Institutions as Tools for Overcoming Social Dilemmas

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Public Good Game (PG game)

groups of size $m \geq 2$

contribute $c > 0$ or not

contribution multiplied by $r > 1$

divided among $m-1$ *other* players

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contribution multiplied by $r > 1$

divided among $m-1$ *other* players

m_C players contribute, m_D don't $(m = m_C + m_D)$

exploiters earn $rc\dfrac{m_C}{m-1}$

contributors $rc\dfrac{m_C - 1}{m-1} - c$

if all contribute, payoff $(r-1)c$

Social Dilemma

Social learning

Players switch preferentially to strategies with higher payoff

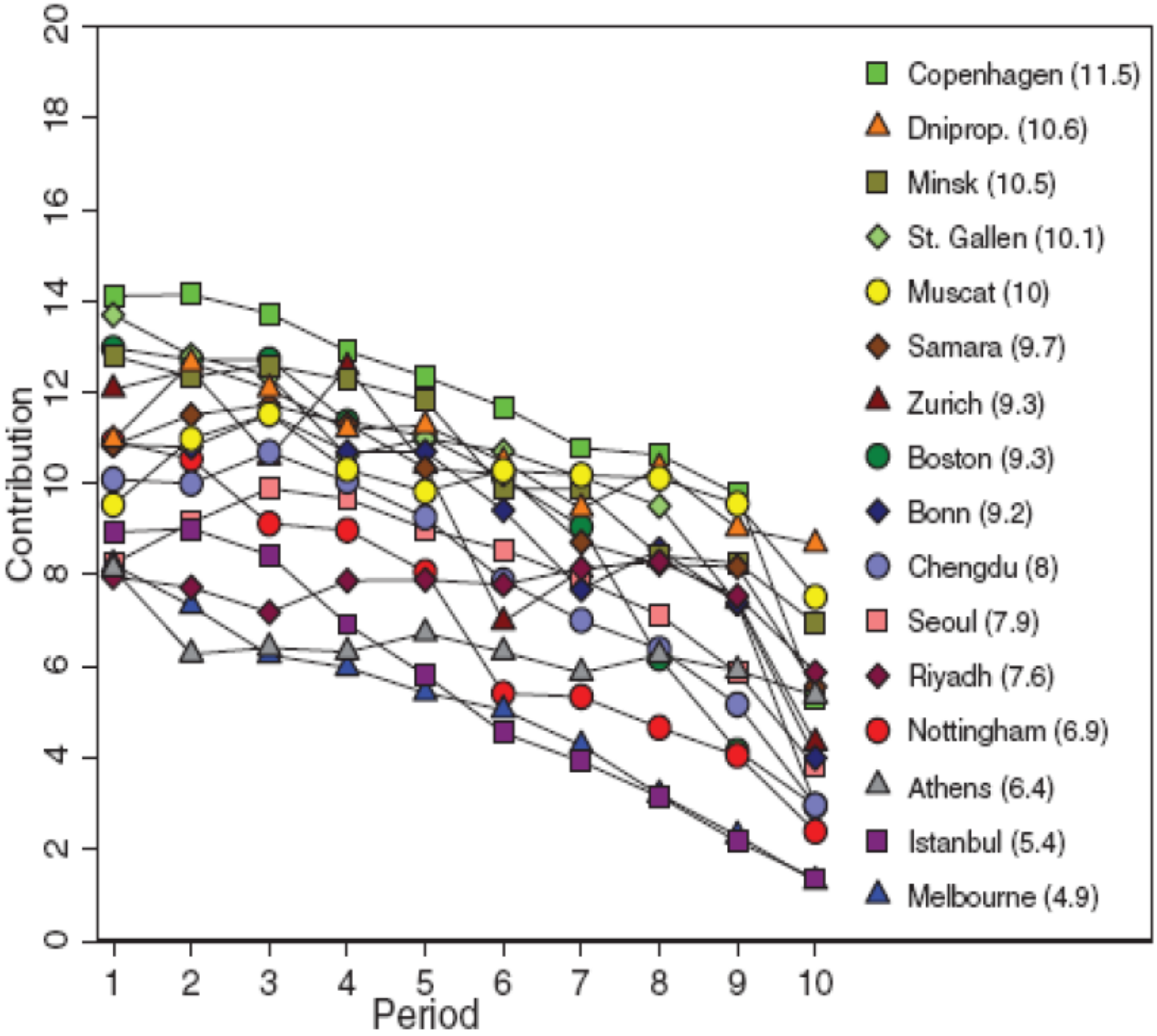
Replicator dynamics for population state

+ Occasional exploration (small random perturbation of state)

