The Public Goods Game (PGG)

- Goods can be of 4 types:

	Excludable	*Non-excludable*
Rival	Private good (clothing, food)	Common property (Pool) Resource (fishing stocks, potential buyers)
Non-rival	Club good (streaming music, online movies)	Public good (global climate, rules of calculus)

- 'Public goods' are non-excludable and non-rival.
  - *Non-excludable*: hard to stop people from accessing it.
  - *Non-rival*: one person's use doesn't reduce availability for others.
- Classic example: a lighthouse.
- Also: clean air, knowledge, global climate, etc.

Public Goods & Coordination Failures

- Non-excludability means it is very hard to make profits by producing a public good.
- As a result, no one has an incentive to provide them.
- *Underprovision* without institutional intervention.
- *Coordination failure* due to (positive) *externality.*

The Public Goods Game (PGG)

- n players
- each starts with endowment z
- player *i*'s contribution to common pot: e^i
- player *i* keeps for herself : $\mathrm{z} - e^i$
- public good returns = sum of contributions $(\sum_i e^j)$ * rate of return (M)
- 0 < M < 1.
- *Own payoff = Endowment − Contribution + Public good returns*
- $u^i = z - e^i + M\ (\sum_i e^j)$

Your turn:

- Write the payoff matrix of the public good game with:
  - 2 players (n=2)
  - Initial endowment z=10
  - Rate of return M=0.8
  - 2 possible choices: $e^i = 10$ or $e^i = 0$.
- Then find the Nash equilibrium

		Player 2	
		$e^2 = 10$	$e^2 = 0$
Player 1	$e^1 = 10$	?, ?	?, ?
	$e^1 = 0$	?, ?	?, ?

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		$e^2 = 10$	$e^2 = 0$
Player 1	$e^1 = 10$	16, 16	8, 18
	$e^1 = 0$	18, 8	10, 10

Player 2

Player 1	$e^2 = 10$	$e^2 = 0$
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Under self-interest, the (inefficient) Nash Equilibrium is both contributing 0.

A Prisoners' Dilemma.

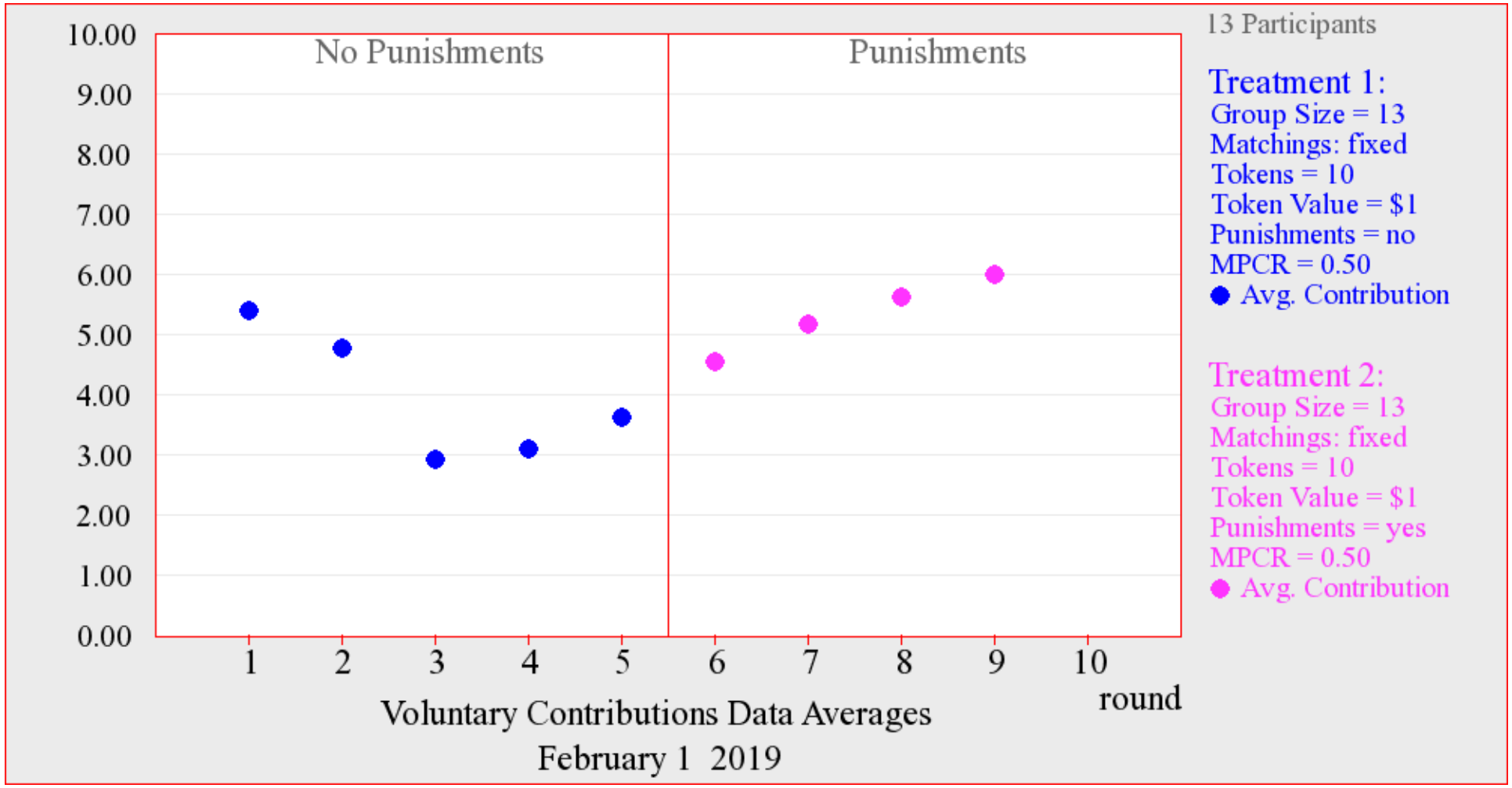
Public Goods Game (PGG)

- Self-interest Nash Equilibrium predicts zero contributions;
  - For each $ you contribute, you get $M < 1 back;
- Lab experiments with the PGG:
  - One-shot-game: contributions around ½
  - Repeated game: contributions start high, then decline towards zero;
- How to explain the decline in contributions?
  - Self-interest + learning?
  - Reciprocity?

The Public Goods Game with punishment

- A Public Goods Game, BUT after each round
  - contributions are made public;
  - each player can punish some other (reduce their payoff).
  - but need to pay a cost to ‘punish’.
- Empirical results from PGG w/ punishment:
  - non-cooperators get punished.
  - contributions remain high throughout all rounds.
  - proof of *reciprocity* .
  - reciprocators can keep cooperating with each other while punishing the non-cooperators.

Students from a previous class playing the public good game in a seminar:



You playing the game in the seminar today in groups of 4
(The graph shows average contributions across all groups in each round)