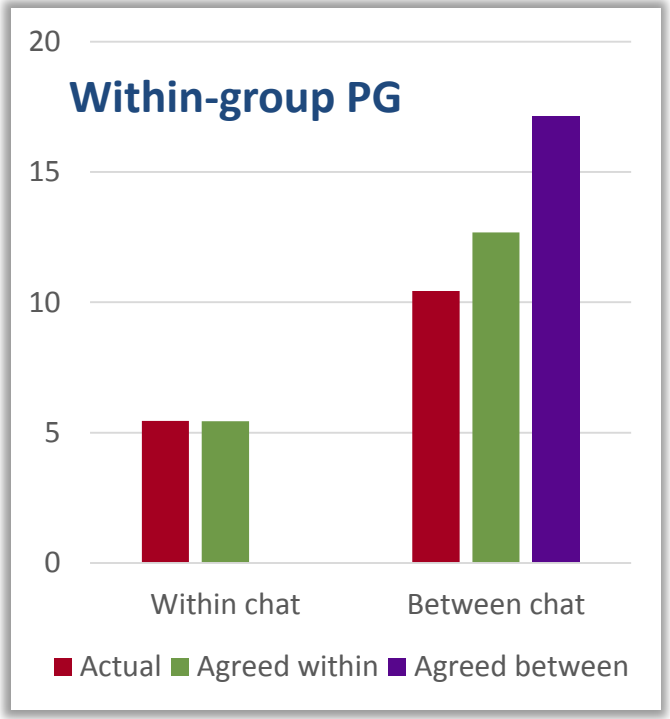


COMMUNICATION AND SOCIAL STRUCTURE

Angelovski & Reuben (2018)

- Differences in contributions mirror differences in agreed contributions **within** groups



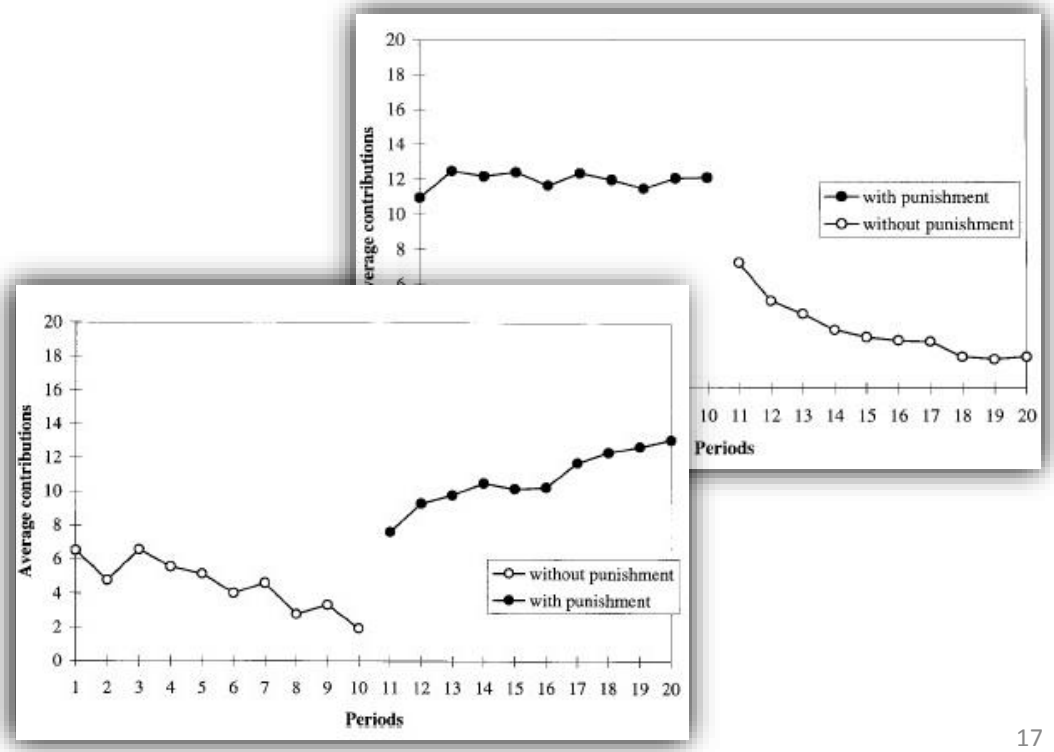


Peer punishment

Fehr & Gächter (2000)

- After contributing, subjects can punish other group members at a cost to themselves (approximately 1 token per 3 tokens of damage), subjects know whether they are punished but do not know by whom
- 112 subjects play a VCM with n = 4, e = 20 tokens, 20 periods, MPCR = 0.4 with either **no punishment** or **punishment**

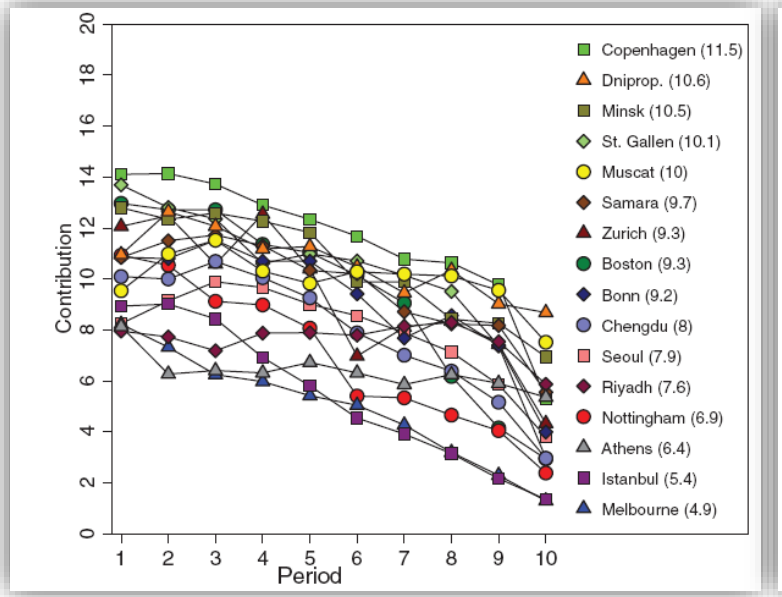
- Punishment increases contributions, even with strangers matching