No assumption of rationality

Evolutionary game theory

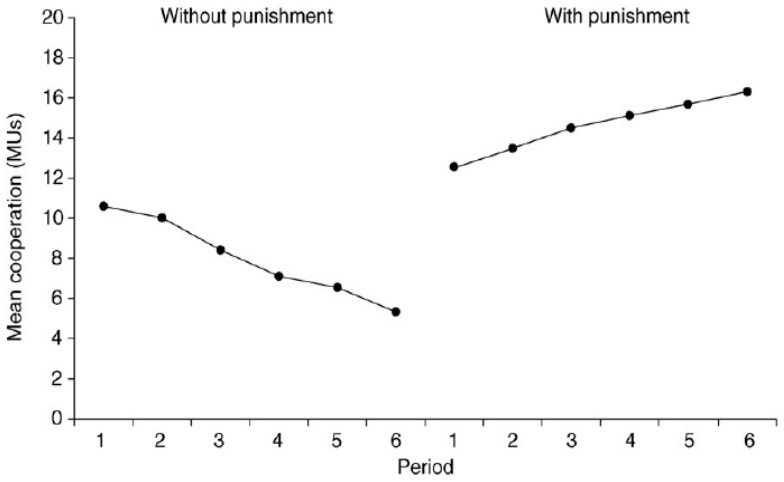
Example from Herrmann, Thöni & Gächter,



Peer Punishment

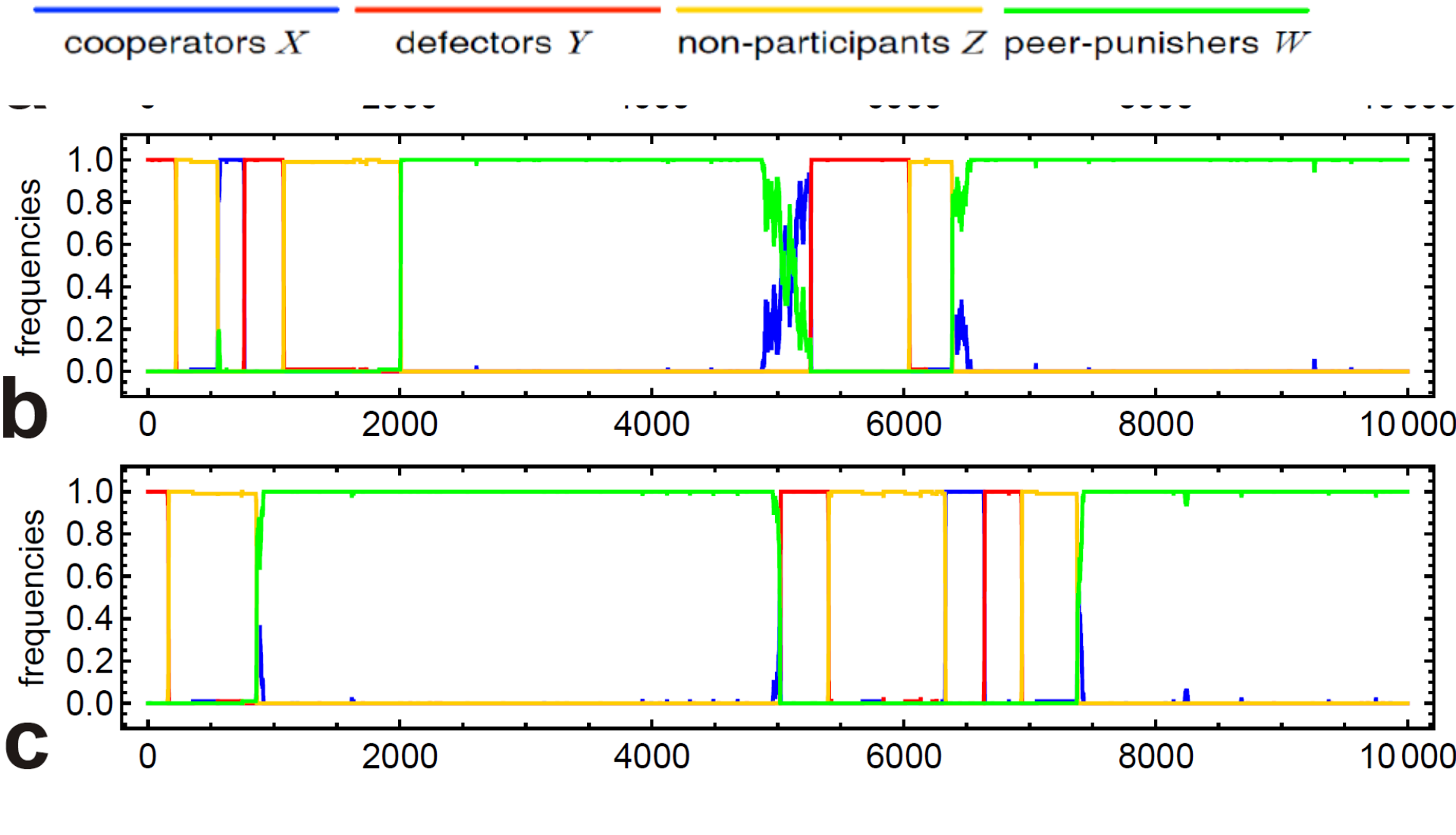
- After the Public Good game, players can punish each other: imposing a fine

  at a cost to the punisher



Fehr and Gächter 2000,…

Peer punishment (with Brandt, Traulsen, Hauert, Nowak, Science)



Institutions?

‚Institutions are tools that offer incentives to enable humans to overcome social dilemmas‘

Elinor Ostrom

Understanding Institutional Diversity, Princeton UP (2005)

Institutional punishment

- Contracts
- Small-scale societies (Ostrom,…)
- Guilds, settlers…
- Janitors, custodians, wardens…

Pool punishment

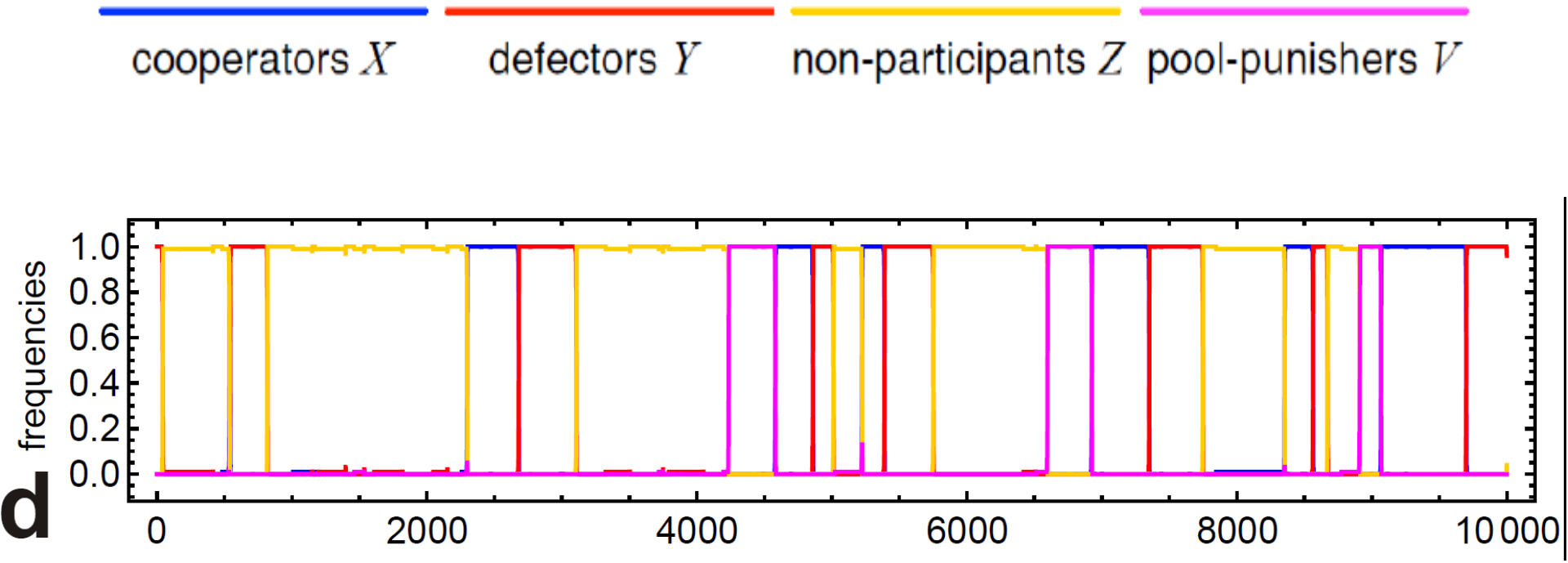
Yamagishi (1986):

