Game theory and strategic interaction

cooperation and punishment

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Why are there cooperation norms?

Ultimate questions:

Why does cooperation emerge?

How does punishment enforce cooperation norms?

Definitions of social norms

(important for the argument of enforcement of cooperation by punishment due to adherence to cooperation norms)

Pattern of behavior in a particular group, community, or culture, accepted as normal and to which an individual is accepted to conform.
http://www.businessdictionary.com/definition/social-norm.html

Axelrod (1986): „A norm exists in a given social setting to the extent that individuals usually act in a certain way and are often punished when seen not to be acting in this way“.

Coleman (1990): „A norm exists only when others assume the right to affect the direction an actor's action will take. [...] Acceptance of the legitimacy of others' right to partially control his action is necessary to establish the norm that gives him a legitimate right to control others' similar actions.“

A social norm is

- a behavioral regularity that
- rests on a common belief of how one should behave and
- is enforced by informal sanctions.

Voluntary cooperation in the public goods game

Group with n subjects.

y_i is endowment of player i.

2 investment possibilities

- Private account
- Public good (called “project”, “alternative B”)

c_i = contribution to the public good.

Simultaneous contribution decision.

One-shot game or finitely repeated game.

Average contribution in the group or contribution vector as feedback.

Income per period:

$$\pi_i = (y_i - c_i) + \alpha \sum_{j=1}^{n} c_j$$

Prediction

Marginal per capita return (MPCR) α determines incentive:

If $\alpha < 1$: $c_i = 0$ is a dominant strategy

If $n\alpha > 1$ surplus maximization requires $c_i = y_i$

Typical example

- $n = 4$
- $y_i = 20$
- $\alpha = 0.4$
- groups randomly rematched for 10 periods (stranger design)
- or stable group composition for 10 periods (partner design)

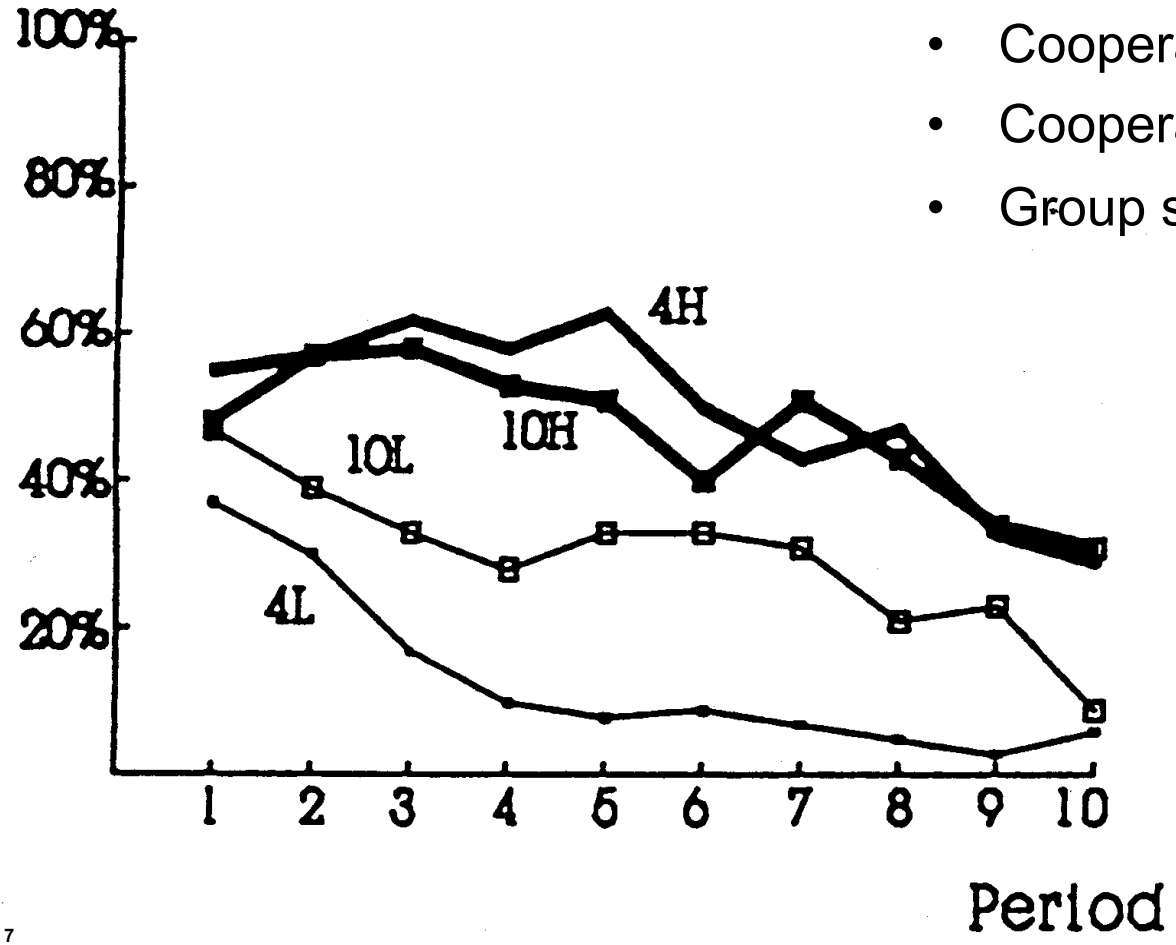
Determinants of Voluntary Cooperation

Isaac, Walker, Thomas (1984)

- Aim: Isolate effects of group size and α.
- $\pi_i = y - c_i + \alpha \Sigma c_i$
- α measures the private marginal benefit, $n\alpha$ the social marginal benefit.
- 10 periods, public information, groups composition does not change.
- Information feedback at the end of each period: sum of contributions and private income.

4L: n=4, MPCR=.3, $n\alpha$=1.2	4H: n=4, MPCR=.75, $n\alpha$ =3
10L: n=10, MPCR=.3, $n\alpha$ =3	10H: n=10, MPCR=.75, $n\alpha$ =7.5

Contributions to Group Exchange (% of Efficient Level)



- Cooperation decreases over time.
- Cooperation increases with α
- Group size effect mixed.

Results

	MPCR=.3	MPCR=.75
n=4	4L: 19	4H: 57
n=10	10L: 33	10H: 59

Table shows average contributions in percent

Cooperation increases with MPCR for both n.

Cooperation increases with n if MPCR is low (not when it is high).

Cooperation decreases with n if group benefit $n\alpha$ constant.

Cooperation decreases over time, in particular in treatments with low MPCR.

MPCR-effect is present in all periods.

Group size effect at low MPCR vanishes over time.

Why do people cooperate?

Mistakes:

- initially they may not understand that zero cooperation is a dominant strategy.

Strategic cooperation

- Repeated game (Kreps et al., JET 1982)
- Reputation formation
- Fear of punishment

Social preferences

- Altruism, “warm glow”, efficiency-seeking motives
- Conformity, conditional cooperation, reciprocity

Why does cooperation decline over time?

Mistakes

- It takes time to learn to play the dominant strategy.

Strategic cooperation

- Higher benefits of a good reputation with a longer horizon

Social preferences

- Subjects are conditionally cooperative and learn that there are free-riders in the group.
- As a response they punish other group members by choosing lower cooperation levels.

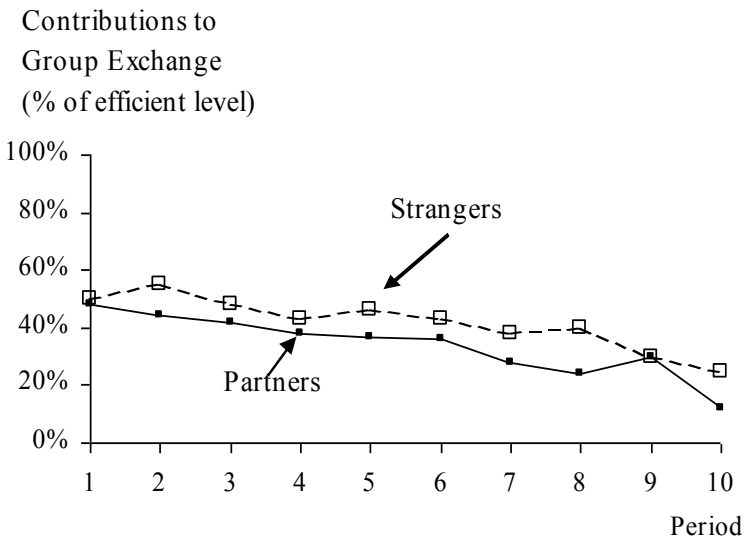
Is there non-strategic cooperation?

