



# Teacher guide to public goods games

Laboratory implementation, theoretical foundations,  
experimental evidence, and variants

Behavioral and Experimental Economics Research Lab  
Department of Economics



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<https://beer-lab.org/>

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# How to use this guide

This guide supports the preparation, delivery, and classroom discussion of the family of public goods games developed for the Behavioral and Experimental Economics Research Lab (BEER Lab), Department of Economics, Tecnológico de Monterrey. It is written for instructors with different levels of familiarity with experimental economics, game theory, and public economics.

The **quick guide** is sufficient to launch a session. The operational chapters explain each screen.

The conceptual chapters present predictions and evidence for interpreting the results. Common rules appear once; each variant then identifies only what changes relative to the baseline game.

## Author

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### For the instructor

This guide matches the English interface. A separate Spanish version is available. Project aggregate results only; do not connect codes to names, student numbers, seats, or individual decisions.

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# Quick implementation guide

## 1.1 Access through the updated laboratory website

Start at <https://beer-lab.org/en/>. Select **CLASSROOM** in the top navigation menu; it opens <https://teaching.beer-lab.org/en/>. In the **Classroom experiments** catalog, use the search box to locate the activity by name. You can also filter by **Topic** or **JEL code**. Clear any filters left from an earlier search before looking for another game.

Each family's card distinguishes **Español** and **English** access links. The **Show extended version** checkbox selects that edition before following a link. Catalog language and session language are separate choices: verify both. Students use the room specified by the instructor; the instructor prepares and monitors the session through this family's own administrative pages.



Figure 1.1: Current institutional website. Select CLASSROOM in the top navigation menu to open the teaching experiments. Captured on October 7, 2026.



Figure 1.2: Current catalog: search by title, topic, or JEL code. Then locate this family's card and select language and edition. Captured on October 7, 2026.

## Checking resources, comprehension, and participant requirements

Before opening the room, check the selected configuration and the number of students present. The session-creation form states the group size and minimum required by that configuration. An individual activity accepts any positive participant count; an interactive activity must satisfy its stated requirement: complete groups when size is fixed, or a minimum participant count when size is flexible. Requirements may change across treatments, for example when adding a third party or changing an institution's size. If you edit a grouping parameter, check the requirement for the edited configuration, rather than relying only on the demo's suggested count.

In the instructions, ensure that students can identify what each role receives, what they can decide, and how the outcome is calculated. An initial account, a distributable budget, and final earnings need not be the same amount. Refer to the resources panel and the example for the selected treatment. Do not carry the basic edition's endowment into a treatment that changes accounts or introduces additional positions.

ECU stands for *Experimental Currency Units*: the activity's unit of account. An outcome of 100 ECU does not automatically equal 100 pesos or 100 dollars. Conversion depends on the session configuration. Before announcing a payment, confirm with the laboratory whether money is paid, the conversion rate, and which decisions count for payment. In hypothetical modules, describe amounts as outcomes in the stated situation.

When a comprehension check is included, an incorrect response receives an explanation beside that question, identifying the submitted answer and the correct answer. Other answers remain in the form. Ask the student to return to the example, locate the relevant rule, and redo the calculation before correcting the response. Avoid revealing answers to the entire class for an individual error, and do not interpret a comprehension mistake as an economic choice in the game.

|                                                               |                                                                                                                                         |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| cos extendido — versión básica, una ronda                     | <b>Juego de bienes públicos / Public Goods Game — BEER Lab</b><br>Seleccione una variante de este juego. Select a version of this game. |
| cos extendido — versión básica, 10 rondas, grupo fijo         |                                                                                                                                         |
| cos extendido — versión básica, 10 rondas, grupos reasignados |                                                                                                                                         |
| cos extendido — comunicación estructurada                     |                                                                                                                                         |
| cos extendido — retorno individual alto                       |                                                                                                                                         |
| cos extendido — retorno individual bajo                       |                                                                                                                                         |
| cos extendido — umbral de provisión con devolución            |                                                                                                                                         |
| cos extendido — castigo costoso, 10 rondas                    |                                                                                                                                         |
| cos extendido — recompensa costosa, 10 rondas                 |                                                                                                                                         |
| cos extendido — liderazgo mediante el ejemplo                 |                                                                                                                                         |
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| Public Goods Game — low individual return                     |                                                                                                                                         |
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| Public Goods Game — costly punishment, 10 rounds              |                                                                                                                                         |
| Public Goods Game — costly reward, 10 rounds                  |                                                                                                                                         |
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| Public Goods Game — social information, 10 rounds             |                                                                                                                                         |
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Figure 1.3: Demo contains only the configurations of this game family, in both languages and editions. Continuation 1/2.

|    |                                                           |
|----|-----------------------------------------------------------|
|    | cos extendido — información social, 10 rondas             |
|    | cos extendido — marco de extracción                       |
| BE | cos extendido — contribuciones condicionales              |
|    | ublic Goods Game — baseline, one round                    |
|    | ublic Goods Game — baseline, 10 rounds, fixed group       |
|    | ublic Goods Game — baseline, 10 rounds, reassigned groups |
|    | ublic Goods Game — structured communication               |
|    | ublic Goods Game — high individual return                 |
|    | ublic Goods Game — low individual return                  |
|    | ublic Goods Game — provision threshold with refund        |
|    | ublic Goods Game — costly punishment, 10 rounds           |
|    | ublic Goods Game — costly reward, 10 rounds               |
|    | ublic Goods Game — leading by example                     |
|    | ublic Goods Game — social information, 10 rounds          |
|    | ublic Goods Game — take frame                             |
|    | ublic Goods Game — conditional contributions              |
|    | enes públicos — una ronda                                 |
|    | enes públicos — 10 rondas, grupo fijo                     |
|    | enes públicos — 10 rondas, grupos reasignados             |
|    | ls Game — one round                                       |
|    | ls Game — 10 rounds, fixed group                          |
|    | ls Game — 10 rounds, reassigned groups                    |

Figure 1.4: Demo contains only the configurations of this game family, in both languages and editions. Continuation 2/2.

## Rooms

### Current rooms:

|                                         |
|-----------------------------------------|
| [ES] Juego de bienes públicos           |
| [EN] Public Goods Game                  |
| [ES] Juego de bienes públicos extendido |
| [EN] Extended Public Goods Game         |

Figure 1.5: Rooms contains the four rooms for this family: basic and extended editions in Spanish and English.

## Room: [EN] Public Goods Game

### Create a new session

Session Config

[EN] Public Goods Game — one round

Number of participants

Complete groups of 4 participants. Use a multiple of 4; minimum 4.

Create

[Configure session](#) 

### App sequence

**public\_goods\_game (10 rounds)**

Juego de bienes públicos bilingüe / Bilingual Public Goods Game.