Players contribute G to punishment funds

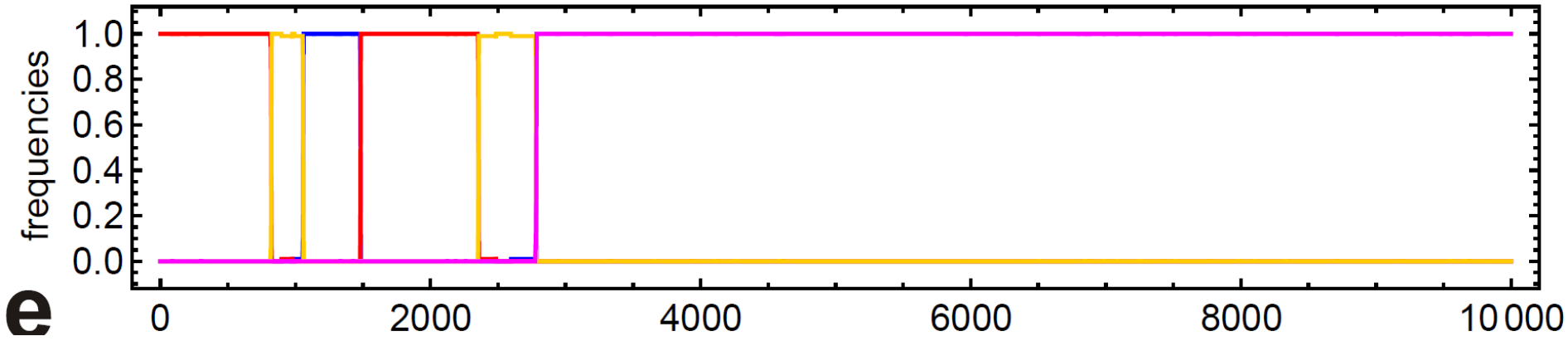
before the Public Good game

Defectors pay fine B

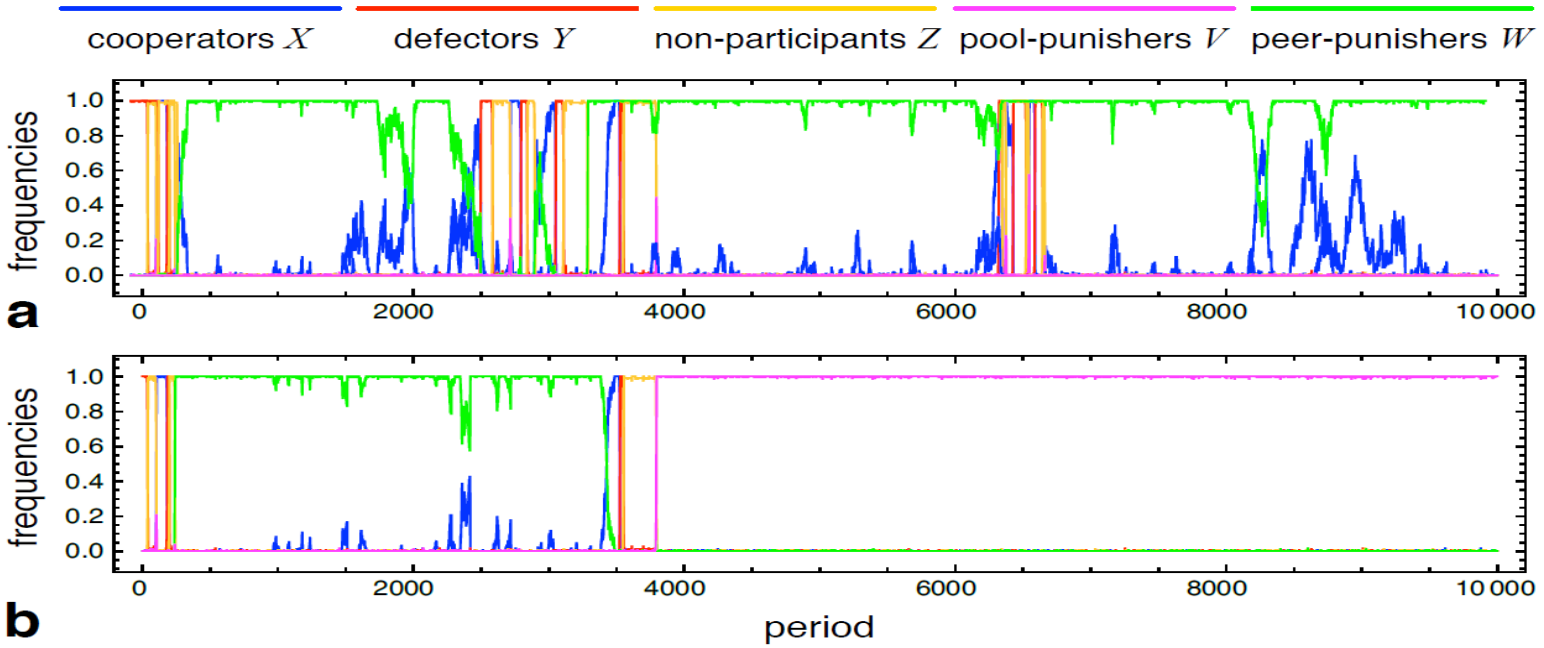
Pool Punishment without second order punishment



Pool punishment with second order punishment



Peer against pool without or with second order punishment



Efficiency traded for stability

Experiment: Peer vs Pool punishment

Boyu Zhang, Cong Li, Hannelore De Silva, Peter Bednarik

(Experimental Economics 2014)

238 students

Randomly assigned to 18 groups of 12-14 players (toy communities)

Play 50 rounds

Groups isolated from each other

Within each group, students can choose each round between alternative games

Optional Public Good Game

- PG game:
- Players receive 3 €

- Can play PG game: invest 1 €, which is multiplied by 3 and divided among all other participants

- Can abstain from game: extra 0.5 €

Players can choose

(a) PG without punishment

(b) PG with peer punishment

(c) PG with pool punishment

(d) no PG game

Players are informed between rounds: how many did what, and what was their payoff

Peer Punishment

- Players see number of defectors
- Can decide: Punish defectors?

  It costs a punisher 0.5 €

  to substract 1 € from a defector

Pool Punishment

Alternatives:

- Contribute nothing
- Contribute 1 € to Public Good Game
- Contribute 1 € to Public Good Game AND 0.5 € to Punishment Pool

(for each 0.5 to Punishment Pool, each defector is fined 1 €)

First and second order version

25 practice rounds

- 5 rounds (a) PG without punishment
- 5 rounds (b) PG with peer punishment
- 5 rounds (c) PG with pool punishment
- 10 rounds full game: choice between (a),(b),(c) and (d) (no participation)