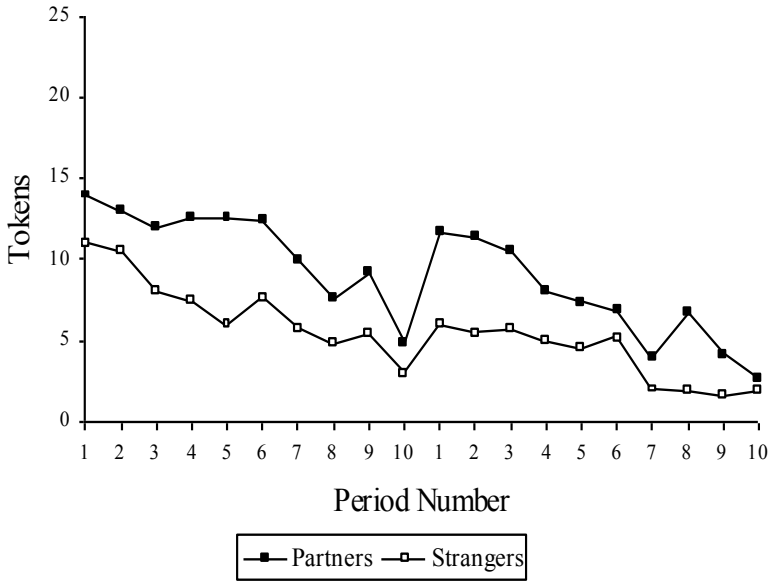
One-shot-game rules out strategic cooperation but it also rules out learning to play the dominant strategy.

Partner-Stranger-Comparison (Andreoni 1988)

- Partner: same group composition in all periods.
- Stranger: random composition of groups in every period.
  - If partners cooperate more: support for strategic cooperation hypothesis
  - However: It is also consistent with a discoordination hypothesis. Conditional cooperators can better avoid discoordination in a partner design.

Partner vs. Stranger

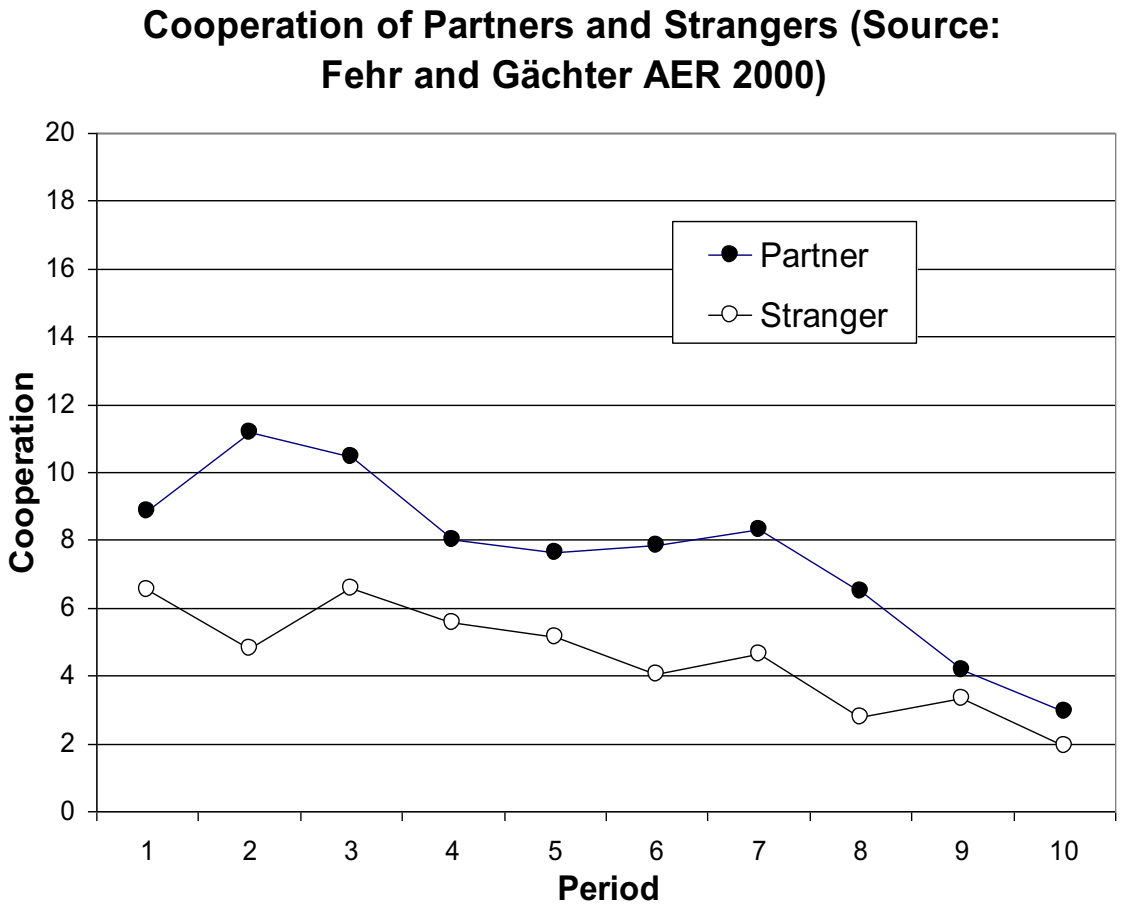




Andreoni JPubE 1988
Claims that strangers cooperate more than partners. However, significance is only achieved by treating each individual decision as an independent observation.

Croson 1996
Partners contribute more than strangers
Note the increase after the restart in period 11. Andreoni 1988 also observed a restart effect.
Restart effect supports conditional cooperation (and is evidence against mistakes which would reduce over time irrespective of restart)

Partners versus Strangers



6 partner groups
2 stranger sessions with 6 groups each

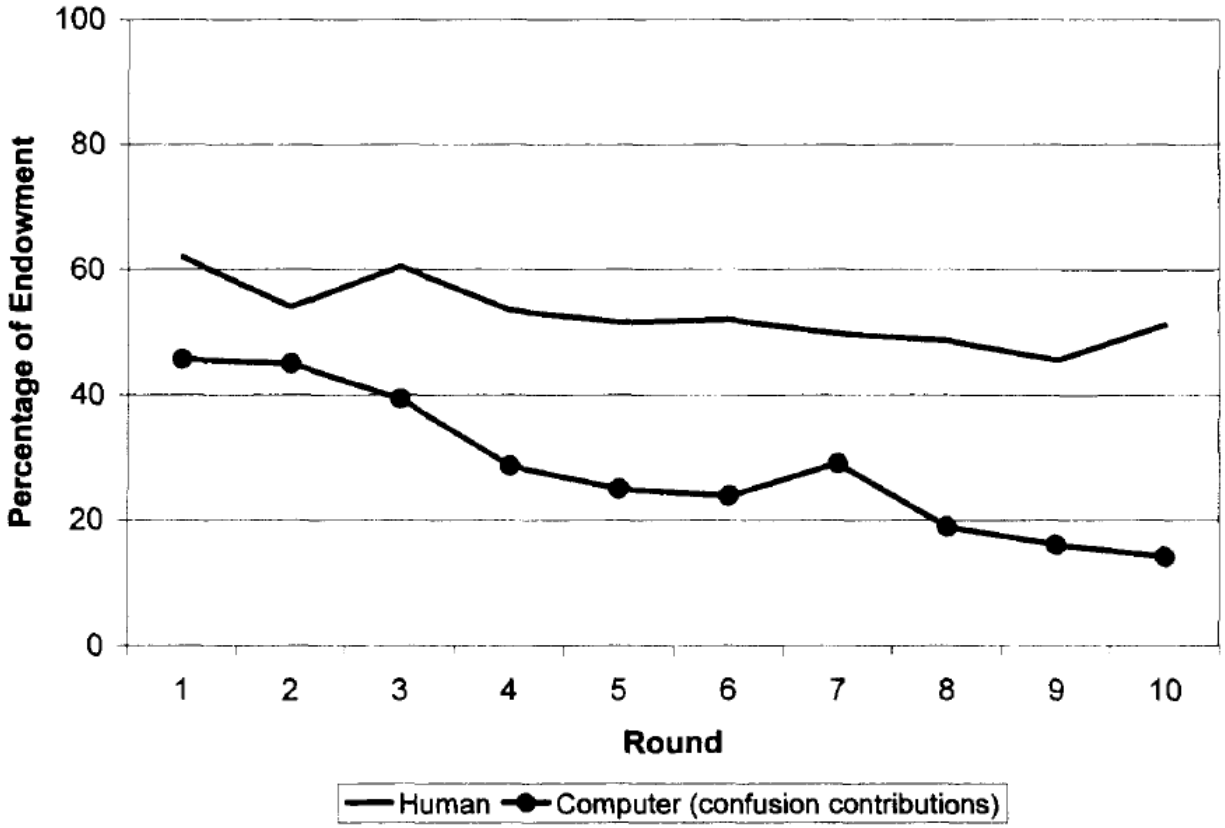
Contributions by mistake
Houser and Kurzban (AER 2002)

If subjects contribute because they want to cooperate, they should not when they play with robots.

Dominant strategy is dominant also when the other subjects' payoffs is taken into account.

Treatment in which robots play as subjects in another treatment.

Results
Houser and Kurzban (AER 2002)



Almost 50% of the contributions are attributed to confusion.

Direct Evidence for Conditional Cooperation
(Fischbacher, Gächter & Fehr Econ Lett 2001)

n = 4, MPCR = .4

One-shot game

Subjects choose...