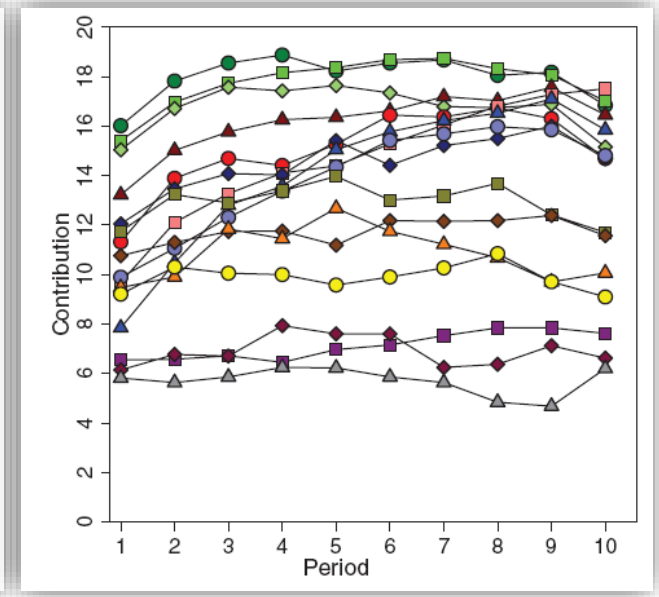


PUNISHMENT ACROSS SOCIETIES

Does peer punishment work across societies? (Herrmann et al. 2008)

- Punishment is pervasive but it does not always increase contributions
  - Works in Boston, Nottingham, Copenhagen, Bonn, Zurich, St. Gallen, Minsk, Seoul, Chengdu, Melbourne, but not in Dnipropetrovs'k, Samara, Athens, Istanbul, Riyadh, Muscat

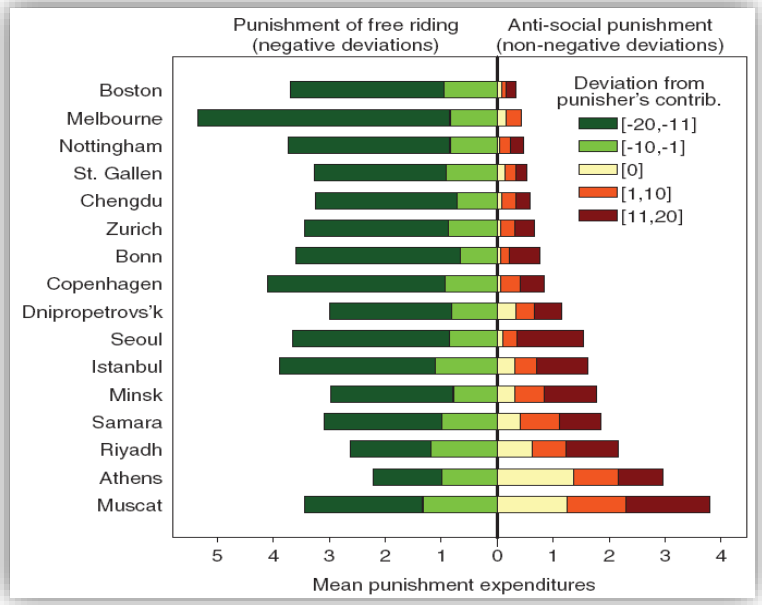




PUNISHMENT ACROSS SOCIETIES

Does peer punishment work across societies? (Herrmann et al. 2008)

- Failure of punishment is related to the amount of antisocial punishment (punishment of above-average cooperators) → correlated with perceptions of the importance of norms of civic cooperation and the rule of law



Independent variables	Punishment of free riders	Punishment of cooperators
Norms of civic cooperation	0.371**	–0.740**
Rule of law	0.067	–0.618**
Constant	–4.708***	2.422
Controls	Yes	Yes

What can we conclude with unrepresentative samples?

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INSTITUTION FORMATION

INSTITUTION FORMATION

Kosfeld et al. (2009)

- Is it possible to form an institution that enforces cooperation if individuals cannot be excluded from the public good and they cannot be forced to join?