50 rounds experiment

9 groups of 12-14 play first-order version

9 groups of 12-14 play second-order version

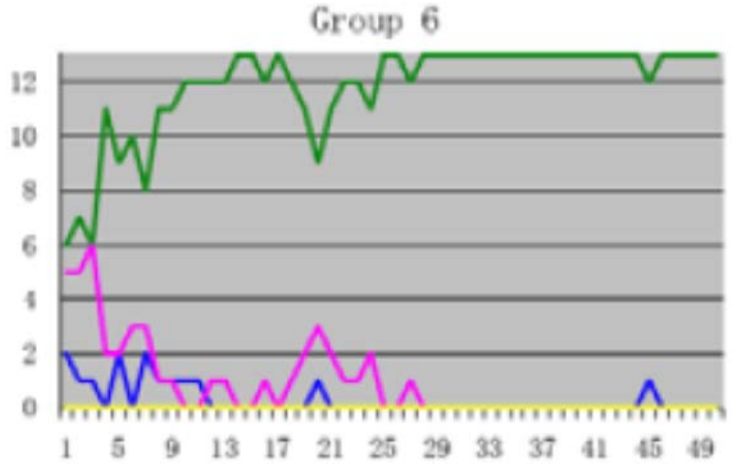
6 end up with peer regime: 3 from each version

6 end up with pool regime: all second-order

Toy histories

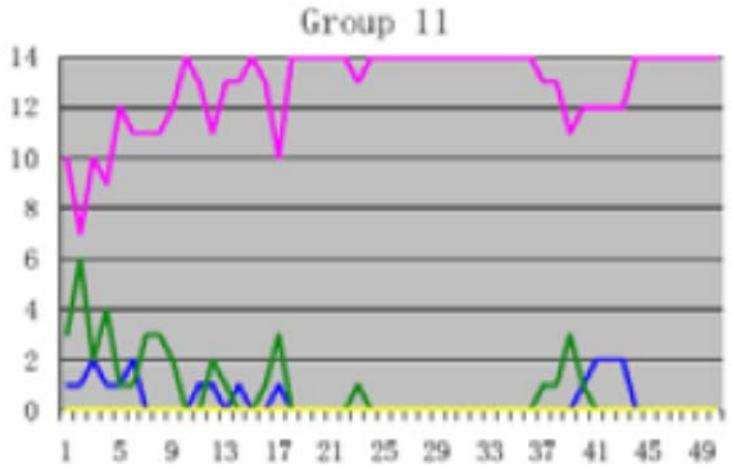
First order pool punishment:

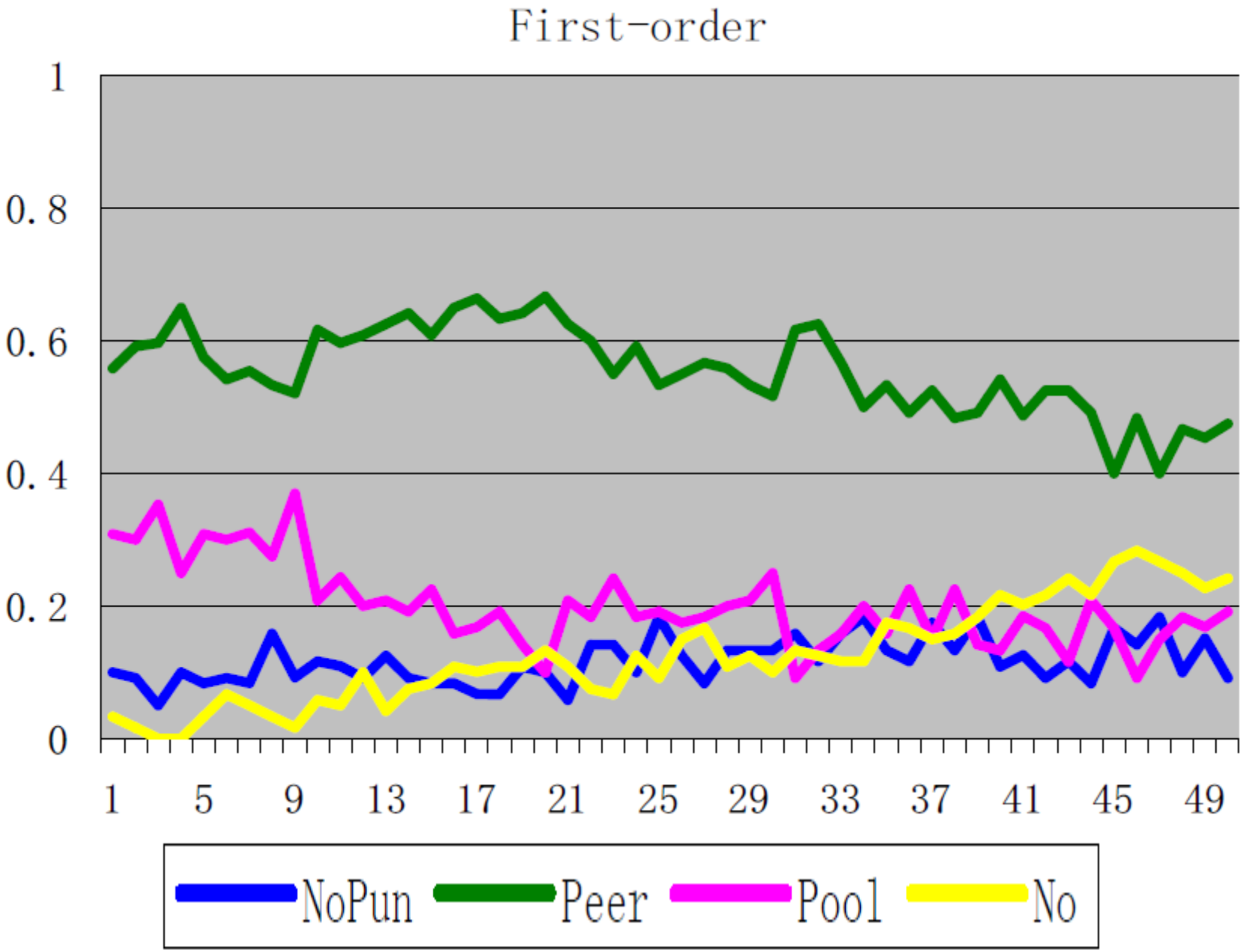
3 out of 9 end with peer punishment, none with pool



Second order pool punishment:

6 out of 9 end with pool punishment, 3 with peer




First-order
1
0.8
0.6
0.4
0.2
0
1
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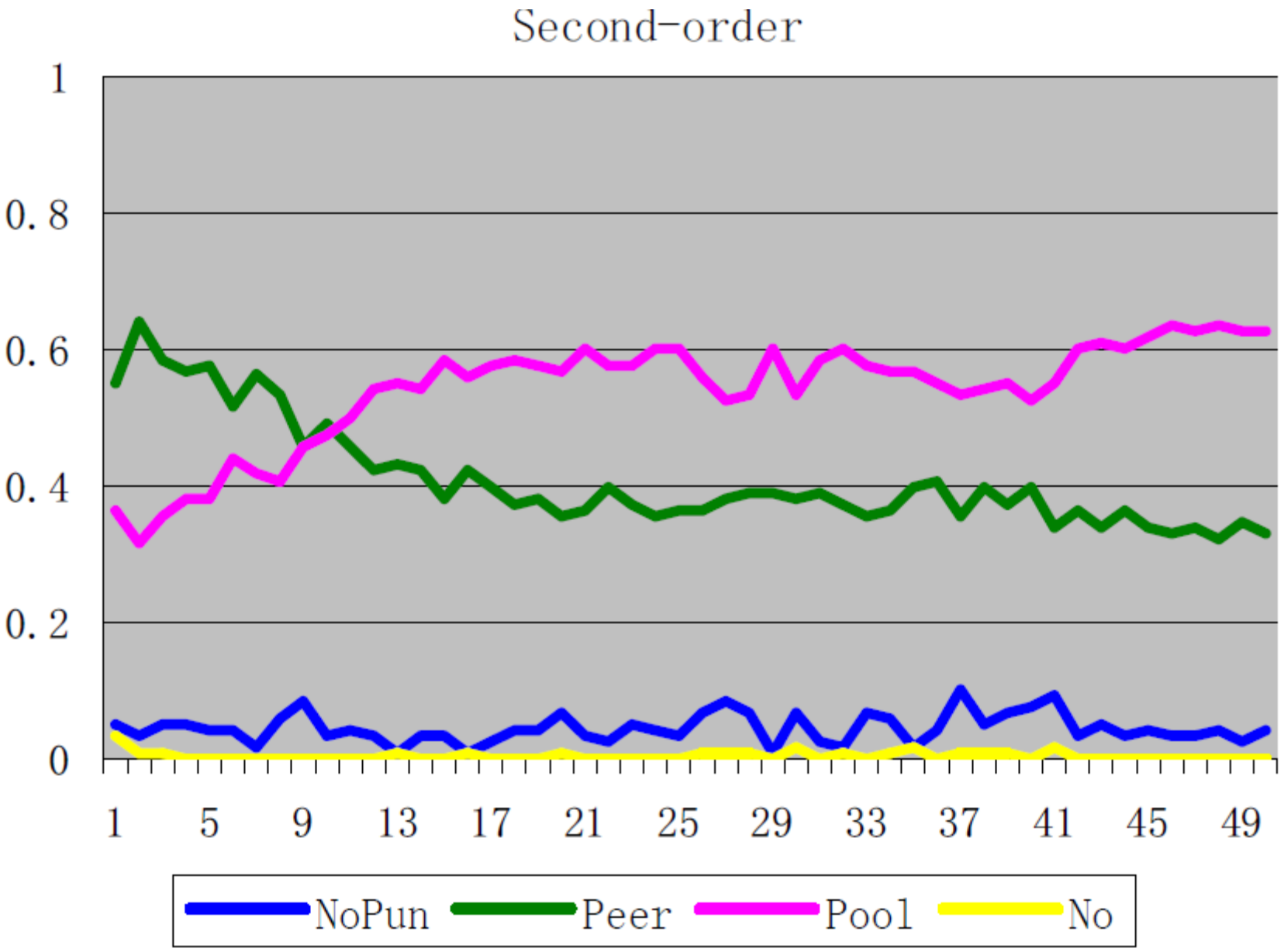
25
29
33
37
41
45
49
NoPun
Peer
Pool
No


Second-order
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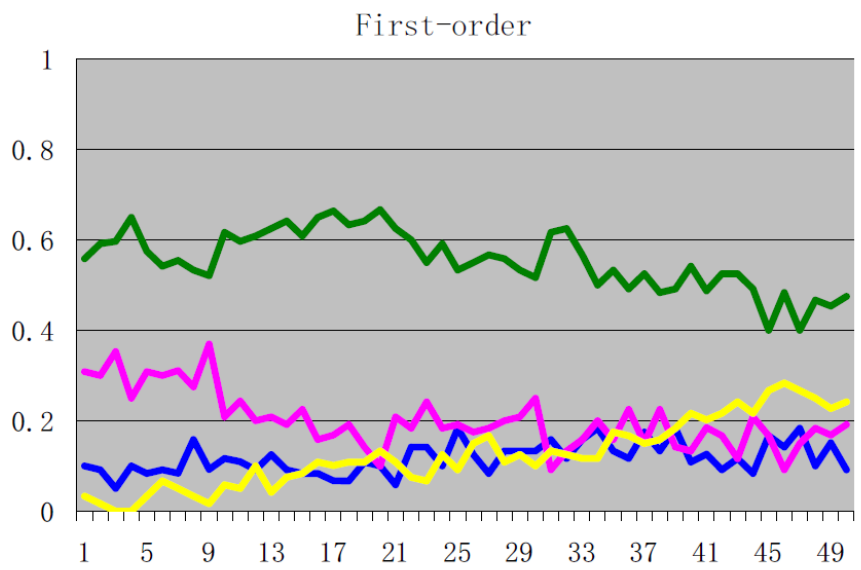
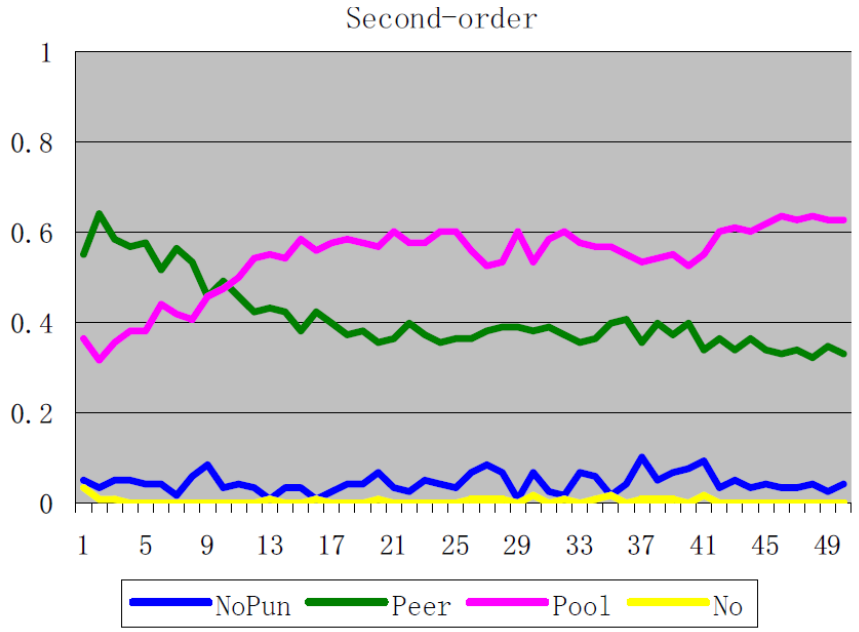
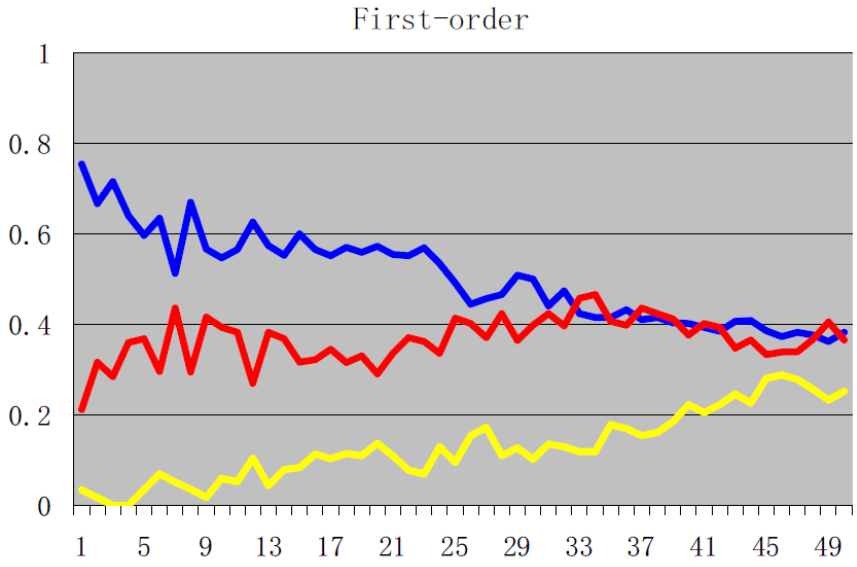
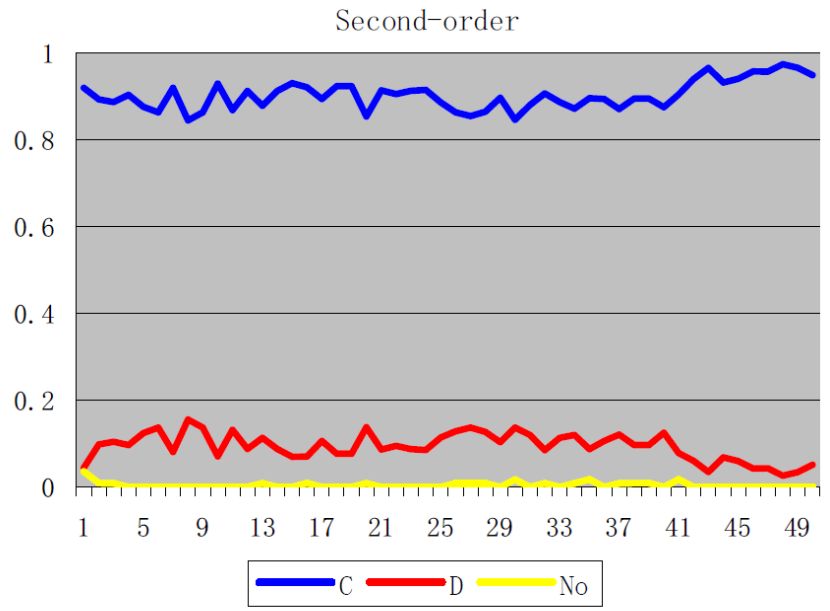
Time evolution