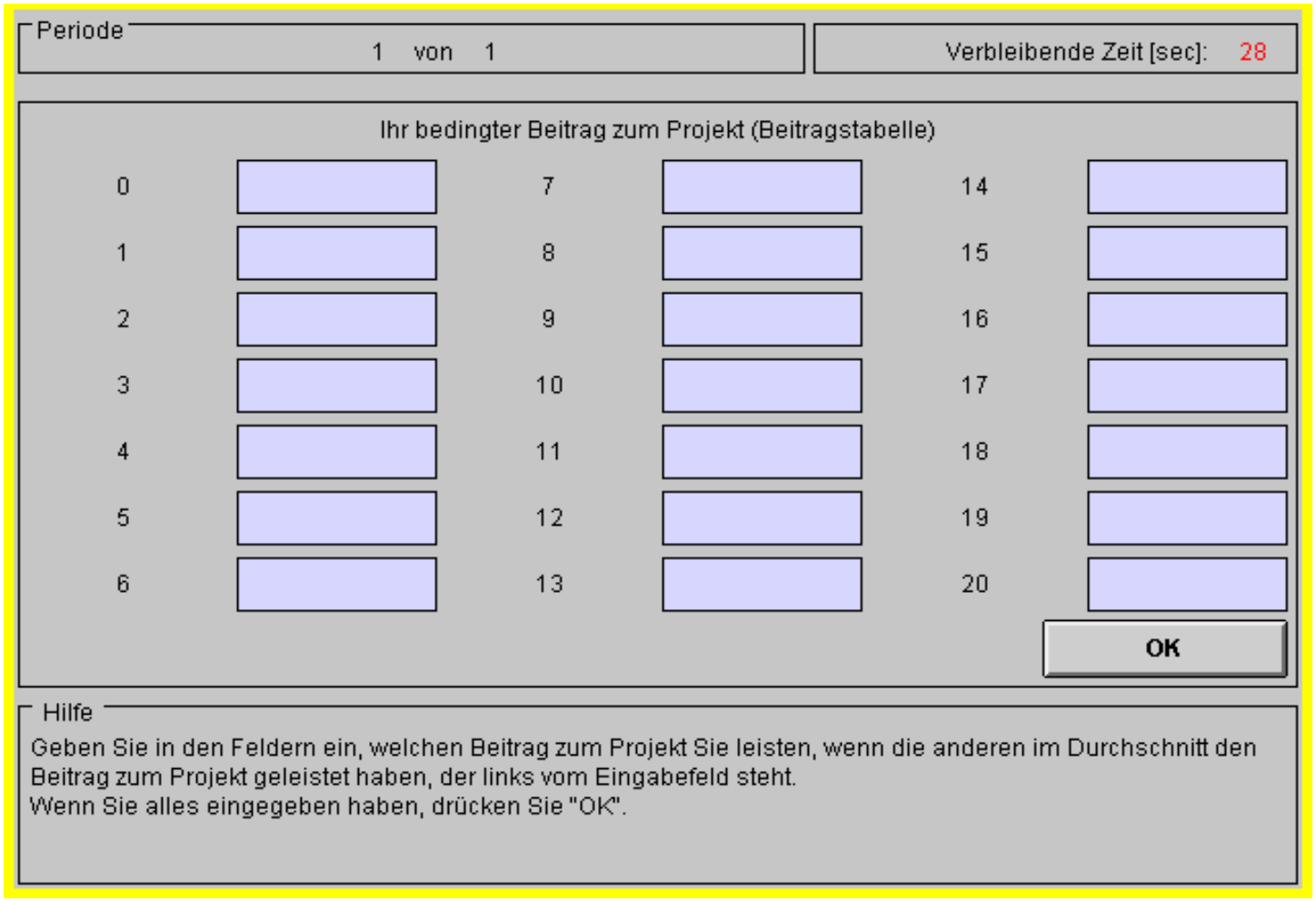
- An unconditional contribution
- A conditional contribution, i.e., for every given average contribution of the other members they decide how much to contribute.

At the end one player is randomly chosen. For her the contribution schedule is payment relevant, for the other three members the unconditional contributions is payment relevant.

A selfish player is predicted to always choose a conditional contribution of zero.

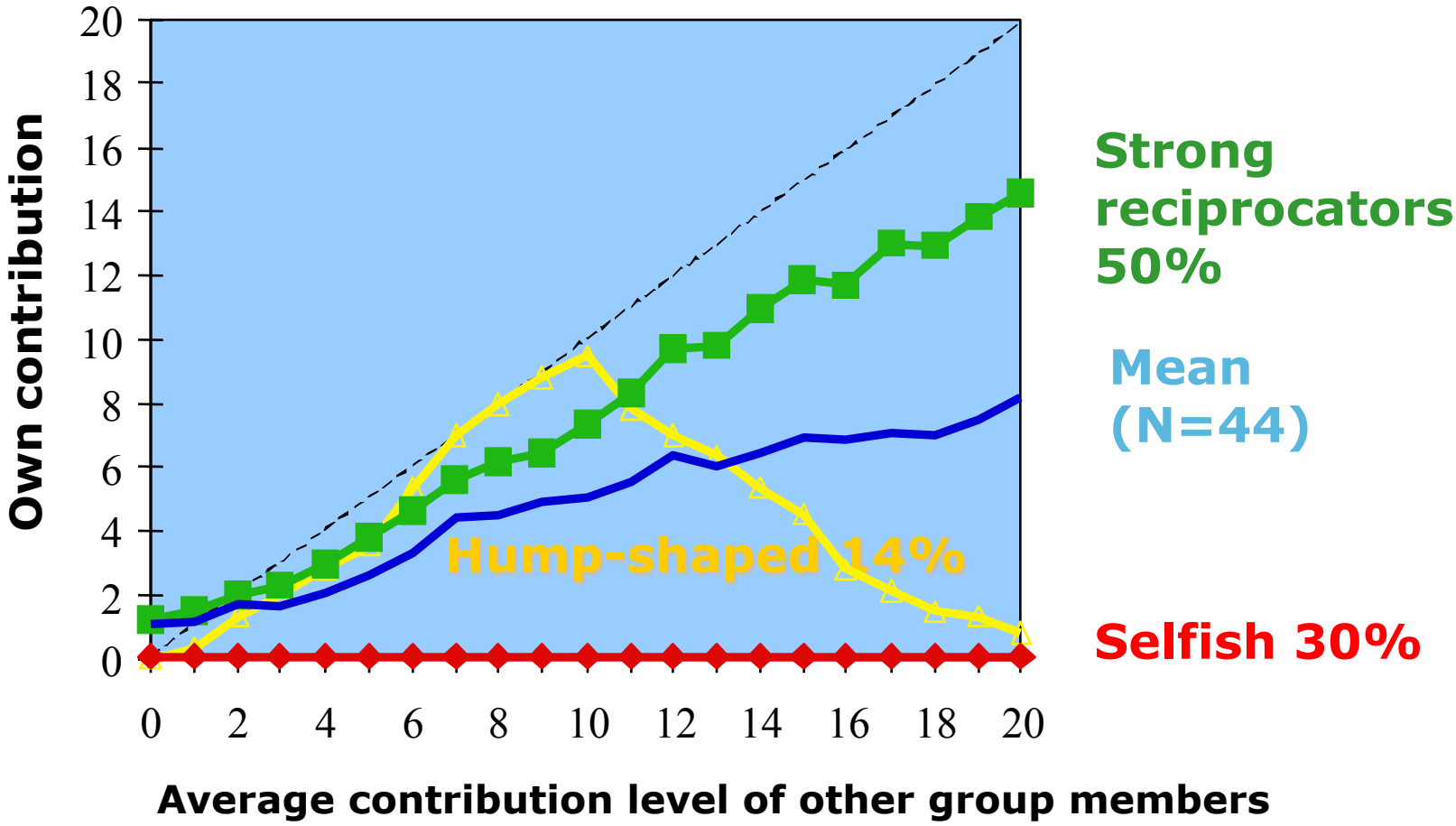
Note that a selfish player may have an incentive to choose a positive unconditional contribution if she believes that others are conditionally cooperative.