Figure 1.6: Session-creation form for the basic English room. Check the selected configuration and participant requirement before creating the session.

## Downloading a session with several rounds

### For the instructor

Open **Data** within the relevant session and use that session's CSV or CSV-for-Excel download link. The general export has one row per participant and columns for the different rounds. Ten rounds do not necessarily mean ten rows per person. When the family provides its own long-format export, observations may instead be organized by participant and round or another unit defined by the design.

Save the original file together with the configuration name, session code, and active-round count. Check that columns for the last active round are present and that the data belong to the selected session. Empty cells can represent inactive rounds, a pending decision, or a field that does not apply to a role; do not automatically recode them as zeros. To compare learning, preserve round and group identifiers alongside participant identifiers. Share only anonymous aggregates in class, and record session incidents before constructing derived tables.

## 1.2 Basic facts

|                             |                                                                                                                                                     |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Purpose</b>              | Study the conflict between private monetary incentives and collective efficiency, together with cooperation, reciprocity, and institutional design. |
| <b>Participants</b>         | A multiple of four; each anonymous group has four members.                                                                                          |
| <b>Endowment and return</b> | Each person receives 100 ECU. Every contributed ECU returns 0.5 ECU to each member; the group multiplier is 2.                                      |
| <b>Payoff</b>               | $\pi_i = 100 - c_i + 0.5 \sum_{j=1}^4 c_j$ .                                                                                                        |

|                          |                                                                                                                                                                                                                                                                                  |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Duration</b>          | 20–30 minutes for one round; 40–60 for ten rounds or an extension.                                                                                                                                                                                                               |
| <b>Students</b>          | <a href="https://publicgoods.beer-lab.org/room/public_goods_en">publicgoods.beer-lab.org/room/public_goods_en</a> .                                                                                                                                                              |
| <b>Instructor</b>        | <a href="https://publicgoods.beer-lab.org/demo">publicgoods.beer-lab.org/demo</a> .                                                                                                                                                                                              |
| <b>Report</b>            | Mean, median, contribution rate, zero and full contributions, histogram, payoffs, and round trend.                                                                                                                                                                               |
| <b>Experimental unit</b> | Interactions in groups of 4 participants.                                                                                                                                                                                                                                        |
| <b>Basic edition</b>     | one round; 10 rounds, fixed group; 10 rounds, reassigned groups.                                                                                                                                                                                                                 |
| <b>Extended edition</b>  | baseline, one round; structured communication; high individual return; low individual return; provision threshold with refund; costly punishment, 10 rounds; costly reward, 10 rounds; leading by example; social information, 10 rounds; take frame; conditional contributions. |
| <b>Decision</b>          | Choose how many ECU from the endowment to contribute to the common fund.                                                                                                                                                                                                         |
| <b>Topics</b>            | public goods; cooperation; free-riding; punishment; repeated games.                                                                                                                                                                                                              |
| <b>JEL</b>               | C92; D64; D91; H41.                                                                                                                                                                                                                                                              |

---

### 1.3 Minimum sequence

1. Confirm that attendance is divisible by four and choose the treatment, number of rounds, and group matching rule.
2. Open [beer-lab.org](https://beer-lab.org), select **View games**, and continue to [teaching.beer-lab.org](https://teaching.beer-lab.org).
3. Select **Public Goods Game** and the session language.
4. From the instructor access, open **Rooms** and select the basic or extended room.
5. Choose the configuration, create the session, and open **Monitor** and **Report**.
6. Share the room or QR code. Reveal the report after the entire class completes the round.

### 1.4 Checklist

- ☐ Computers, internet, browser, and projector are ready.
- ☐ Attendance is divisible by four; treatment, rounds, and matching are confirmed.
- ☐ Credentials, link, or QR code have been tested on another computer.
- ☐ The pedagogical purpose or payment rule has been announced.
- ☐ Monitor, report, and debrief questions are available.
- ☐ The private prediction and social optimum are written down before revealing results.

# Accessing the platform

## 2.1 Route from the laboratory website

At [beer-lab.org](https://beer-lab.org), select **View games** under **Faculty and students**.

The catalog is located at [teaching.beer-lab.org](https://teaching.beer-lab.org). Select the Public Goods Game card and the session language.

## 2.2 Student and instructor routes

|                         | Students                    | Instructor                |
|-------------------------|-----------------------------|---------------------------|
| <b>Basic version</b>    | /room/public_goods_en       | /demo                     |
| <b>Extended version</b> | /room/public_goods_extended | /demo                     |
| <b>Purpose</b>          | Join the session            | Create and supervise      |
| <b>Identification</b>   | Anonymous code              | Administrator credentials |

### For the instructor

The room `/room/public_goods_extended` is a stable address. An individual `/p/...` link belongs to one session. After an update that changes the application, it may return **Not Found**. Create a new session in **Rooms** and share the room again; do not reuse the old individual link.

### What participants will see

Students do not need oTree, GitHub, or ORSEE accounts. They open the room, join the session, and receive an anonymous code.

## 2.3 Creating and monitoring a session

Under **Rooms**, open the room and select a configuration and participant count. Use the persistent room for class and **Demo** for rehearsals. At the address for this game, **Demo** lists only the 32 public goods game configurations, and **Rooms** shows only its four rooms (basic and extended in Spanish and English). If another game appears, do not start the session; contact the laboratory coordinator.