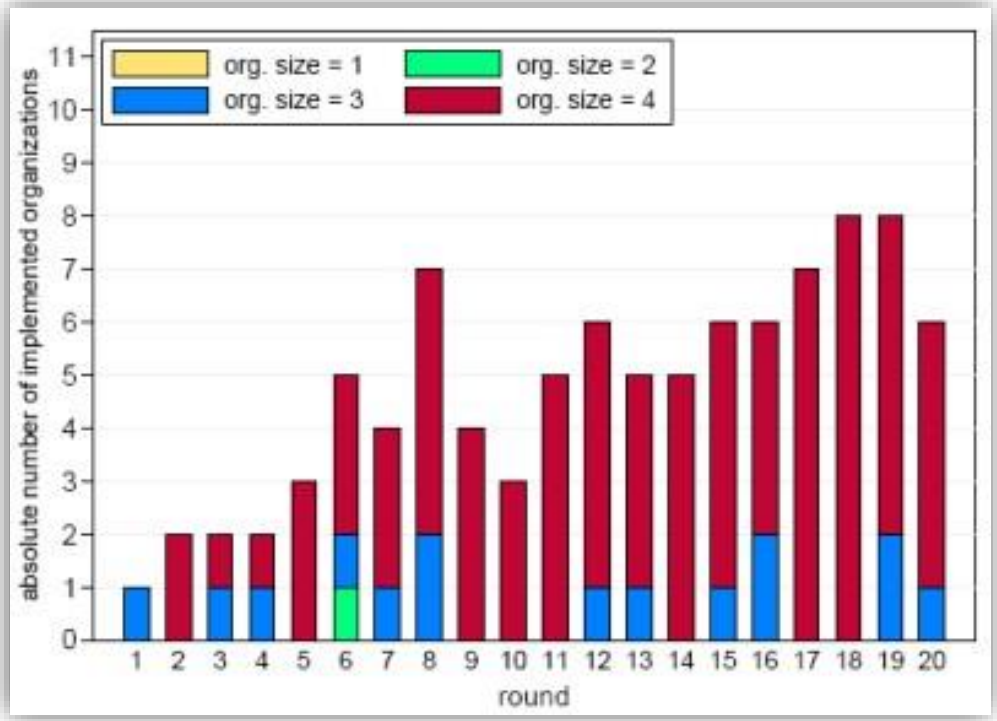
Three stages

- **Participation stage:** decide whether to be part of an institution at a cost shared by those who take part ($k = 2 / n_0$)
- **Implementation stage:** members of the institution decide whether to enforce the maximum contribution among themselves (by unanimity)
- **Contribution stage:** contribute to a VCM with $n = 4$, $e = 20$, and MPCR = 0.4

INSTITUTION FORMATION

Kosfeld et al. (2009)

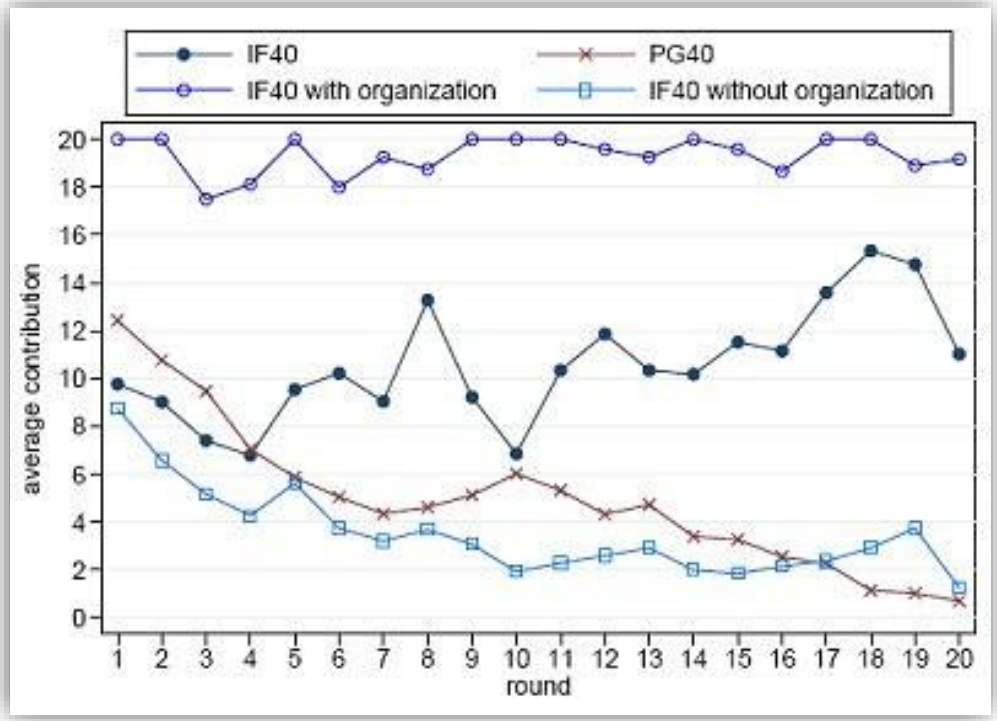
- Institutions are frequently and increasingly **implemented** but mostly only if all participate



INSTITUTION FORMATION

Kosfeld et al. (2009)

- Institutions are frequently and increasingly **implemented** but mostly only if all participate
- If one player doesn't join, the institution isn't implemented and contributions are low
  - Note that the institution pays as long as three participate → downside of conditional cooperation?



Implementing intergroup competition

In theory, intergroup competition can be a Pareto-improving institution, but will it be implemented and if not, why not?

- Individuals might dislike competing or the ensuing variation in income
- Heterogeneity in social preferences can lead to persistent differences in cooperation
- Individuals might not foresee the efficiency gains of competition and focus on the zero-sum prize