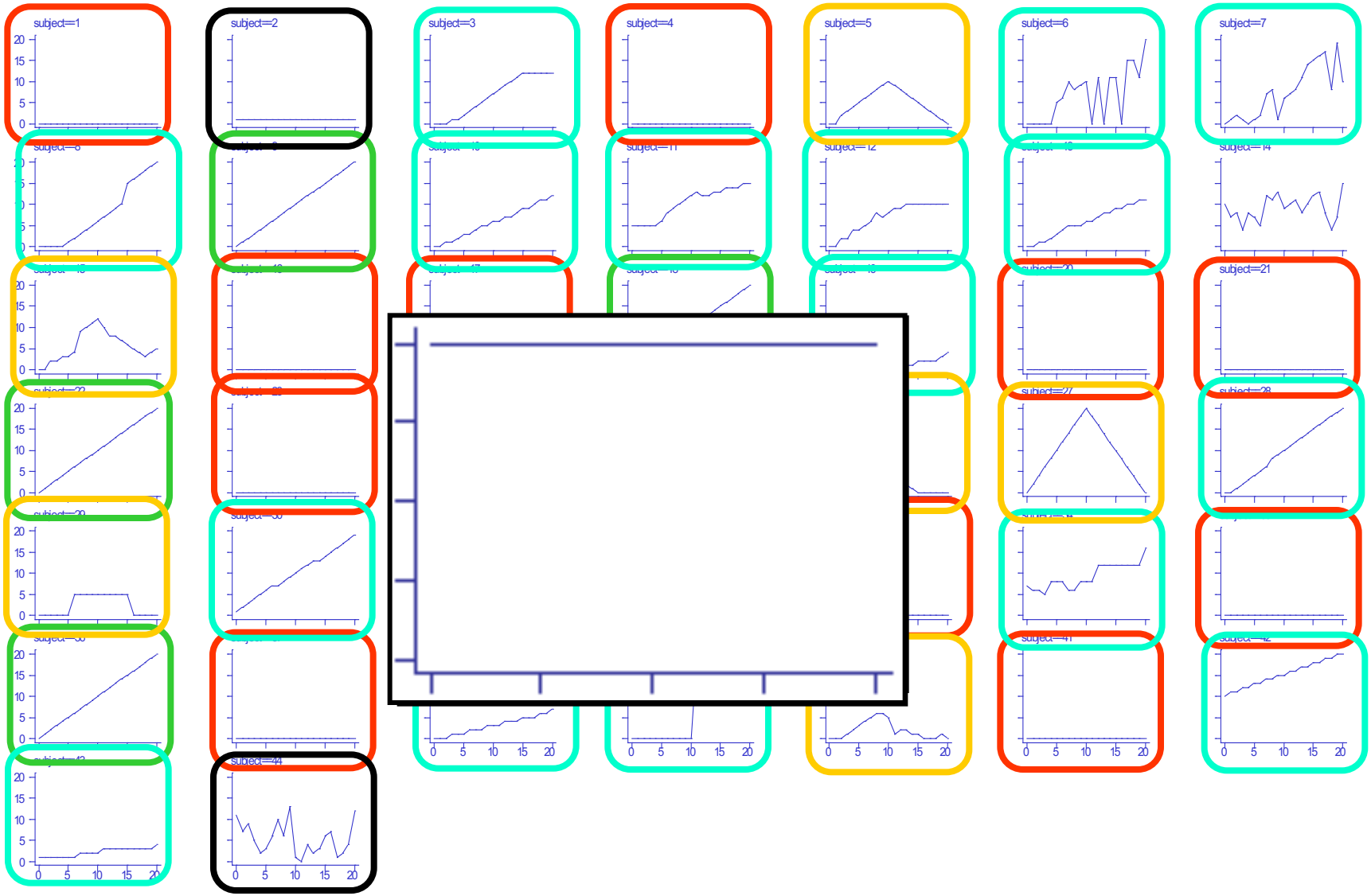
Decision Screen



Average schedules

Fischbacher, Gächter, Fehr 2001





Individual decisions

Results

Unconditional cooperation is virtually absent.

Heterogeneity:

- Roughly half of the subjects are conditional cooperators.
- Roughly one third is selfish.
- A minority has a “hump-shaped” contribution schedule

Question: Can the observed pattern of conditional cooperation explain the unraveling of cooperation?

- Assume adaptive expectations. Subjects believe that the other group members behave in the same way as in the previous period.
- This implies that over time the conditional cooperators contribute little although they are not selfish.
- This result holds qualitatively for any kind of adaptive expectations.

A Comparison

Typen	Fischbacher Gächter & Fehr (N=44)	Fischbacher & Gächter (N=140)	Gächter & Herrmann (N=108)	Ockenfels (N=103)	Kurzban & Houser (N=71)
	Switzerland		Russia	Germany	USA
Conditional Cooperators	50%	50%	50%	33%	34%
Free Riders	29.50%	23%	8.30%	62%	20%
Hump-shaped contributions	13.60%	12%	7.40%	1.50%	3%
Cooperators	-	1.50%	1.90%	1.50%	30%
Negative cond. coop	-		8.30%	1%	
Not classifiable	6.90%	15%	24.10%	2%	13%
Total in %	100%	100%	100%	100%	100%

Burton-Chellew, et al. (2016) find similar conditional cooperation patterns when people play against robots.

Norm Enforcement

A social norm is

- a behavioral regularity that
- rests on a common belief of how one should behave and
- **is enforced by *informal* sanctions.**

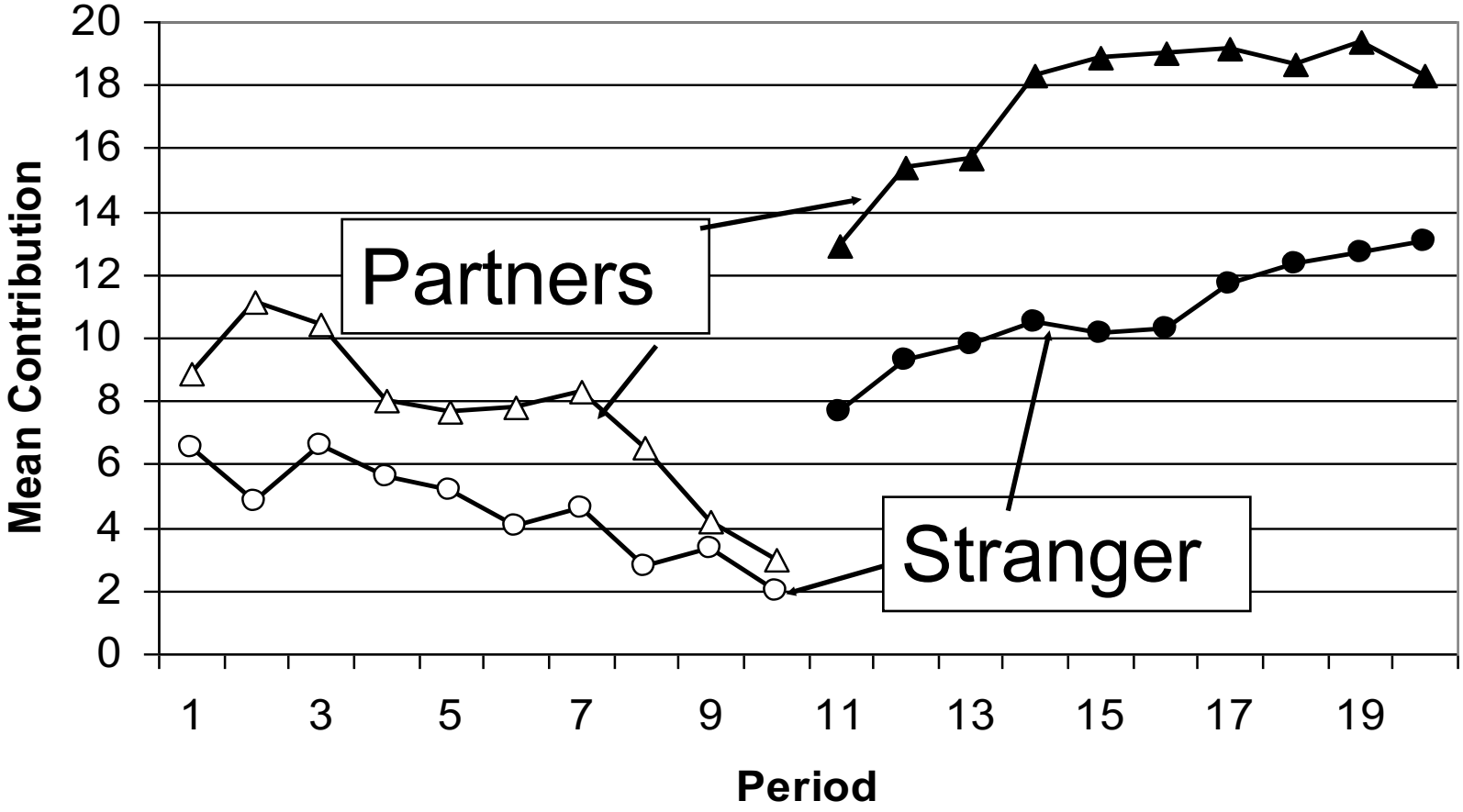
Cooperation, Punishment & Social Norms (Fehr & Gächter AER 2000, Nature 2002)

Stage 1: typical linear public goods design: n = 4, α = 0.4.