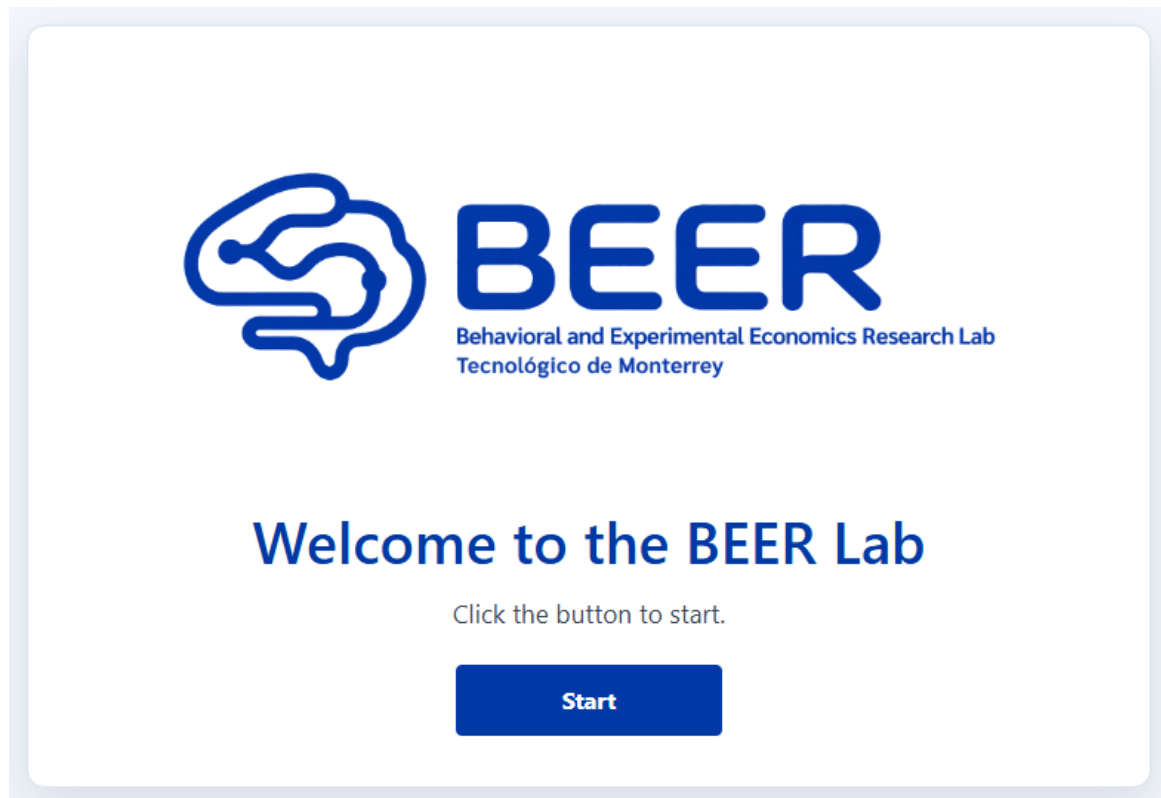


Figure 2.1: Student room.

### Admin Login

Username:

Password:

Log in

Figure 2.2: Administrative login (server with credentials configured).

## [EN] Public Goods Game — one round: session 'up1rv03z' (demo)

[New](#)
[Links](#)
[Monitor](#)
[Data](#)
[Payments](#)
[Report](#)
[Description](#)

Below are temporary links for testing and demonstration. To launch a real study, either create persistent links by setting up a [room](#), or create a session through the [sessions](#) page.

Choose one of the following options to play the session:

## Combined views

☐ Split-screen view

[Launch](#)

☐ Grid view

[Launch](#)

## Session-wide testing link

Open the below link in up to 4 browser tabs.

<http://127.0.0.1:8000/join/tahilaki>

## Single-use links

Open each link in its own browser tab.

|    |                                                                                                                         |
|----|-------------------------------------------------------------------------------------------------------------------------|
| P1 | <a href="http://127.0.0.1:8000/InitializeParticipant/r8d4375s">http://127.0.0.1:8000/InitializeParticipant/r8d4375s</a> |
| P2 | <a href="http://127.0.0.1:8000/InitializeParticipant/4x86217w">http://127.0.0.1:8000/InitializeParticipant/4x86217w</a> |
| P3 | <a href="http://127.0.0.1:8000/InitializeParticipant/l45ei5ql">http://127.0.0.1:8000/InitializeParticipant/l45ei5ql</a> |
| P4 | <a href="http://127.0.0.1:8000/InitializeParticipant/r3tgh8j1">http://127.0.0.1:8000/InitializeParticipant/r3tgh8j1</a> |

Figure 2.3: Links and access codes.

## [EN] Public Goods Game — one round: session 'up1rv03z' (demo)

[New](#)
[Links](#)
[Monitor](#)
[Data](#)
[Payments](#)
[Report](#)
[Description](#)

| ID | Code     | Label | Progress | App               | Round | PageName | Waiting | WaitsFor | Since |
|----|----------|-------|----------|-------------------|-------|----------|---------|----------|-------|
| P1 | 18d4375s |       | 20/200   | public_goods_game | 1     | Summary  |         |          | 11m   |
| P2 | 4x86217w |       | 19/200   | public_goods_game | 1     | Results  |         |          | 11m   |
| P3 | l45ei5ql |       | 19/200   | public_goods_game | 1     | Results  |         |          | 11m   |
| P4 | r3tgh8j1 |       | 19/200   | public_goods_game | 1     | Results  |         |          | 11m   |

4 started, 4 in progress (total: 4)

Figure 2.4: Monitor for tracking progress without projecting individual decisions.

# The baseline game and its screens

## 3.1 Rules, incentives, and efficiency

Each person simultaneously chooses an integer contribution  $c_i \in [0, 100]$ . Total contributions are doubled and divided equally among the four members. The marginal per capita return is therefore 0.5:

$$\pi_i = 100 - c_i + 0.5 \sum_{j=1}^4 c_j.$$

An additional ECU lowers the contributor's retained balance by 1 ECU and returns 0.5 ECU, a private effect of  $-0.5$ . It creates  $4(0.5) - 1 = 1$  net ECU for the group. With own monetary payoffs alone, contributing zero is a dominant strategy. Collective efficiency requires everyone to contribute 100 ECU.

### For the instructor

Ask for both predictions before play: what maximizes a person's payoff holding others' contributions fixed, and what maximizes the sum of payoffs? The tension between these answers structures the debrief.

## 3.2 Welcome, instructions, and comprehension

The comprehension check covers the multiplier, equal sharing, and payoff calculation before groups are formed.

## 3.3 Contribution, waiting, and result

The decision is simultaneous and private. After submitting, the screen waits for the other three group members. The round result shows the participant's own contribution, the group total, each member's return, and the individual payoff.

### What participants will see

"Please wait" means that the application is synchronizing the group. It is not an error. The participant should not close or refresh the page.



## Welcome to the BEER Lab

The **Behavioral and Experimental Economics Research Lab** of the Department of Economics at Tecnológico de Monterrey is a space designed to learn about economic decision-making through controlled activities.

During this session, you will make decisions individually. There are no “good” or “bad” answers: read carefully and respond according to your own judgment. Class results will be presented in aggregate form for discussion.

### Laboratory rules

- Remain silent and do not communicate with other participants.
- Do not look at other screens or decisions.
- Put away your phone and work individually and privately.
- Read each screen before continuing.
- Do not close, refresh, or leave the page.
- If you need help, raise your hand and a staff member will assist you privately.
- When you finish, remain seated and wait for the instructor.

**By continuing, you confirm that you have read and understood these instructions.**

☐ I have read and understood the laboratory rules.

**Continue to the game instructions**

Powered by [oTree](#)

Figure 3.1: Entry and instructions. BEER Lab welcome and rules.



## Decisions for the group

### Resources and unit of account

Each participant's initial endowment per round: 100 ECU.

ECU stands for Experimental Currency Units. It is the unit of account for this activity.

This session does not convert ECU into real money.

Public Goods Game · BEER Lab

### One round

One randomly assigned group

Your group has four people. Each person receives **100 ECU**. Simultaneously, each person decides how many ECU to keep in a private account and how many to contribute to the group account.