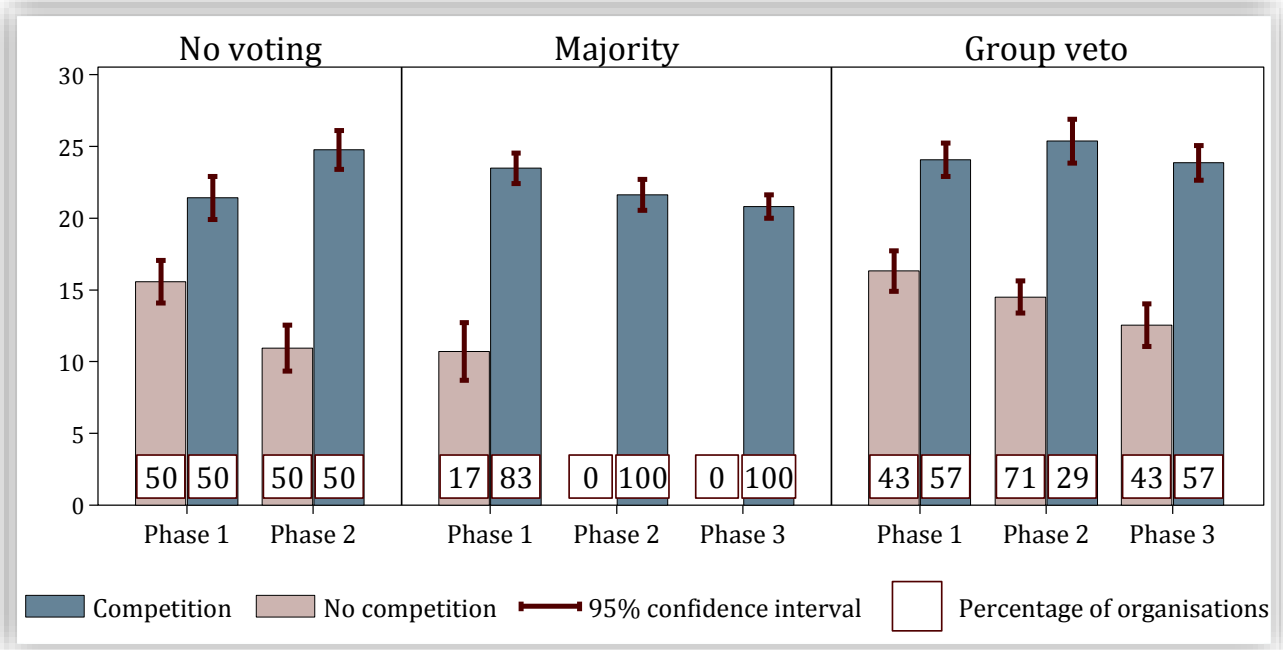
Markussen et al. (2014)

- Subjects play a VCM with n = 3, e = 30, 24 periods, MPCR = 0.5
- Every 8 periods, groups vote whether they want **competition** or **no competition**
  - Compete with 2 other groups: each player in the group ranked 1st wins 10 and each player in the group ranked 3rd loses 10 (ties broken randomly)
- Three voting rules: **Majority** (5 votes) vs. **Group veto** (2 votes per group) vs. **No voting**

IMPLEMENTING COMPETITION

Markussen et al. (2014)

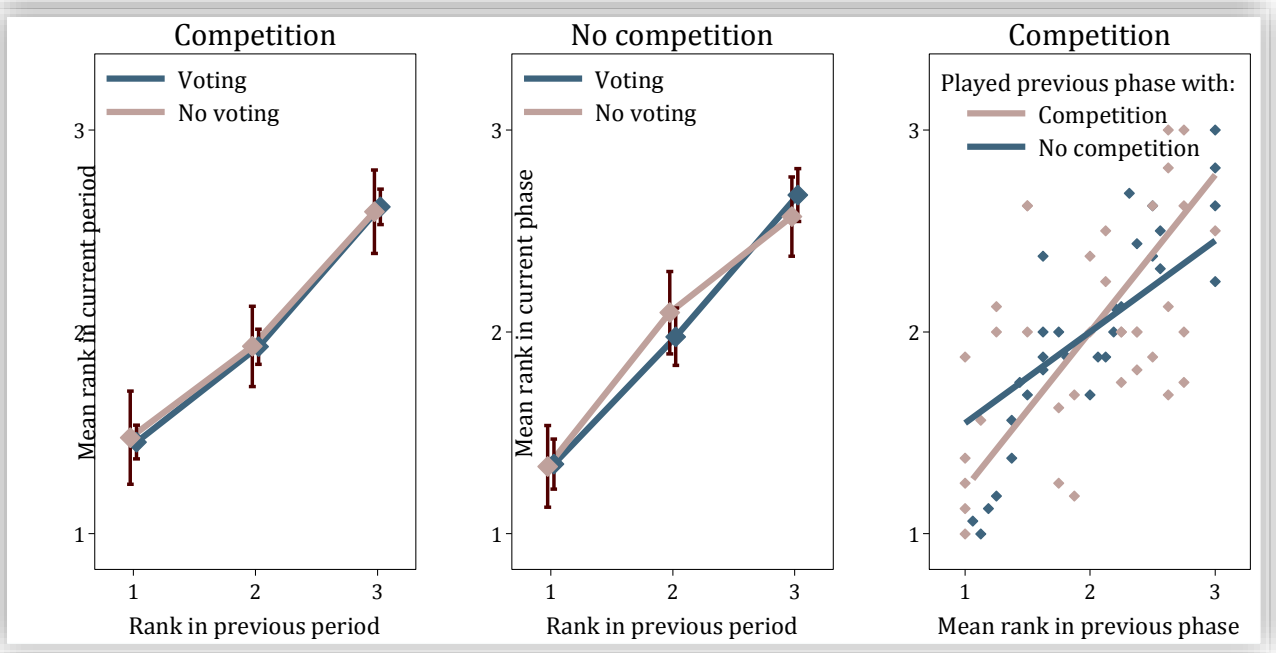
- Competition increases contributions. Its effect is immediate and independent of whether competition is imposed exogenously or implemented through voting



IMPLEMENTING COMPETITION

Markussen et al. (2014)