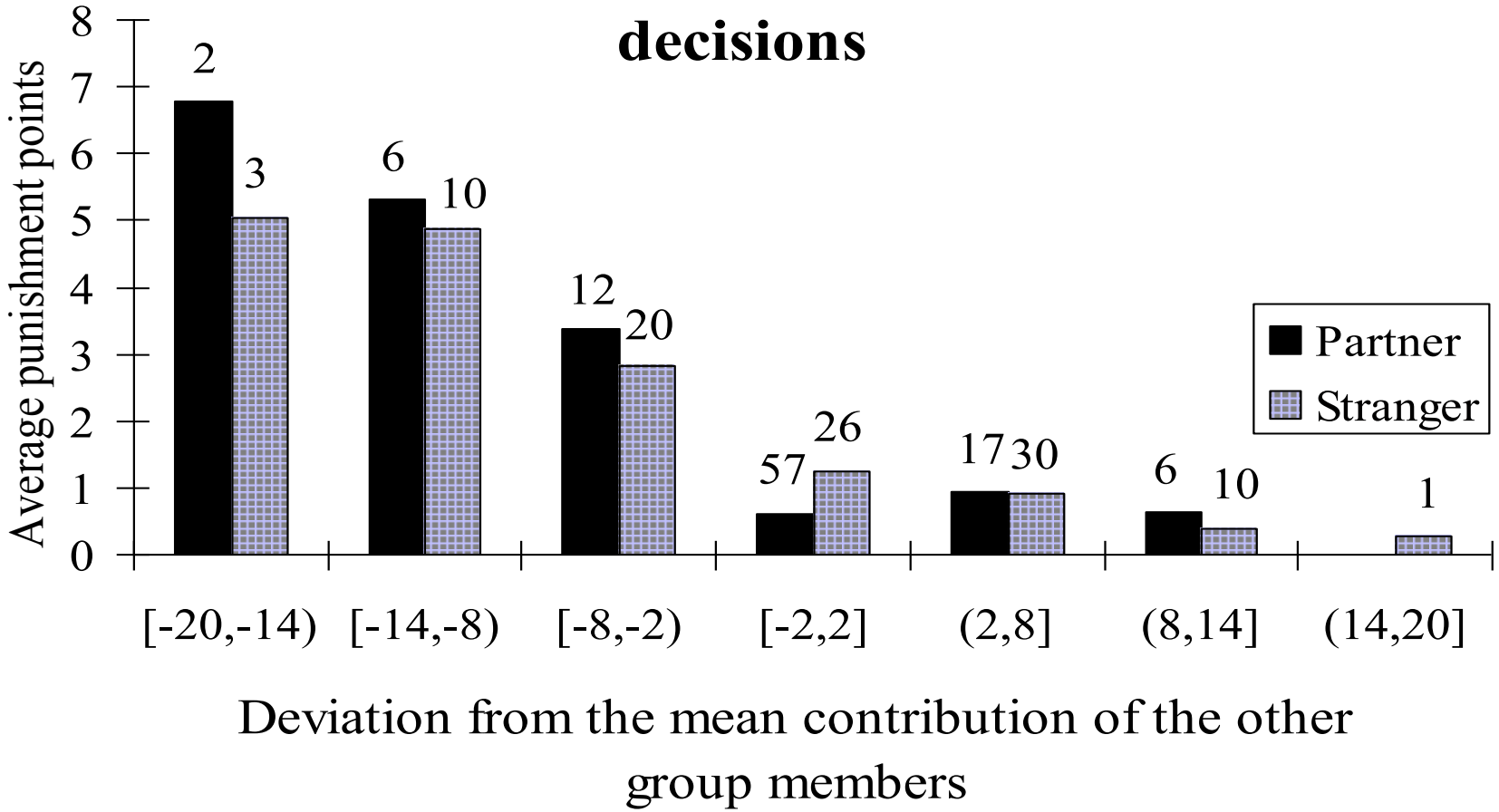
Stage 2: Punishment opportunity

- Subjects are informed about each member's contribution.
- Subjects can punish other group members at a cost to themselves.
- A punished subject could not lose more than the first-stage income.

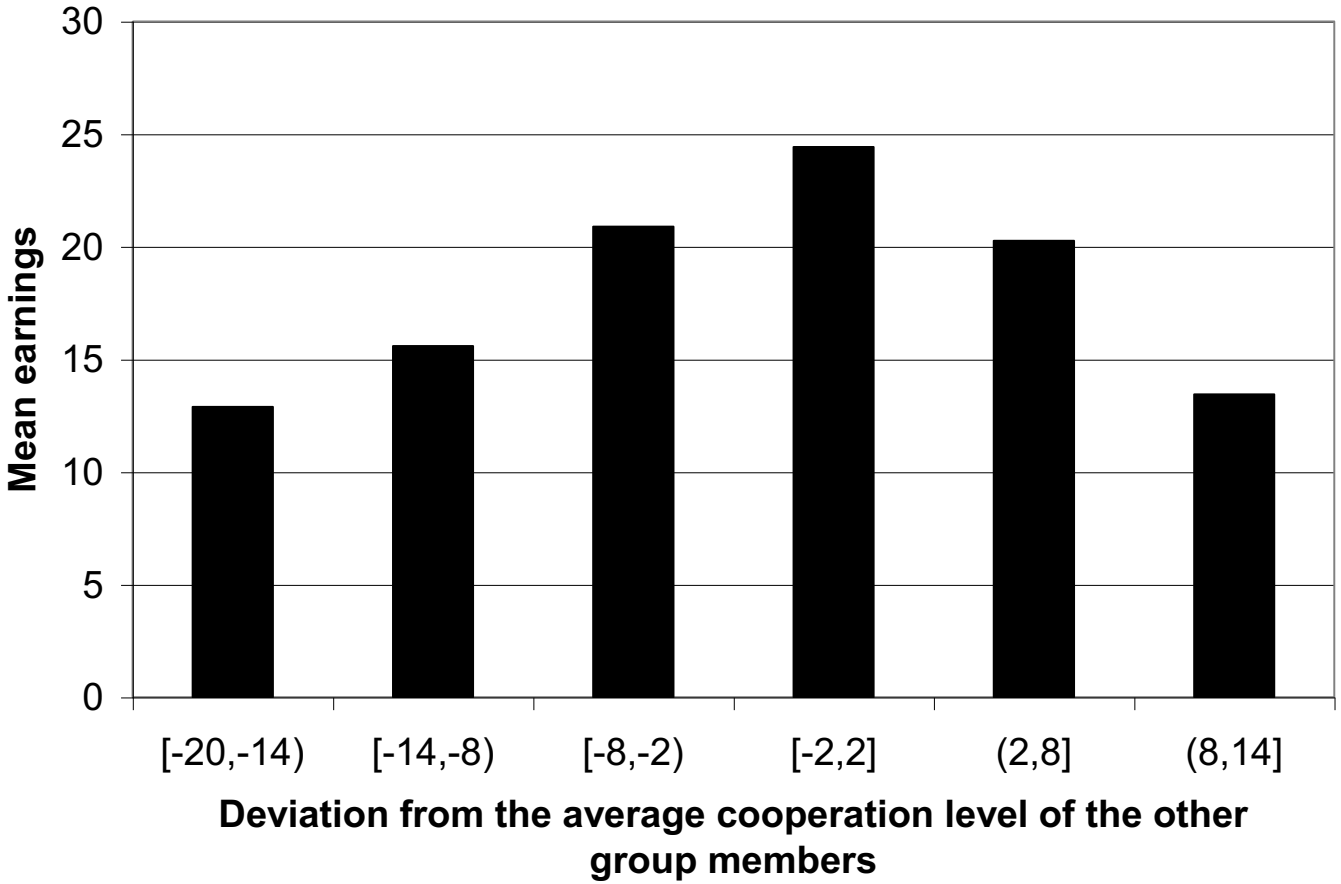
Cooperation without and with Punishment (Fehr & Gächter AER 2000)



Received punishment points per deviation from average and percentage of decisions



Punishment: Incentives to Obey the Norm



Source: Fehr&Gächter, Nature 2002

Note: You could replicate respective earning differences of „punishers“ with the Fehr & Gächter 2000 data (see also Gächter, Renner Sefton 2008, Science)

Public Goods with Punishment Opportunity Conclusions

Punishment opportunity allows enforcement of cooperative norms.

Subjects whose contributions are below a relevant reference points are punished.

By those who cooperate

This also enhances cooperation in a perfect stranger design.

Norms of cooperation in a cross-societal perspective

Herrmann, Thöni & Gächter (Science 2008)

- Which cooperation levels do emerge in different pools?
- Repeated games (10 periods), n=4, N-P sequence.
- N=1128 participants in 15 different subject pools.

- Prediction: Free riding in the N-experiment and multiple equilibria (i.e., cooperation levels) in the P-experiment.
  - ➢ What gets punished might be culture-dependent ("local norms")
  - ➢ Punishment can stabilise "everything" (Boyd & Richerson).