Your endowment

**100 ECU**

Group-account multiplier

**×2.0**

Individual return per contributed  
ECU

**0.5 ECU**

Your payoff =  $100 - \text{your contribution} + 0.5 \times \text{total group contributions}$

Example: if all four people contribute 20 ECU, the group account contains 80 ECU and is multiplied by 2. Each person receives 40 ECU from the account. A person who contributed 20 ends with  $100 - 20 + 40 = 120$  ECU.

**Economic tension:** each ECU you contribute reduces your private payoff by 0.5 ECU but increases the group's joint payoff by 1 ECU.

**Group formation:** One randomly assigned group. Identities are not shown and communication is not allowed.

**Continue**

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Figure 3.2: Current basic-edition instructions, with initial resources and experimental units.



Review the marked questions. Each shows your answer and an explanation; your other answers are retained.

## Comprehension check

### Resources and unit of account

ECU stands for Experimental Currency Units. It is the unit of account for this activity.  
This session does not convert ECU into real money.

Public Goods Game

### One round

One randomly assigned group

Answer correctly before continuing. If an answer is incorrect, the screen will explain the relevant rule.

In the example where all four people contribute 20 ECU, what is your payoff for the round?

Your answer: 121. The correct answer is 120. If all four people contribute 20 ECU, the group account contains 80, each person receives 40 from it, and your payoff is 120 ECU.

How many rounds does this session have?

- ☒ 1 round  
☐ 10 rounds

How are groups formed?

- ☒ The interaction occurs once in a randomly assigned group.  
☐ The same group remains together for all 10 rounds.  
☐ Groups are reassigned in every round.

Check answers

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Figure 3.4: Current comprehension check: specific feedback explains the incorrect answer and preserves the other responses. Continuation 2/2.

## Your place in the group

Public Goods Game

One round

One randomly assigned group

Anonymous identifier within the group

# Member A

All four people have the same endowment, the same options, and the same payoff formula.

Decide independently. No one will know your contribution before making their own decision.

**Go to the decision**

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Figure 3.5: Rounds and group matching.

## Round 1 of 1

Decide how much to contribute to the group account.

One round

One randomly assigned group

Your endowment for this round

# 100 ECU

How many ECU do you want to contribute to the group account?

0 ECU · keep everything

100 ECU · contribute everything

For each contributed ECU, every group member—including you—receives **0.5 ECU**.

**Confirm contribution**

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Figure 3.6: Decision and waiting. Contribution decision.

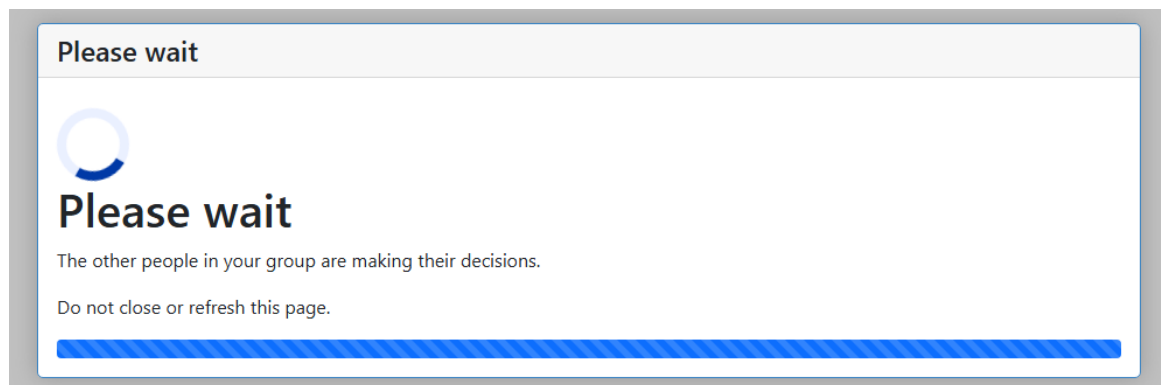


Figure 3.7: Group synchronization.

## Round result

Round 1 of 1

One round

One randomly assigned group

Your contribution

**20 ECU**

Total group contributions

**170 ECU**

Return to each group member

**85.0 ECU**

Your payoff

**165.0 ECU**

The group's average contribution was **42.5 ECU**. Your cumulative payoff is **165.0 ECU**.

[View final summary](#)

Powered by [oTree](#)

Figure 3.8: Individual results. Round result.

## Participation summary

The activity is complete.

**One round**

One randomly assigned group

Cumulative payoff

**165.0 ECU**

Your average contribution was 20 ECU.

### Session completed

You do not need to take any further action.

Remain on this screen while the instructor presents the class's aggregate results.

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Figure 3.9: Summary and explicit closure.

# Instructor report and debrief

## 4.1 When to reveal

The report remains hidden while decisions are pending. Once everyone finishes, the instructor presses the reveal button. This prevents early results from influencing participants who are still choosing.

### Public Goods Game · One round

Round 1 of 1 · One randomly assigned group · MPCR 0.5

Participants

4

Completed groups

0/1

Completed decisions

0/4

Pending

4

Decisions will remain hidden until everyone completes this round. This page refreshes automatically.

Reveal results

Figure 4.1: Controlling projection. Hidden report.