Cooperation





Corruption of Institutions

Jung-Hun Lee, Ulf Dieckmann, Yoh Iwasa

(JTB 2015)

Donation Game

C (cooperate) provide help b to co-player at own cost c ($b > c$)

D (defect) don't

	C	D
C	$b-c$	$-c$
D	b	0

Donation Game with Commitment

players can commit to enforceable contract

(cost s, penalty $-A$; $A > b, c < s$)

	C	D
C	$b-c-s$	$-c-s$
D	$b-A-s$	$-A-s$

C dominates

Optional Commitment

Comitting Cooperator (willing to enter a contract)

Comitting Defector (willing to enter a contract)

Non - committing Cooperator

Non - committing Defector

$$\begin{array}{cccc} b-c-s & -c-s & b-c & -c \\ b-s-A & -s-A & b & 0 \\ b-c & -c & b-c & -c \\ b & 0 & b & 0 \end{array}$$

New strategy : Conditional Cooperator

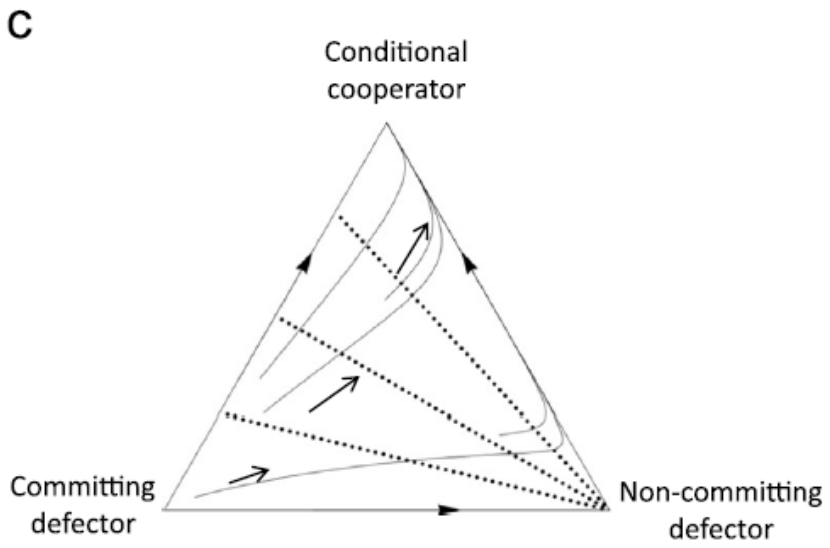
(willing to enter contract; if so, cooperates;

if other does not enter contract, defects)

- Comitting and noncommitting cooperators

  dominated (not shown)

Conditional Cooperator wins



What if law can be bribed?

Anti-corruption campaigns

What if law can be bribed?

A committing defector can pay bribe B
(smaller than penalty A)

In examples, A>b>c>s>B and b>c+s)