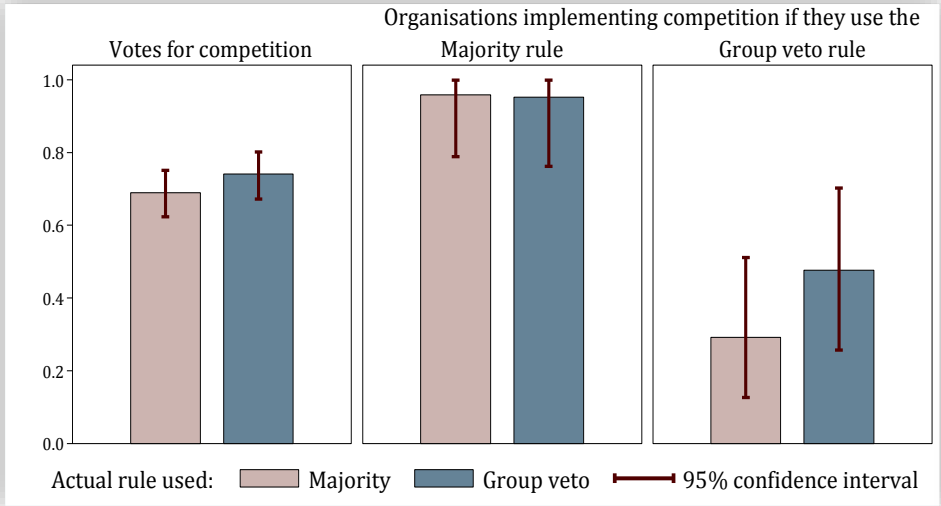
- However, some groups consistently cooperate more/less irrespective of whether they play with or without competition
  - About 80% of groups are net winners and 20% are net losers from competition

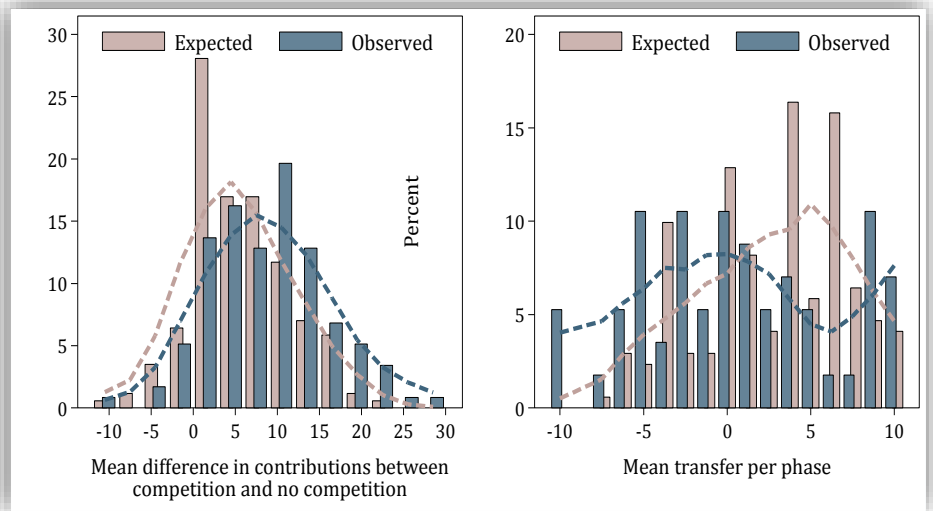


IMPLEMENTING COMPETITION

Markussen et al. (2014)

- 30% vote against competition → competition is implemented often with the majority rule but less than half the time with the group veto rule → not due to strategic voting
- Underestimate the increase in contributions but overestimate their chance of winning





IMPLEMENTING PEER PUNISHMENT

- Peer punishment works but do subjects choose to live in a world with punishment?

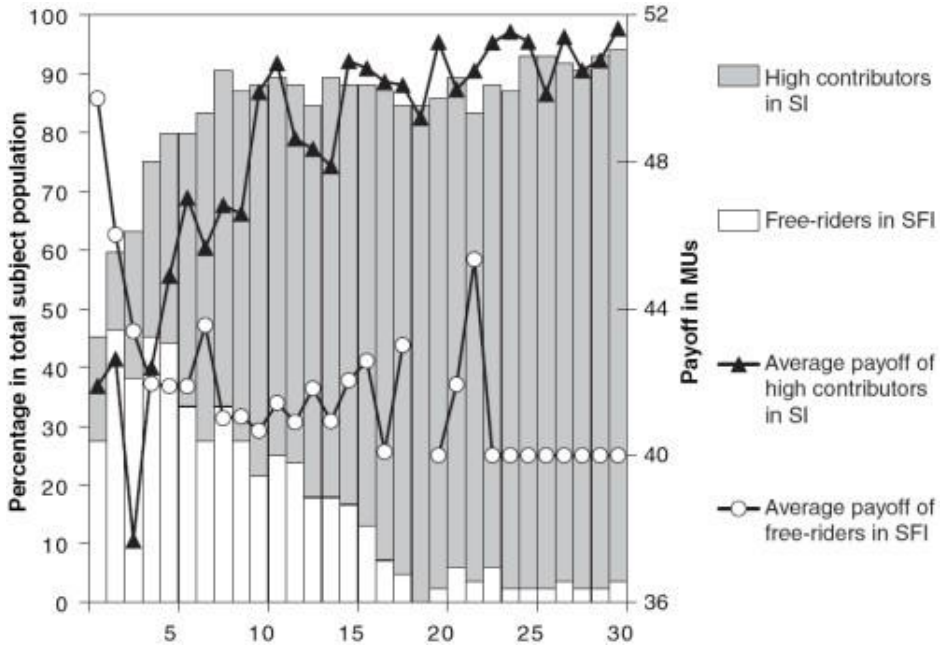
Gürerk et al. (2006)

- VCM: *n* = 1-12, *e* = 20+20, 30 periods, MPCR = 1.6 / *n*
- Two institutions/groups
  - **Punishment**
  - **No punishment**
- Three stages
  - Stage 0: choose group
  - Stage 1: contribution stage
  - Stage 2: punishment stage (only in punishment group)
    - The cost of punishment is 1 point for 3 points of damage

IMPLEMENTING PEER PUNISHMENT

Gürerk et al. (2006)