## 4.2 Reading the report

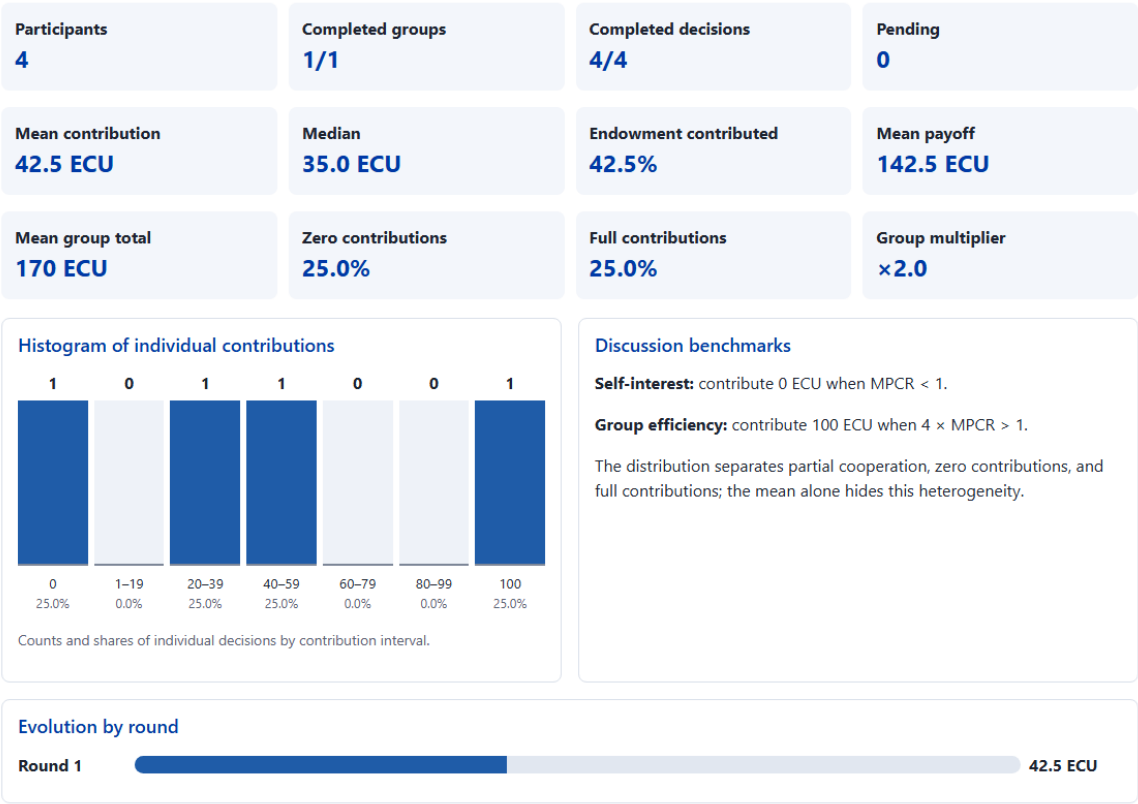
1. Begin with sample size and completed groups.
2. Compare mean and median. A large gap suggests skewness or outliers.
3. Read the contribution rate together with zero and full contribution rates.
4. Use the histogram to discuss heterogeneity, focal points, and possible participant types.
5. Across rounds, inspect the path before attributing a decline to learning or reciprocity.
6. Compare mean payoffs with the collective maximum; higher contributions create surplus even when gains are distributed unevenly.

### Feedback script

Ask what the class expected before revealing the distribution. Separate description, mechanism, and causal interpretation. A low mean does not prove selfishness, and a declining path does not by itself identify learning.

Public Goods Game · One round

Round 1 of 1 · One randomly assigned group · MPCR 0.5



Aggregate anonymous results. The histogram uses individual decisions; group totals use completed groups only.

Figure 4.2: Revealed aggregate report.

# Theory and evidence

## 5.1 Standard prediction and social dilemma

### Theoretical foundation

With own monetary payoff as the only utility argument and  $0 < \alpha < 1$ ,  $\partial \pi_i / \partial c_i = \alpha - 1 < 0$ . Zero is a dominant strategy. If  $n\alpha > 1$ , each contribution raises total surplus. Here  $\alpha = 0.5$ ,  $n = 4$ , and  $n\alpha = 2$ .

The voluntary contribution mechanism provides a clear private prediction and a clear efficiency benchmark. Foundational experiments document positive contributions that respond to parameters and institutions ([Marwell and Ames, 1979, 1980](#)). [Ledyard \(1995\)](#) surveys the broader evidence.

## 5.2 Social preferences and conditional cooperation

Positive contributions may reflect altruism, inequality aversion, reciprocity, norms, or a willingness to cooperate when others do so. [Fischbacher et al. \(2001\)](#) document conditional contribution schedules with the strategy method. Heterogeneity helps explain why cooperation may start above zero and decline when conditional cooperators observe less cooperation than expected.

## 5.3 Repetition and group composition

A fixed group supports reciprocity, learning about specific others, and group reputation. Reassigned groups weaken individual reputation while preserving general learning and classroom norms. Classic evidence finds declining cooperation in many repeated settings, while institutions and information substantially change its path ([Andreoni, 1995](#); [Isaac and Walker, 1988b](#)).

## 5.4 Regularities for discussion

- Initial contributions are often positive and heterogeneous; zero and one half are common focal choices.
- Average contributions often decline across repeated rounds without an additional institution.
- A higher private return generally supports contribution; group size and return should be distinguished.

- Communication can substantially raise cooperation even when messages are nonbinding ([Isaac and Walker, 1988a](#)).
- Punishment and reward can sustain cooperation, but they impose costs and affect distribution ([Fehr and Gächter, 2000](#); [Sefton et al., 2007](#)).

#### Attention

Classroom outcomes are descriptive. Without random treatment assignment, adequate samples, and a research protocol, differences between sessions are not causal estimates.

## 5.5 Baseline modes

## 5.6 One round

`public_goods_en_1_round` removes strategic history. It is well suited for introducing dominant strategy, efficiency, and social preferences. The debrief should distinguish a participant's choice from beliefs about others.

## 5.7 Ten rounds with a fixed group

`public_goods_en_10_fixed_group` keeps the same four members. It permits indirect reciprocity, group reputation, and learning. Avoid announcing class results between rounds if only private group history should operate.

## 5.8 Ten rounds with reassigned groups

`public_goods_en_10_random_groups` reassigns groups and minimizes repeated pairings when attendance permits. With small classes, some repetition is unavoidable. Use this mode to discuss how interaction structure changes reputational incentives.

# Extended variants

## 6.1 Treatment map

| Variant            | Parameter       | Teaching question                                                   |
|--------------------|-----------------|---------------------------------------------------------------------|
| Communication      | One round       | Can nonbinding promises or appeals coordinate expectations?         |
| High return        | MPCR 0.75       | How does contribution change when its private cost falls?           |
| Low return         | MPCR 0.30       | Does cooperation survive a low private return?                      |
| Threshold          | Target 240      | How do discontinuity and coordination risk matter?                  |
| Punishment         | 1:3, ten rounds | Does sanctioning sustain cooperation, and at what cost?             |
| Reward             | 1:3, ten rounds | Does a positive incentive substitute for or complement reciprocity? |
| Leadership         | Sequential      | Does the first contribution act as a signal or focal point?         |
| Social information | Ten rounds      | Does the class converge toward a descriptive norm?                  |
| Take frame         | Equivalent rule | Does behavior change when the choice is framed as taking?           |
| Conditional        | Complete plan   | How does a contribution respond to others' average?                 |

## 6.2 Structured communication

Before contributing, each participant selects a predefined message. The group observes the messages and then decides. Communication may coordinate beliefs, create psychological commitments, or make a norm salient ([Isaac and Walker, 1988a](#)).

# Message to the group

Extended Public Goods Game · BEER Lab

**Structured communication**

One round · One randomly assigned group

The message does not change payoffs or bind anyone.

Select the message you want to send to your group:

- ☐ I propose that we contribute little and keep most of the endowment.
- ☐ I propose that we contribute about half of the endowment.
- ☐ I propose that we contribute most or all of the endowment.

**Send message**

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Figure 6.1: Selecting messages before contributing.