Unified procedures

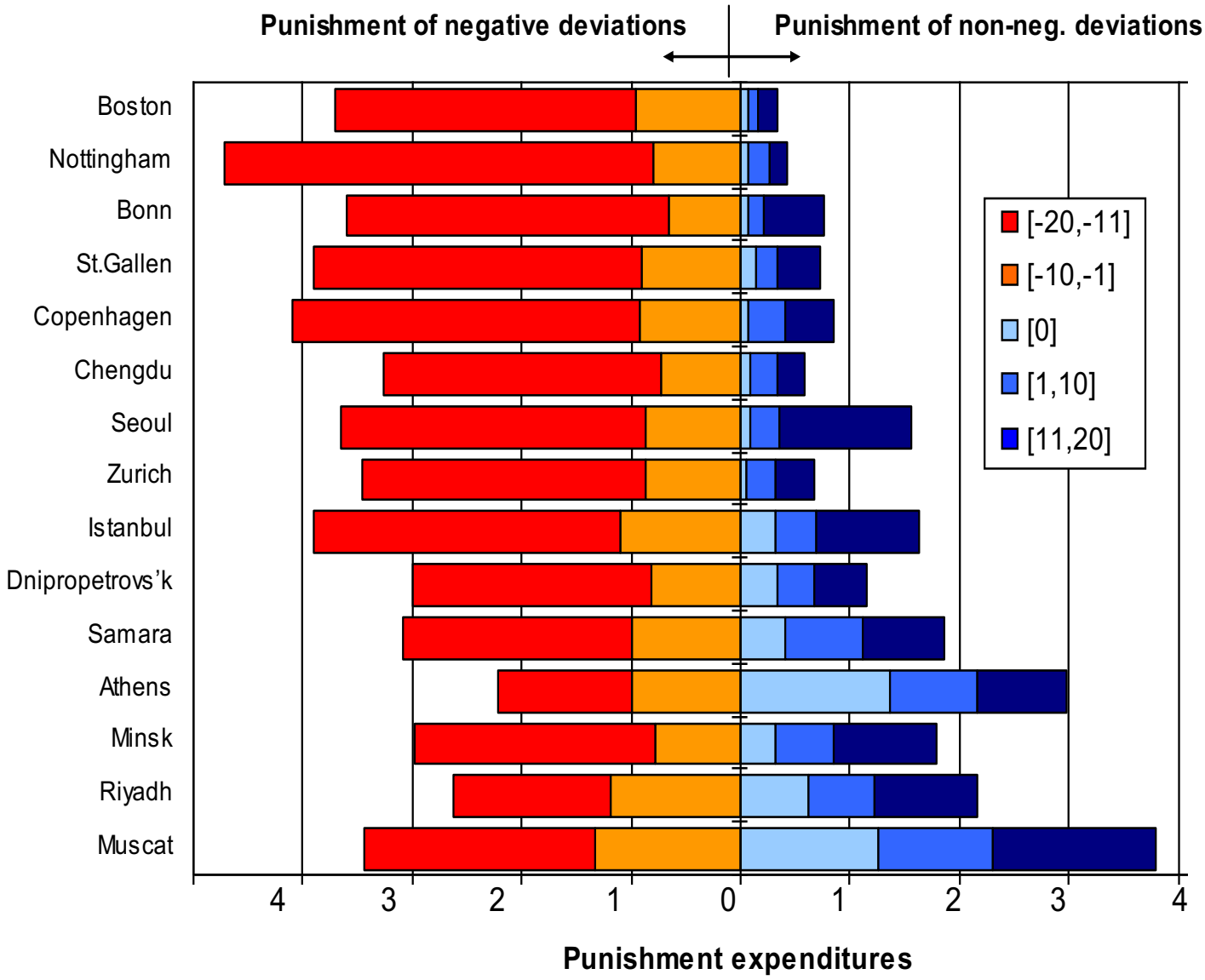
Same software (z-Tree)

Same (translated) instructions,

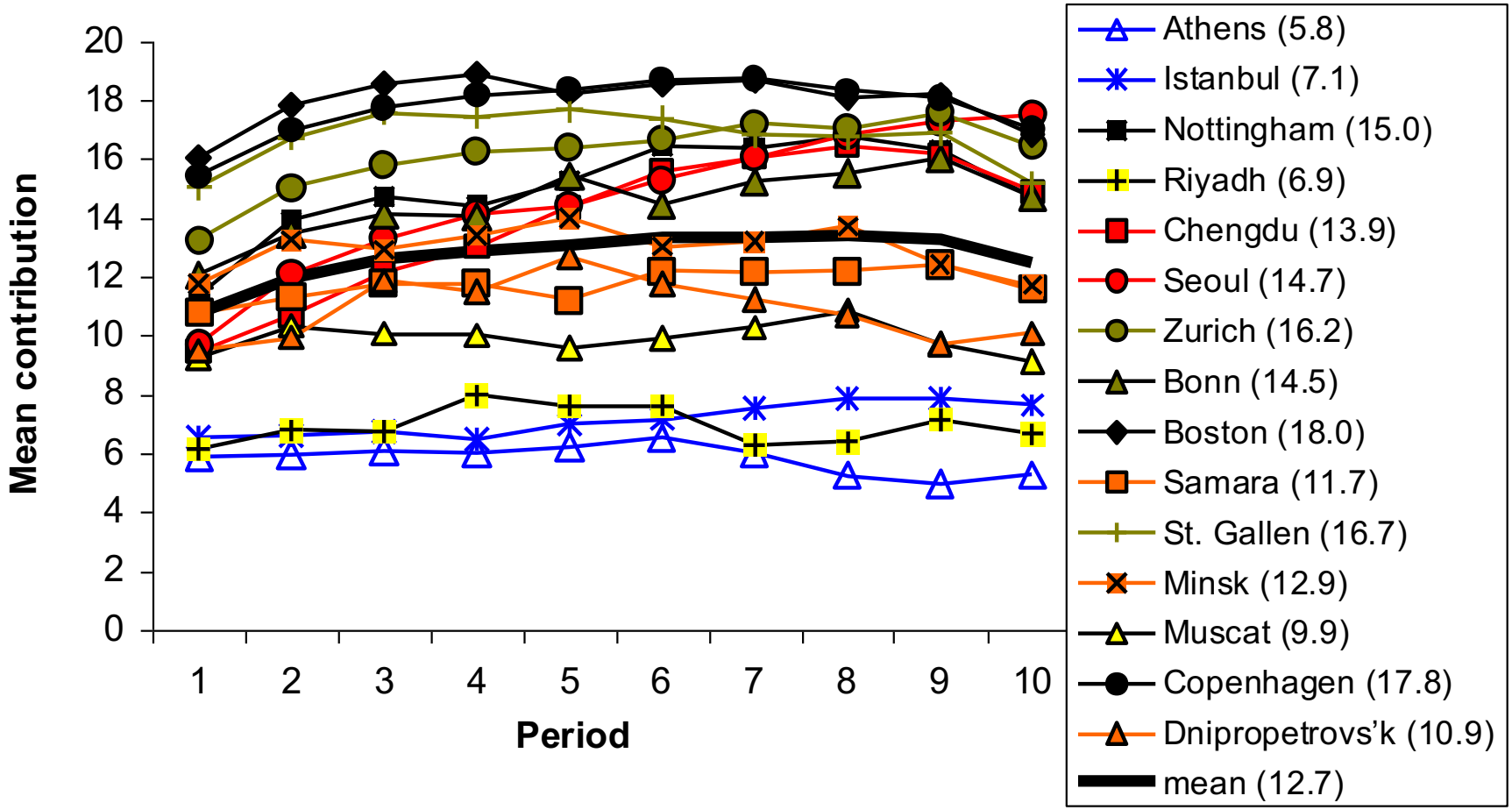
Same experimenter (B.H.)