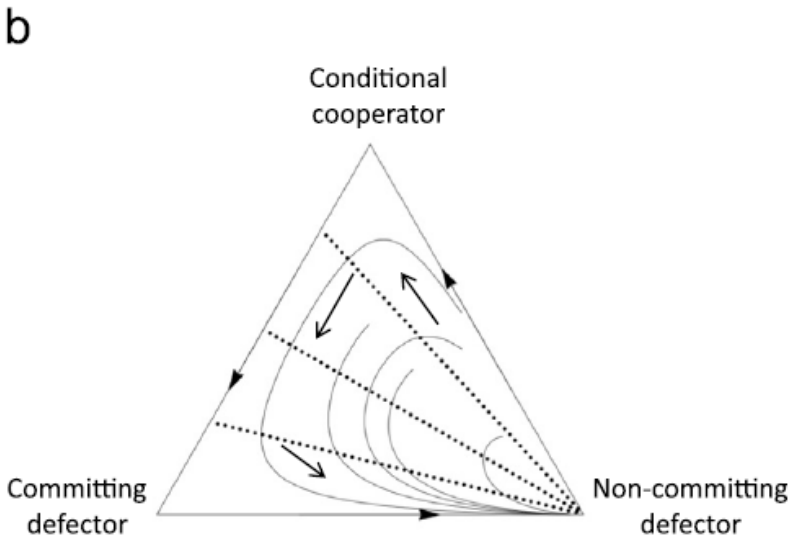
With corrupt law-enforcers

- Comitting and noncommitting cooperator

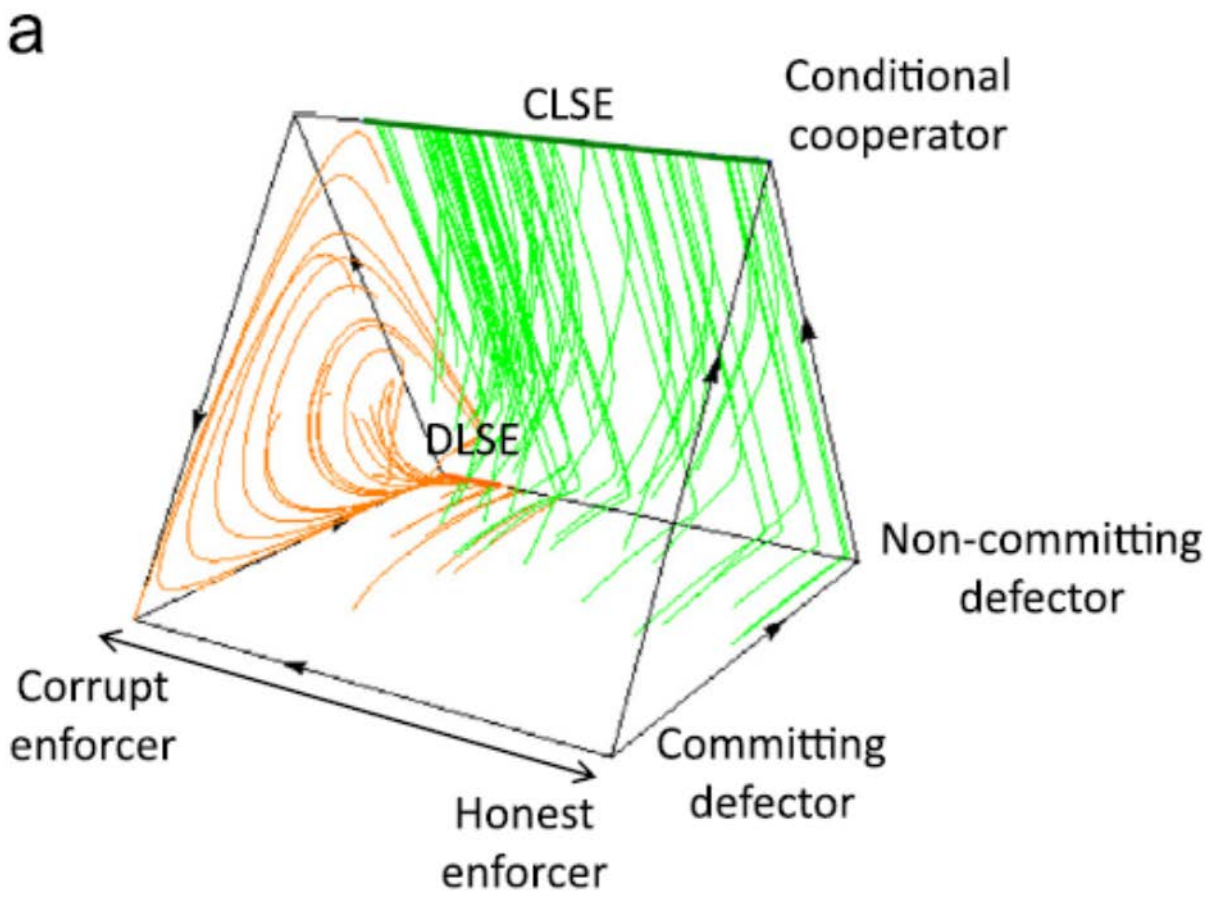
  dominated (not shown)