- As of period 4, high contributors make higher earnings in the punishment group than free-riders in the non-punishment group



Implementing peer punishment & rewards

Choosing the carrot or the stick (Sutter et al. 2010)

- VCM: $n = 4$, $e = 20$, 10 periods, MPCR = 0.4

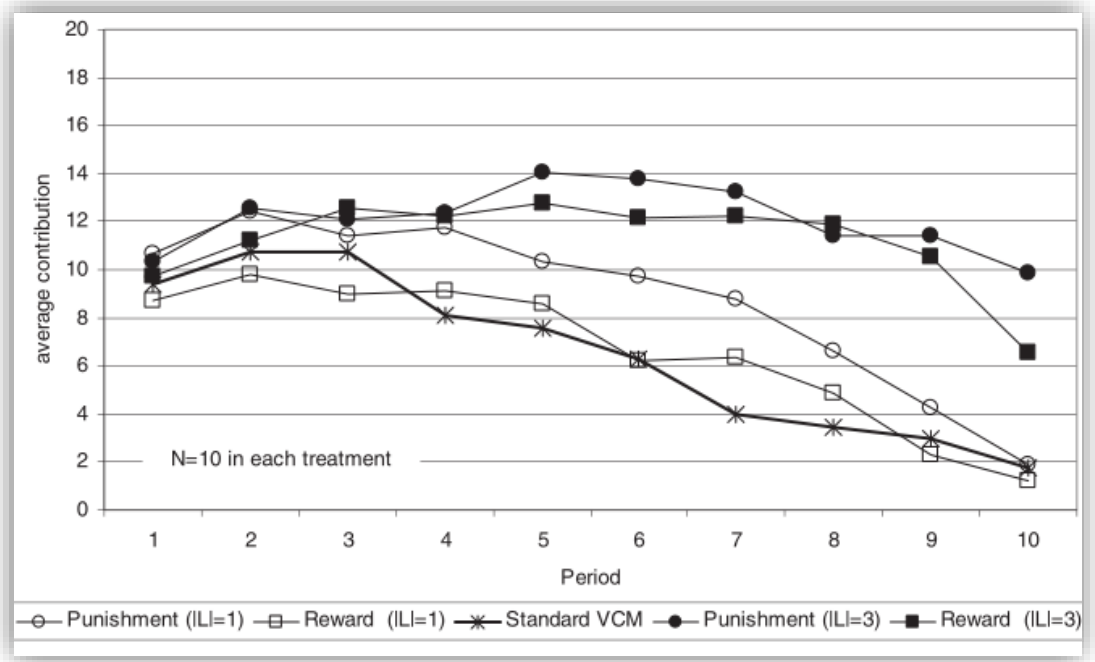
Three institutions

- **Punishment** vs. **reward** vs. **none**
  - **High** (costs 1 to punish/reward by 3) or **low** (costs 1 to punish/reward by 1)
- Institutions implemented either
  - **Exogenously** vs. **endogenously**
    - Vote for one of the three institutions (costs 10) or abstain

IMPLEMENTING PEER PUNISHMENT & REWARDS

Choosing the carrot or the stick (Sutter et al. 2010)

- **Exogenous institutions:** punishment and rewards with **high** leverage raise cooperation



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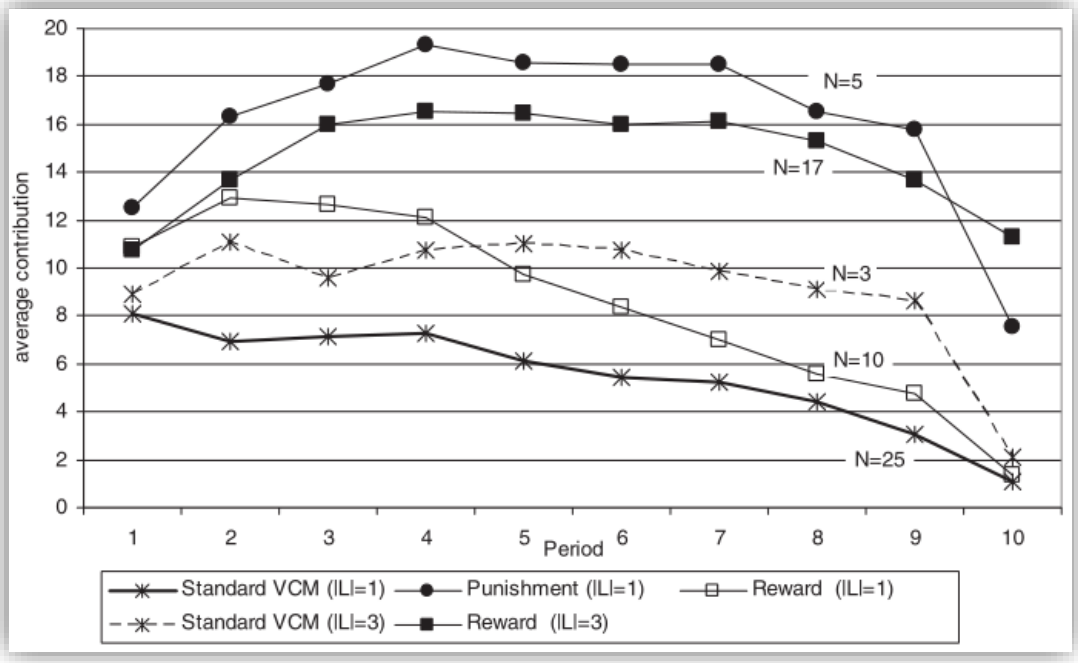
IMPLEMENTING PUNISHMENT

Choosing the carrot or the stick (Sutter et al. 2010)