## Feedback script

Compare message categories and contributions without treating the association as causal: the message is also a choice. Ask which message shifted expectations and which appeared credible.

## 6.3 High and low individual return

The MPCR is 0.75 or 0.30. Both remain below 1, so zero contribution remains the private monetary prediction. The group multiplier is 3 under high return and 1.2 under low return; full contribution remains collectively efficient.

## Feedback script

Compute the private cost of one contributed ECU: 0.25 under high return, 0.70 under low return, and 0.50 at baseline. Compare distributions as well as means.

## 6.4 Provision threshold with refund

The public good is provided if the group reaches 240 ECU. If successful, each person receives 80 ECU and keeps the unallocated endowment. If unsuccessful, contributions are refunded and everyone earns 100 ECU. The design introduces coordination, discontinuity, and incentives to let others cover the target.

## Feedback script

Show the share of groups that reached the target and compare the mean group total with the 240 ECU threshold. A refund removes the risk of losing the contribution when the target fails, but it does not remove coordination.

# Round 1 of 1

Extended Public Goods Game · BEER Lab

**Provision threshold**

One round · One randomly assigned group

Endowment

100 ECU

How many ECU do you want to contribute to the group account?

**Group provision target: 240 ECU.** If the target is reached, each member receives 80 ECU. If it is missed, all contributions are refunded and each person keeps their initial endowment.

**Confirm contribution**

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Figure 6.2: Contribution with a provision target and refund.

## Extended Public Goods Game · Provision threshold

Round 1 of 1 · One randomly assigned group · One round

**Participants**  
4

**Completed groups**  
1/1

**Final decisions**  
4/4

**Pending**  
0

**Mean contribution**  
60 ECU

**Median**  
60.0 ECU

**Endowment contributed**  
60.0%

**Mean payoff**  
120.0 ECU

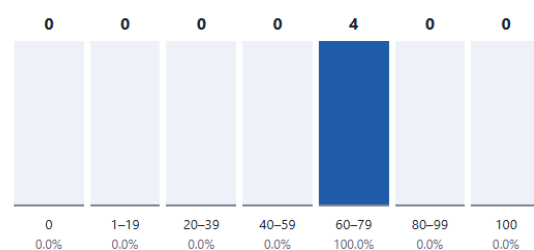
**Mean group total**  
240 ECU

**Zero contributions**  
0.0%

**Full contributions**  
0.0%

**Provision target**  
240 ECU

### Histogram of individual contributions



Counts and shares of individual decisions by contribution interval.

### Treatment indicators

Groups meeting the threshold: **100.0%**

If the target is missed, contributions are refunded. Compare the provision rate with the mean group total.

### Evolution by round

Round 1 60 ECU

Aggregate anonymous results. The histogram uses individual decisions; group totals use completed groups only.

Figure 6.3: Instructor report: target, provision rate, contribution distribution, and payoffs.

## 6.5 Costly punishment and reward

After observing all four contributions, each person allocates up to 20 points. A point costs 1 ECU to its sender. Under punishment it reduces the recipient's payoff by 3 ECU; under reward it adds 3 ECU. Groups remain fixed for ten rounds. Evidence shows that punishment can raise

### Group contributions

**Costly punishment**

10 rounds · fixed group · The same group for all 10 rounds

Extended Public Goods Game · BEER Lab

These identifiers are anonymous.

| Member   | Contribution |
|----------|--------------|
| Member A | 20 ECU       |
| Member B | 40 ECU       |
| Member C | 50 ECU       |
| Member D | 30 ECU       |

Continue to point allocation

 Powered by [oTree](#)

Figure 6.4: The punishment stage. Observed contributions.

### Assign punishment

**Costly punishment**

10 rounds · fixed group · The same group for all 10 rounds

Extended Public Goods Game · BEER Lab

You may allocate at most 20 points in total. Each point costs you 1 ECU and reduces the recipient's payoff by 3 ECU.

**Member B · 40 ECU**

**Member C · 50 ECU**

**Member D · 30 ECU**

Confirm points

 Powered by [oTree](#)

Figure 6.5: Point allocation.

cooperation, while consuming resources and sometimes inducing retaliation (Fehr and Gächter, 2000, 2002). Rewards and sanctions need not have symmetric effects (Sefton et al., 2007).

### Feedback script

Compare cooperation, point expenditure, and final payoffs. Greater cooperation does not automatically produce greater welfare when sustaining it is costly.

## 6.6 Leading by example

Member A contributes first. The other three observe this contribution before deciding. A leader may signal expectations, establish a focal point, or bear a disproportionate share of the cost (Potters et al., 2007).

### Your contribution as leader

Leading by example

One round · One randomly assigned group

Extended Public Goods Game · BEER Lab

You are Member A. The other members will observe your contribution before deciding.

How many ECU do you want to contribute to the group account?

Confirm contribution

Powered by [oTree](#)

Figure 6.6: Leadership sequence. Leader's decision.

### Decision after the leader

Leading by example

One round · One randomly assigned group

Extended Public Goods Game · BEER Lab

Member A contributed

**60 ECU**

The other three members now decide simultaneously.

How many ECU do you want to contribute to the group account?

Confirm contribution

Powered by [oTree](#)

Figure 6.7: Followers' response.

**Feedback script**

Compare leader and follower means and inspect responses to different first contributions. A positive relationship is descriptive because leader contributions were not randomly assigned.

## 6.7 Social information

From round 2 onward, participants see their group's and the class's previous average. This can update beliefs or activate social comparison. Related field evidence documents prosocial responses to comparative information (Chen et al., 2010); it is not an exact replication of this protocol.

**Feedback script**

Look for convergence toward the displayed mean, while remembering that the same pattern may reflect group history, learning, or reciprocity.

## 6.8 Take frame

Each participant chooses how much to withdraw from an account containing 100 ECU. For analysis, the equivalent contribution is  $100 - \text{withdrawal}$ . Material payoffs match the baseline, so differences motivate a discussion of framing, entitlement, and aversion to taking.

### Withdrawal from the group account

Extended Public Goods Game · BEER Lab

**Take frame**

One round · One randomly assigned group

The group account begins with 400 ECU, equivalent to 100 per member. The amount left is multiplied by 2 and divided equally.

How many ECU do you want to withdraw from the group account for your private account?

Withdrawing 0 is equivalent to contributing 100; withdrawing 100 is equivalent to contributing 0.

**Confirm withdrawal**

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Figure 6.8: The materially equivalent decision framed as taking.

**Feedback script**

Always transform withdrawals into equivalent contributions before comparison. Ask whether leaving resources in a common account feels the same as giving one's own resources.