Rock-Paper-Scissors

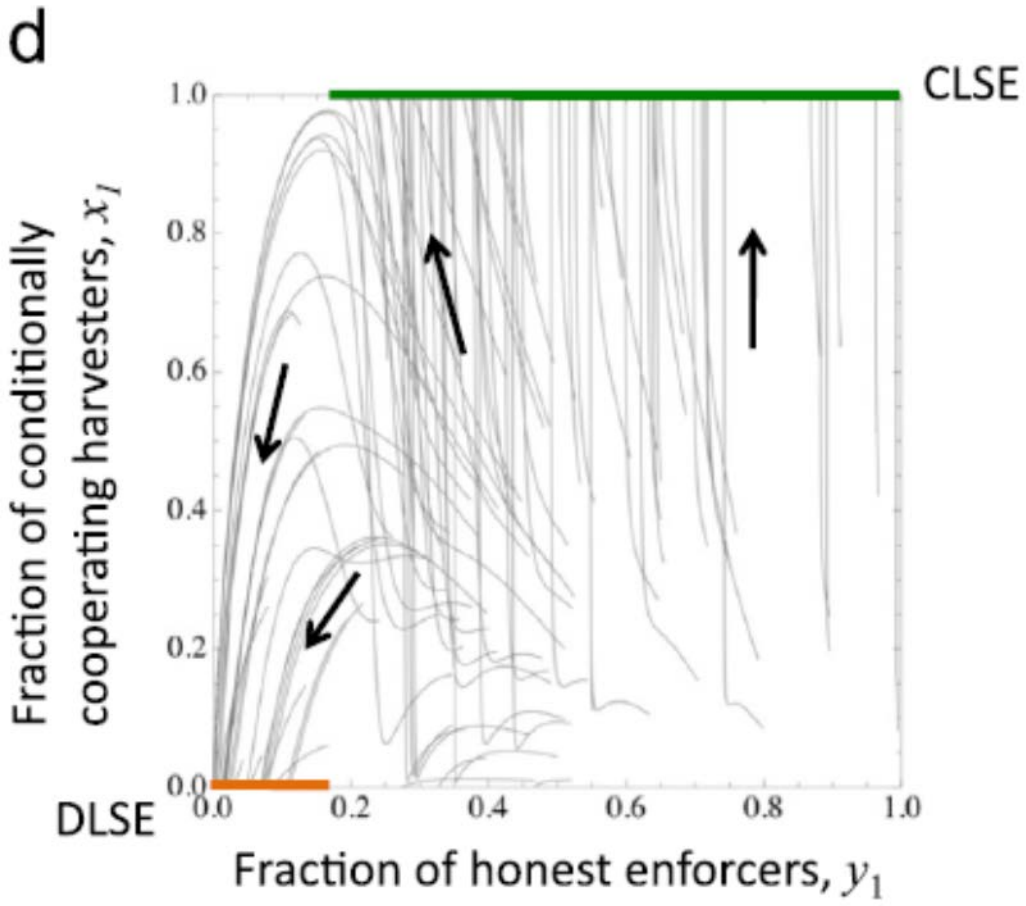
Bursts of cooperation



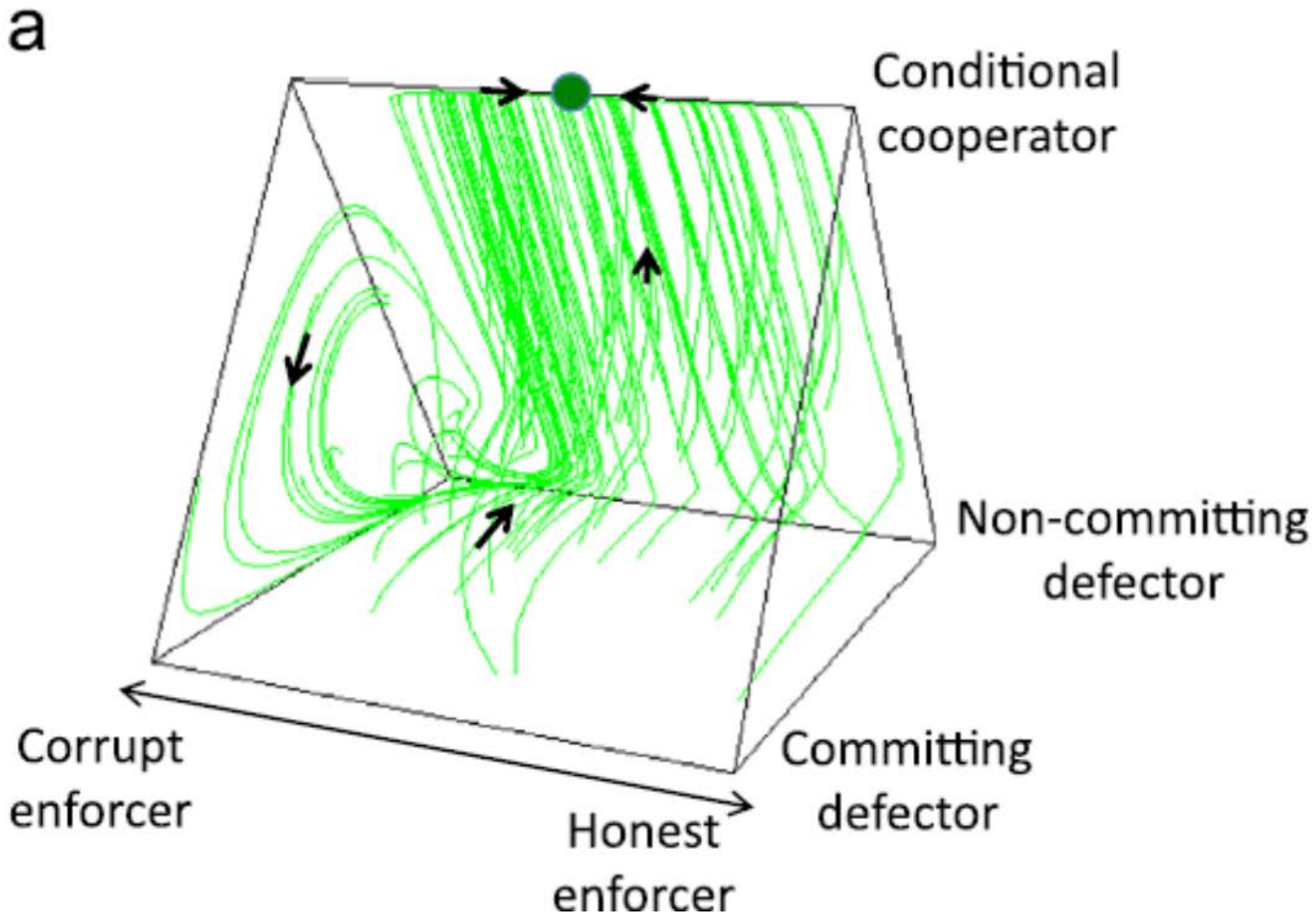
When law-enforcers can learn



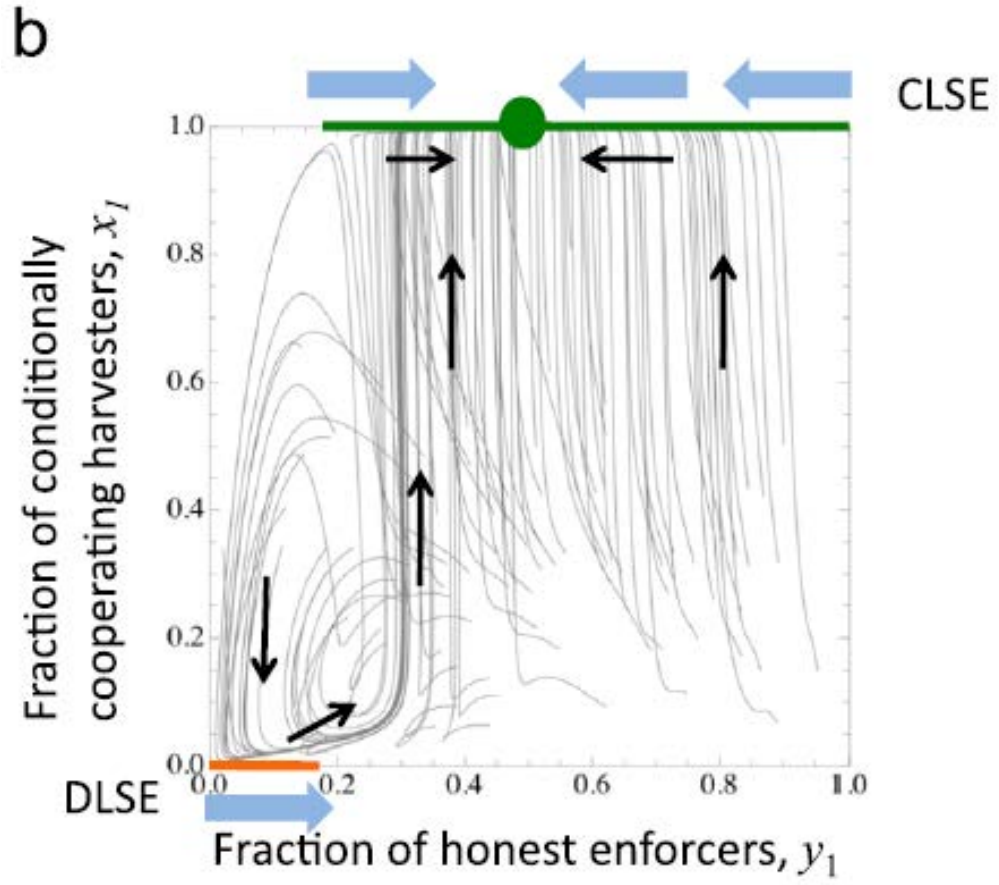
Bistability



When players can also explore (not just copy)



Global stability (outcome depends on exploration rates)



With reputation effects