- **Endogenous institutions:** punishment with low leverage and rewards with high leverage increase cooperation
  - 45% vote with low leverage and 60% with high leverage
  - **Cooperation is higher with endogenously chosen institutions!**



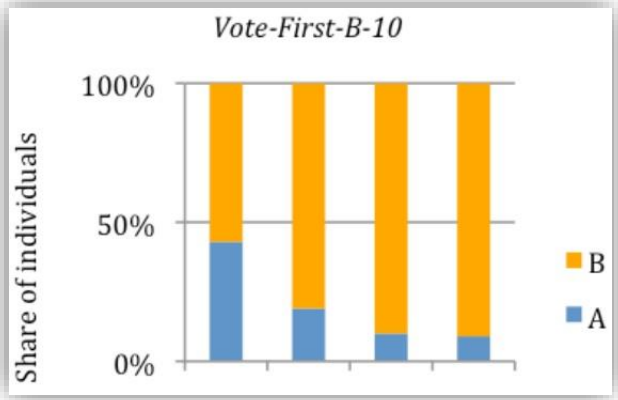
THE PRISONERS' DILEMMA TRAP

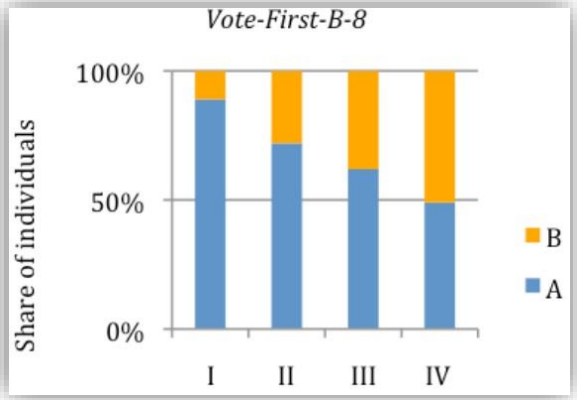
Barrett & Dannenberg (2017)

- 300 subjects play 20 periods in groups of five
- Majority vote every 5 periods to decide which game to play: **A game** or **B game** (B10 or B8)
- A vs. B10: B10 played 89% of the time
- A vs. B8: B8 played 19% of the time

A game	Number of red choices by others				
	0	1	2	3	4
Red	2	4	6	8	10
Black	5	7	9	11	13

B-8 game	Number of red choices by others				
	0	1	2	3	4
Red	0	2	4	6	8
Black	5	5	5	5	5





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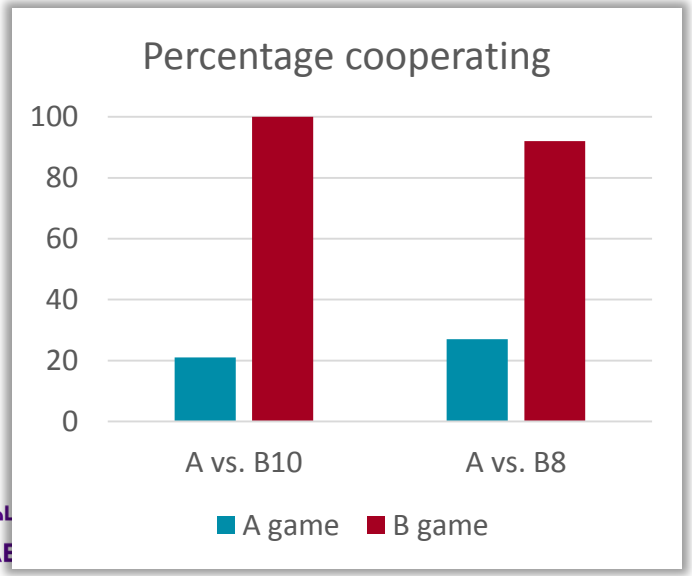
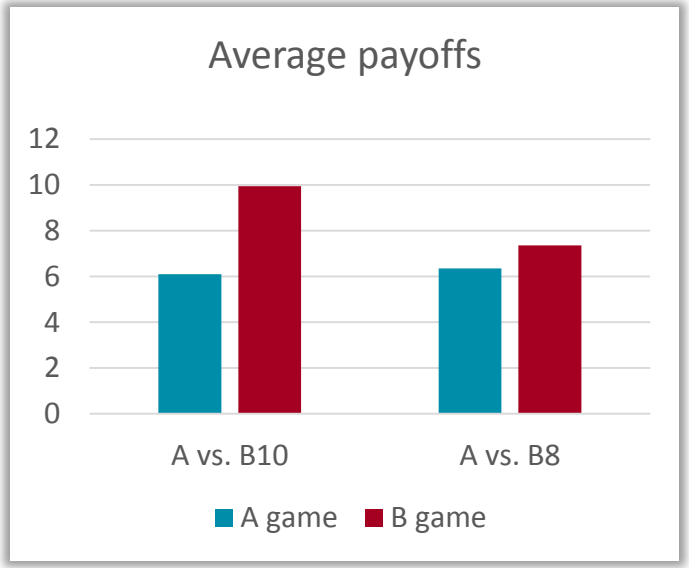
THE PRISONERS' DILEMMA TRAP

Barrett & Dannenberg (2017)

- A vs. B10: Higher cooperation and payoffs in B10 than A
- A vs. B8: Higher cooperation and payoffs in B8 than A
- Groups that cooperate relatively well in A fail to move to B8, where they would do better





THE EFFECT OF DEMOCRACY

Dal Bo et al. (2010)

- Prisoners' dilemma game, 10 periods, random matching in group of four
- First play **unmodified game**
- Then **vote on modified game** but with 50% probability the vote is ignored and the computer assigns institution randomly
- 53% vote for modified game
  - Correlated positively with own cooperation and strategic sophistication, and negatively with other's cooperation