Similar subject pools (university undergrads), same age, (upper) middle class

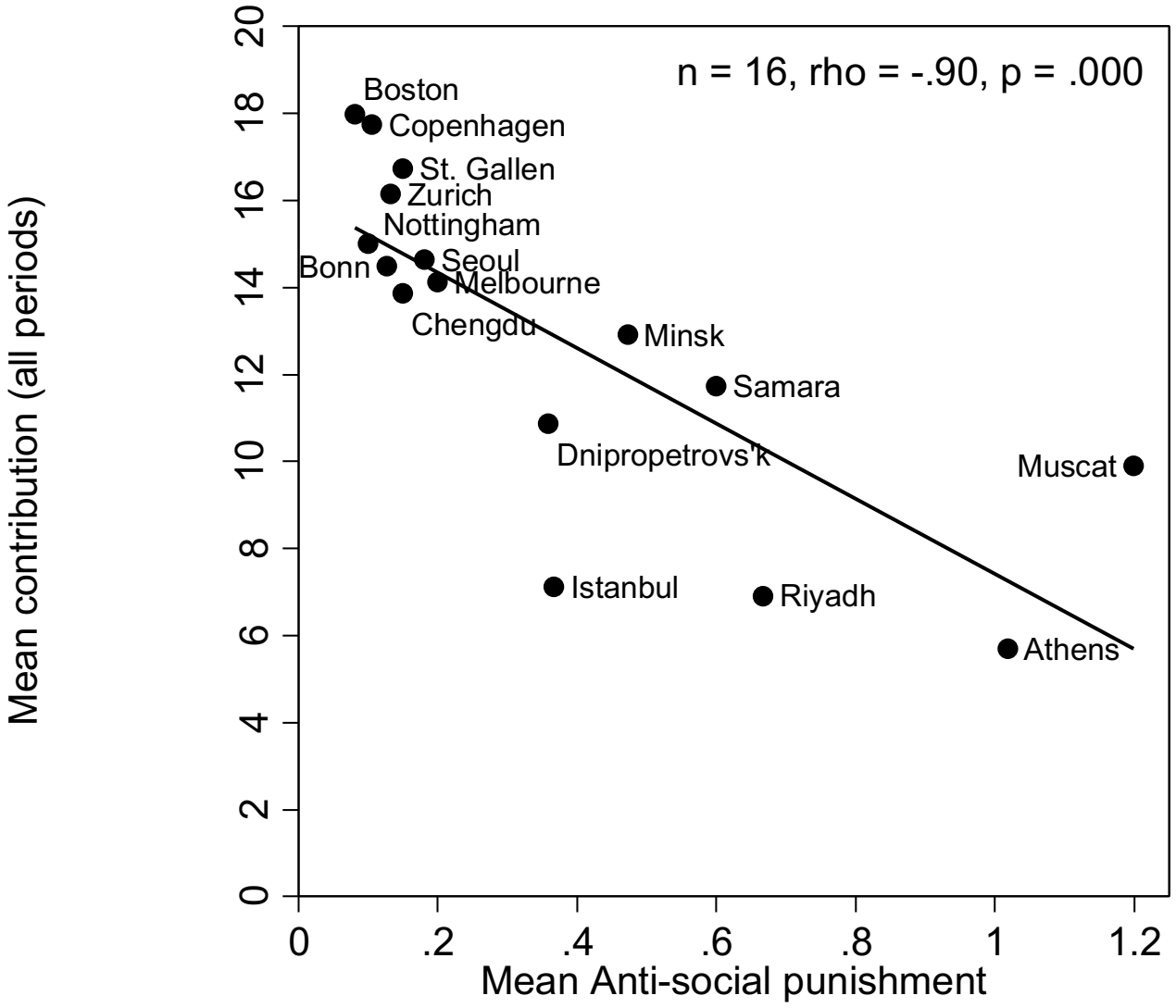
Punishment


Punishment of negative deviations
Punishment of non-neg. deviations
Boston
Nottingham
Bonn
St.Gallen
Copenhagen
Chengdu
Seoul
Zurich
Istanbul
Dnipropetrovs'k
Samara
Athens
Minsk
Riyadh
Muscat
[-20,-11]
[-10,-1]
[0]
[1,10]
[11,20]
4
3
2
1
0
1
2
3
4
Punishment expenditures

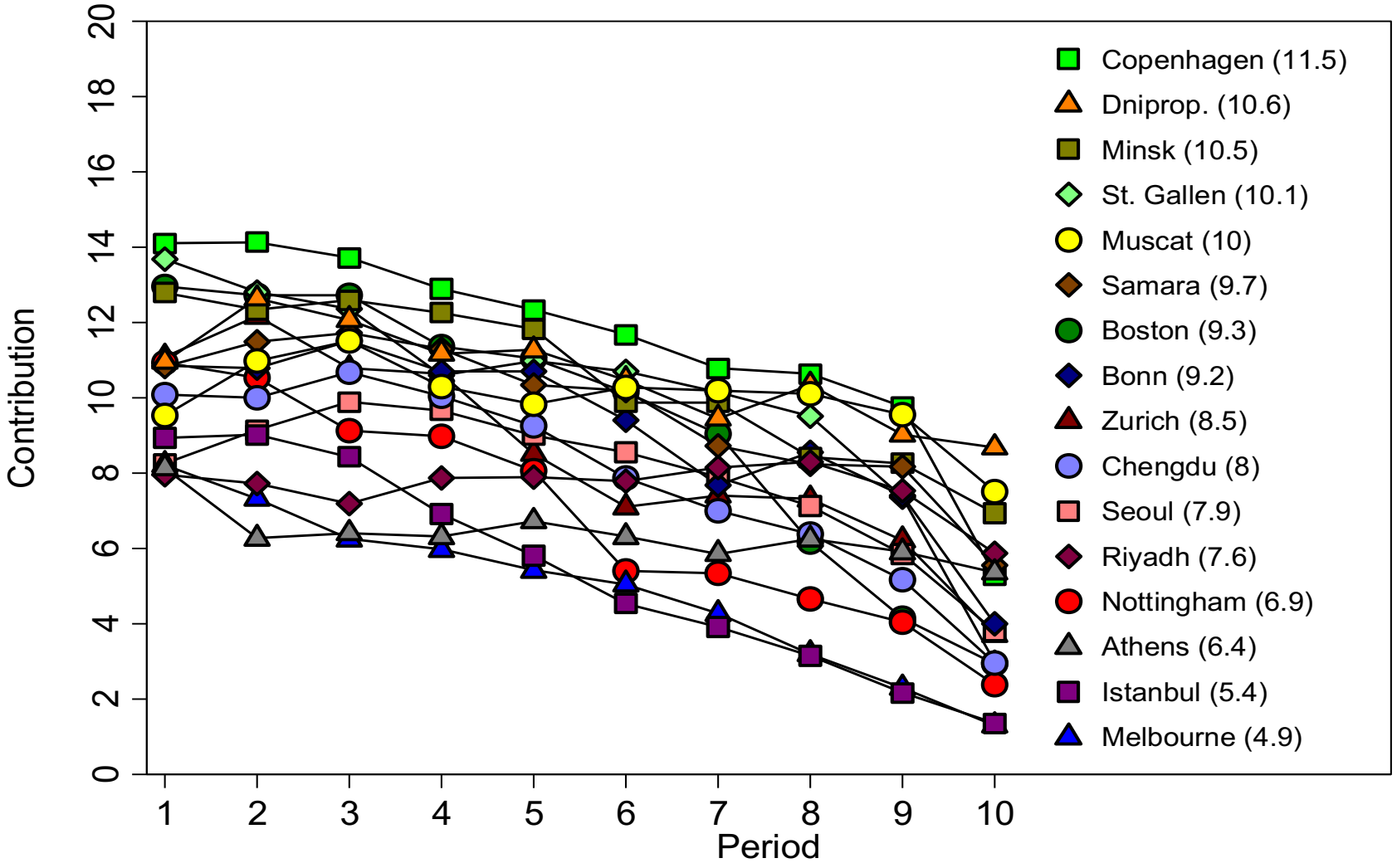
Cooperation in the P-experiment



Anti-social punishment & cooperation



Cooperation in the N-experiment



Summary Herrmann et al.

Repeated public good experiments in fifteen subject pools to study development of cooperation.

In the N-experiment cooperation breaks down everywhere; “unique equilibrium”.

In the P-experiment punishment stabilises cooperation at vastly different levels; “multiple equilibria”.

Behaviour similar within a given culture, different between cultures.

Punishment behaviour is strongly different between subject pools.

Results consistent with theories of cultural evolution.

Results might also be relevant for discussions of social capital.

What do people choose when they can?

Gürerk, Irlenbusch, Rockenbach (2013)

People initially prefer an institution without punishment but move to an institution with.

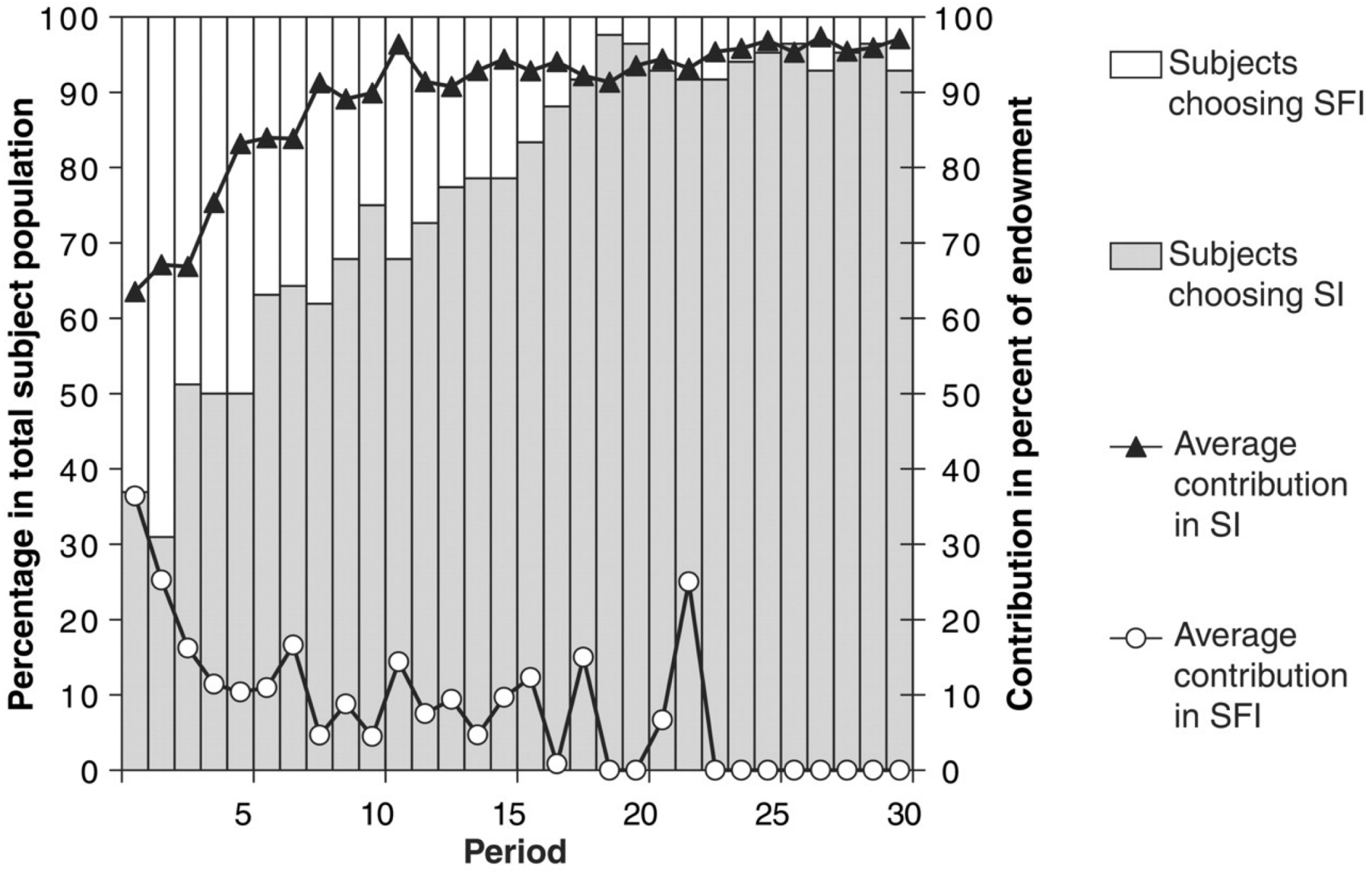
Sutter, Haigner, Kocher (2010)

People tend to opt for reward institutions even though punishment institutions lead to higher average profits.