## 6.9 Conditional contributions

Each participant records an unconditional contribution and a plan for others' average contributions of 0, 20, 40, 60, 80, or 100. The class curve helps distinguish conditional cooperators, unconditional contributors, and participants whose schedule slopes downward ([Fischbacher et al., 2001](#)). In

### Contribution plan

Extended Public Goods Game · BEER Lab

#### Conditional contributions

One round · One randomly assigned group

First choose your unconditional contribution. Then state how much you would contribute if the average of the other three members were each value shown.

Unconditional contribution: how many ECU do you want to contribute?

| Others' mean | Your conditional contribution |
|--------------|-------------------------------|
| 0            | <input type="text"/>          |
| 20           | <input type="text"/>          |
| 40           | <input type="text"/>          |
| 60           | <input type="text"/>          |
| 80           | <input type="text"/>          |
| 100          | <input type="text"/>          |

**Confirm plan**

Powered by [oTree](#)

Figure 6.9: Conditional contribution schedule.

this classroom adaptation, the first three group members make unconditional contributions and member D's implemented contribution is taken from the plan at the level nearest the other three members' average. This should not be described as an exact replication of the original protocol.

# Class plan and interpretation

## 7.1 Suggested 50-minute session

---

|           |                                                                        |
|-----------|------------------------------------------------------------------------|
| 0–5 min   | Access, laboratory rules, and group formation.                         |
| 5–12 min  | Instructions, example, and comprehension check.                        |
| 12–22 min | Decisions. For ten rounds, proceed without revealing the class report. |
| 22–27 min | Elicit class predictions before displaying outcomes.                   |
| 27–40 min | Histogram, zeros, full contributions, payoffs, and round trend.        |
| 40–47 min | Theory, alternative mechanisms, and published evidence.                |
| 47–50 min | Conclusion and transfer to taxes, teams, climate, or organizations.    |

---

## 7.2 Debrief questions

1. Which contribution maximizes individual payoff? Which maximizes total payoff?
2. What did each person expect others to contribute?
3. Does the distribution suggest one behavior or several participant types?
4. How did contributions change with repetition and group composition?
5. Did an institution increase cooperation, payoffs, or both?
6. Which real institutions resemble communication, thresholds, sanctions, or leadership?

## 7.3 Frequent interpretation errors

---

| Quick reading                         | Correction                                                                                  |
|---------------------------------------|---------------------------------------------------------------------------------------------|
| The equilibrium is full contribution. | With monetary self-interest, zero is dominant; full contribution is the collective optimum. |

---

| Quick reading                           | Correction                                                                             |
|-----------------------------------------|----------------------------------------------------------------------------------------|
| A high contribution proves altruism.    | It may also reflect beliefs, reciprocity, confusion, norms, or repeated-game strategy. |
| The mean describes everyone.            | Inspect the median, zeros, full contributions, and histogram.                          |
| A decline proves learning.              | It may reflect disappointment, reciprocity, end effects, or composition.               |
| Punishment improves welfare.            | It may increase contributions while destroying surplus.                                |
| A difference between classes is causal. | Comparable assignment and a research design are required.                              |

# Operations, privacy, and troubleshooting

## 8.1 Privacy and conduct

- Do not request names, student numbers, or demographics during this activity.
- Project the aggregate report; keep codes, groups, and individual screens private.
- Do not use the activity to label personal traits such as generosity or selfishness.
- Treat the session as a teaching activity unless a specific research protocol and consent process apply.
- Prevent conversation while choices are active, except under structured communication.

## 8.2 Common problems

| Situation                  | Action                                                                                                                                   |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| “Please wait”              | Check <b>Monitor</b> . A group member or decision is missing. Do not refresh first.                                                      |
| “No more pages left”       | The session ended. The current version should show a summary; confirm that the current configuration was used.                           |
| “This user does not exist” | The link belongs to a reset database or old session. Create a new session and share its current link.                                    |
| Not Found on a /p/... link | The individual link points to an earlier session. The room still works; create a new session in <b>Rooms</b> and share its current link. |
| Hidden report              | Wait until everyone finishes and press reveal under <b>Report</b> .                                                                      |
| Incomplete group           | Use a participant count divisible by four; restart before decisions begin.                                                               |
| Repeated groups            | With few participants and ten rounds, all repeated pairings may be impossible to avoid.                                                  |
| Negative payoffs           | Costly punishment can reduce payoff below zero; ECUs are teaching units unless a conversion rule is defined.                             |

### 8.3 Data for later analysis

The export records session, configuration, pseudonymous code, round, group, position, treatment, matching, return, message, unconditional choice, implemented contribution, withdrawal, group total, threshold success, pre-point payoff, cost, points received, and final payoff. Document treatment and unit of observation, and treat repeated decisions by the same person or group as dependent.

---

# Expanded teaching manual for nonspecialist instructors

This part brings together what an instructor needs to turn Public goods into a learning experience. It complements the operational material above. It can be read before the first session and reused as a script during the discussion of results. The central question is how the tension between the private incentive not to contribute and the collective benefit of funding the public good is resolved. The guide always separates four levels: rules, benchmark prediction, observed behavior, and interpretation. Moving directly from a bar in a chart to a psychological explanation confuses those levels.

## 9.1 Conceptual map before opening the session

### 9.1.1 Unit of analysis

The relevant unit is the group in each round, while retaining each participant's contribution and payoff. One data row is not always one independent person: the same person may decide repeatedly, and interacting participants share information, payoffs, or history. The instructor should therefore state what enters the numerator, what enters the denominator, and whether observations are people, decisions, pairs, groups, or rounds. This prevents thirty repeated decisions from being presented as thirty independent participants.

The task is to divide an endowment between a private account and a group account. Before presenting theory, ask students to restate the rule and identify what information is available when they decide. A correct calculation does not guarantee understanding of the strategic or behavioral structure. Check available actions, information, payoffs, order, and feedback timing separately.

### 9.1.2 Benchmark prediction

The starting point is: when the individual marginal return is below one, zero contribution is the material best response in a one-shot interaction; full contribution can be socially efficient when the group return exceeds one. The benchmark is a disciplined comparison, not a moral statement about what a person ought to do. First write the assumptions that support it, then derive the action or pattern, and only then compare it with the class. If information, repetition, incentives, matching, or the reference point changes, derive the prediction again instead of carrying it over automatically.

Keep equilibrium, efficiency, and fairness separate. An action can be a best response and generate a poor joint outcome; another action can raise surplus and remain vulnerable to unilateral deviation.

Likewise, an equal outcome need not be efficient, and an efficient distribution does not reveal the process that produced it. Asking the class to label each statement as positive, normative, or strategic reduces confusion.

### 9.1.3 Alternative mechanisms

The literature and treatments permit discussion of altruism, inequality aversion, conditional cooperation, reciprocity, norms, communication, punishment, and learning. These mechanisms are not interchangeable labels. Two can predict the same baseline action and separate only when a treatment changes. The informative comparison therefore asks not only how much behavior occurred but also what experimental change should increase, reduce, or leave the pattern unchanged if one mechanism matters.