Unmodified	C	D
C	50,50	10,60
D	60,10	40,40

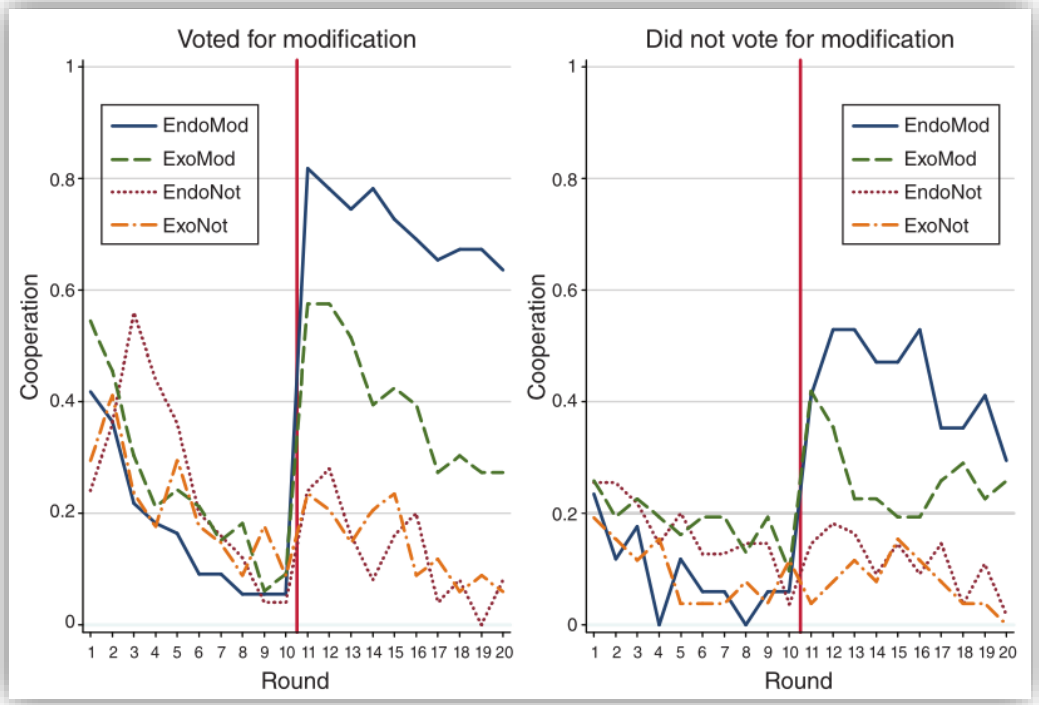
Modified	C	D
C	50,50	10,**48**
D	**48**,10	40,40

THE EFFECT OF DEMOCRACY

Dal Bo et al. (2010)

- More cooperation in modified game when endogenous!
- For subjects who voted for modification, democracy does not affect in the unmodified game but does in the modified game

	Exo	Endo
Unmodified	15%	18%
Modified	50%	72%

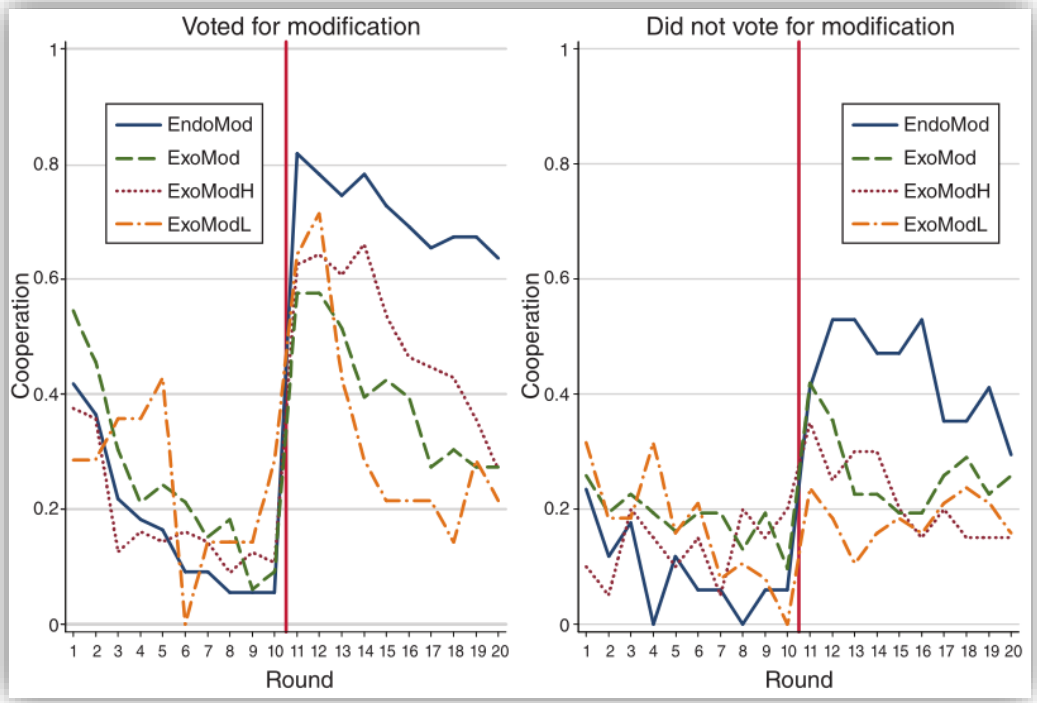


THE EFFECT OF DEMOCRACY

Dal Bo et al. (2010)

- More cooperation in modified game when endogenous!
- For subjects who voted for modification, democracy does not affect in the unmodified game but does in the modified game

	Exo-inf	Endo
Unmodified	-	18%
Modified	55%	72%



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