Fischbacher, von Hesler (2017)

It depends on the situation whether reward or punishment is preferred. People choose the option that is most desired.

Choosing: punishment or not



Gürerk, Ö., Irlenbusch, B. and Rockenbach, B., 2006. The competitive advantage of sanctioning institutions. *Science*, *312*(5770), pp.108-111.

Results V: Aversion from shame more powerful motivator than anticipation of prestige

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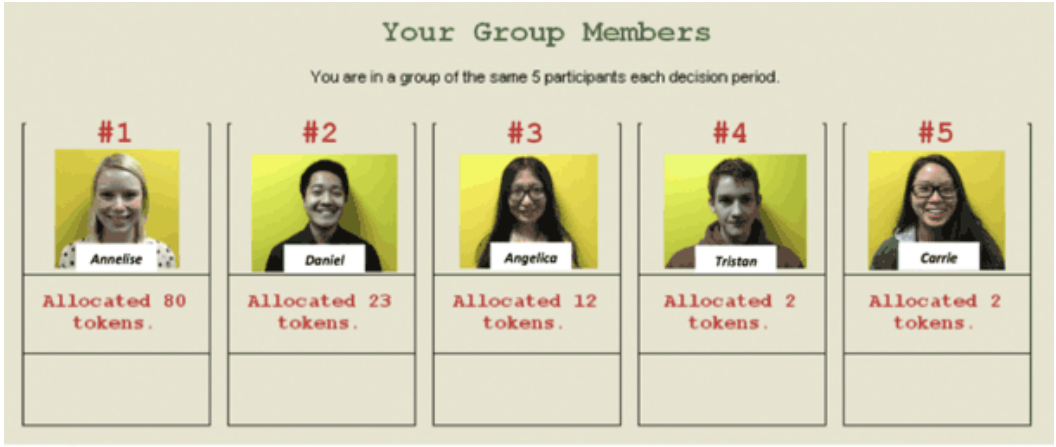
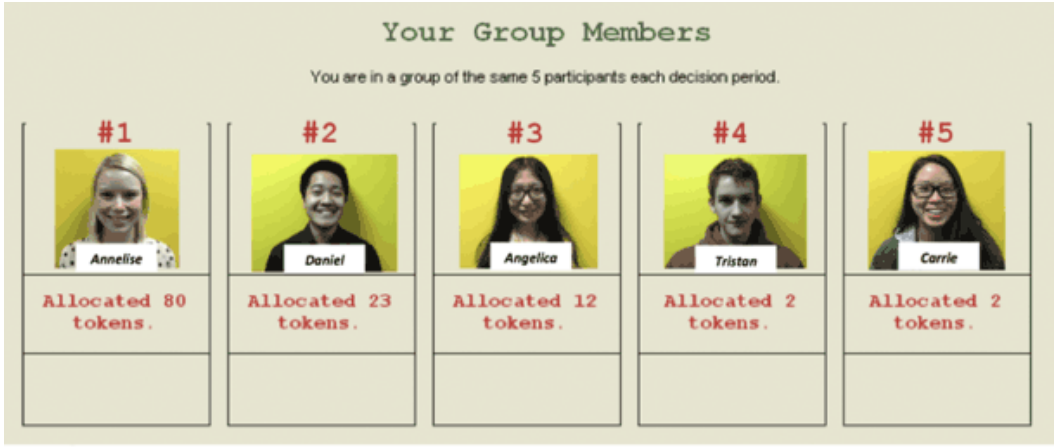


Treatment ALL

Treatment TOP

Treatment NONE

Results V: Aversion from shame more powerful motivator than anticipation of prestige



Treatment ALL

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Samek, A. S., & Sheremeta, R. M. (2014). “Recognizing contributors: an experiment on public goods.” Experimental Economics, 17(4), 673-690.

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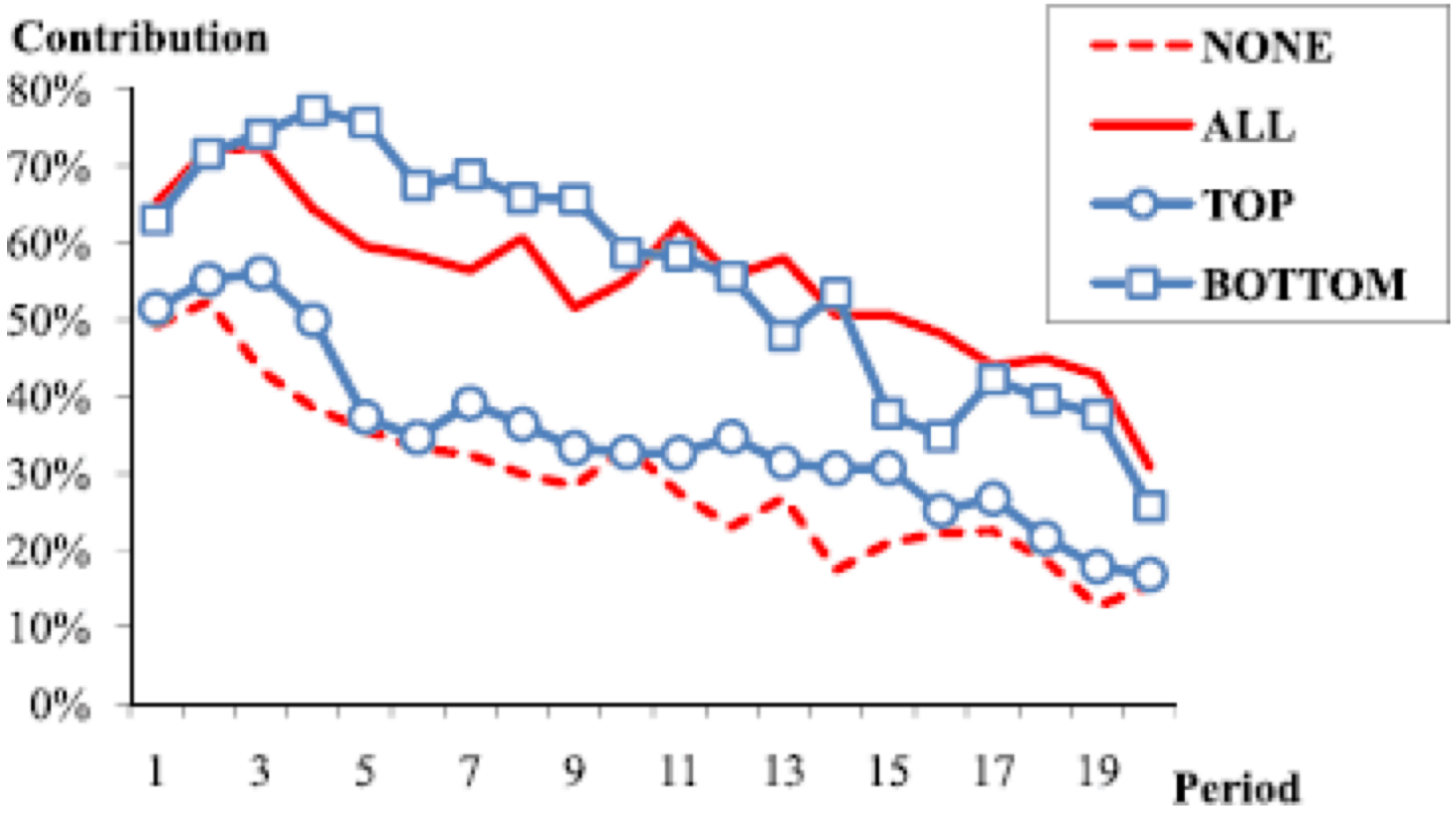

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Concluding remarks on behavioral models of social norms

Models of social preferences

- Inequality aversion (Fehr and Schmidt, 1999).
- Reciprocity (Rabin 1993, Levine 1998).

Can cope individual preferences but less so cultural differences.

Model with flexible norms

López-Pérez (2008)

There is also heterogeneity in norm enforcement.

Cannot explain the heterogeneity of norms.

Model to come

…have to take temporal development into account.

Requires a better understanding of individual heterogeneity.