Organize discussion in three columns. Write the observed fact in the first, such as a share, median, or trajectory. List compatible mechanisms in the second. Record the additional evidence needed to distinguish them in the third. The third column is essential because a classroom session rarely identifies a stable preference or causal relationship by itself.

## 9.2 Worked example and explanation

Four people receive 20 ECU and each contributed ECU returns 0.4 ECU to every member. If they contribute 20, 10, 0, and 10, the fund contains 40 and each person receives 16. Payoffs are 16, 26, 36, and 26. For one person, contributing one ECU costs one and returns 0.4; for the group it returns 1.6. That is the dilemma.

Solve the example in six steps. First list actions and possible states. Second calculate payoffs or consequences without interpreting motives. Third derive the theoretical benchmark under its assumptions. Fourth identify the minimum observation needed to evaluate that benchmark. Fifth compare treatments while stating what is held constant and what changes. Sixth formulate a limited conclusion: “the pattern is consistent with” is more accurate than “the experiment proves” when rival explanations remain.

Then change one parameter and ask for a new prediction before calculating. This pause turns the example into a reasoning tool. It also reveals whether students memorized an answer or understood the mechanism. If answers diverge, ask each group to identify the assumption producing the difference.

## 9.3 Reading the instructor report

The central measures are contribution rate relative to the endowment; total group contribution; efficiency relative to the maximum; evolution and dispersion across members. Write the denominator next to every indicator. A rate can divide by eligible participants, completed decisions, formed pairs, groups, or rounds; these alternatives are not equivalent. If records are incomplete, show how many were excluded and why.

Use this reading order:

1. Verify participants, groups, and completed decisions. Do not interpret percentages before checking coverage.
2. Inspect the full distribution. A mean can hide two groups with opposing responses or a concentration at focal values.

3. Compare the median, range, and theoretically relevant categories. Explain whether the graph counts people or decisions.
4. Inspect time paths only when rounds are comparable. Changes in matching or treatment must be marked.
5. Compare treatments with absolute differences and denominators, not merely with bars of different heights.
6. Select one anonymous case or sequence connecting rules and the aggregate. Never use it to identify or ridicule a student.

A visible difference in a small class is descriptive evidence from that session. Do not call it a causal effect without appropriate assignment, adequate size, and a comparison defined before seeing the data. Across classes, composition, time, and prior experience may change together. The pedagogical value lies in stating a prediction, confronting it with evidence, and asking what design would teach us more.

## 9.4 Step-by-step debrief script

Begin without revealing results. Ask for the benchmark prediction and which assumption students find most demanding. Record two quantitative class predictions. Next reveal the observation count and distribution, initially withholding the mean if it would distract from heterogeneity. Ask students to describe the chart without explaining causes.

In a second stage, show aggregate measures and ask: which observation contradicts the simplest prediction, which remains compatible with it, and what heterogeneity disappears in the average? Accept multiple explanations, but require each to yield a testable prediction. Introduce the variants: communication; high or low return; threshold with refund; punishment and reward; leadership; social information; take framing. For each variant, identify the single changed element, predicted direction, and report measure to inspect.

Close by connecting the laboratory to collective finance, climate action, teamwork, and tax compliance. Point out which elements of the real setting are absent: institutions, selection, repetition, long-run consequences, or rich information. The analogy is useful when it isolates a mechanism; it becomes misleading if the class assumes that the laboratory reproduces the full context.

A verbal sequence that works well is: “first describe,” “now derive,” “then interpret,” and “finally ask what evidence is missing.” This discipline allows a nonspecialist instructor to lead a rigorous discussion without treating every departure as a bias or every match as definitive confirmation.

## 9.5 Comparable class plans

### 9.5.1 A 50-minute class

Use one mode. Spend five minutes on rules and comprehension, five on private predictions, ten on the activity, five collecting predictions about the aggregate, fifteen revealing the report in layers, and ten connecting the result to theory. The goal is not to cover every variant but to ensure that every student can explain how the tension between the private incentive not to contribute and the collective benefit of funding the public good is resolved. End with one written sentence separating outcome from mechanism.

### 9.5.2 An 80-minute class

Run the baseline and one variant from communication; high or low return; threshold with refund; punishment and reward; leadership; social information; take framing. Allow ten minutes for instructions, fifteen for each treatment, twenty for comparing distributions, and fifteen for theory and applications. Before the second treatment, request a directional prediction. If the result points the other way, do not dismiss it: inspect comprehension, composition, denominators, and descriptive power.

### 9.5.3 A 110-minute class

Combine experience, derivation, and design. After two treatments, give small groups a rival explanation and ask them to propose a third condition that distinguishes it. Each group must define the manipulated variable, outcome, unit of analysis, and prediction. Close by comparing proposals with existing variants and with collective finance, climate action, teamwork, and tax compliance. This stage turns the student from participant into experimental designer.

## 9.6 Frequently asked questions and model answers

**Should theory be explained before play?** In a first session, collect predictions without revealing the full solution. Explain rules, payoffs, and information. Then derive when the individual marginal return is below one, zero contribution is the material best response in a one-shot interaction; full contribution can be socially efficient when the group return exceeds one. In a second session, reverse the order and assess whether theory improves prediction or only changes vocabulary.

**Is there a correct answer?** Separate a normative or equilibrium solution from a behavioral prediction. Theory supplies a conditional benchmark. The laboratory reveals what occurs and why a reasonable person may choose differently.

**Does a departure prove irrationality?** No. It may reflect omitted preferences, beliefs, error, weak comprehension, or a different institution. Check controls and incentives. Then treat altruism, inequality aversion, conditional cooperation, reciprocity, norms, communication, punishment, and learning as hypotheses requiring further comparisons.

**Why show the distribution?** The same mean can arise from moderate consensus or two opposing groups. A distribution reveals focal values, boundaries, and heterogeneity. In Public goods, connect those shapes to contribution rate relative to the endowment; total group contribution; efficiency relative to the maximum; evolution and dispersion across members.

**How many observations are enough?** There is no universal threshold for debriefing. A small class is useful when described cautiously. Treatment comparisons require several independent units, clear assignment, and common protocols. Repeated decisions do not create new participants.

**Can sessions be pooled?** Yes, if parameters and definitions remain fixed. Retain session identifiers and inspect each cohort first. If instructions, composition, or incentives change, document the heterogeneity.

**What if results contradict the literature?** Check rules, treatment, comprehension, exclusions, and calculation. If no error exists, preserve the result. A class need not reproduce a published estimate. Ask what design would distinguish chance, composition, and mechanism.

**How can embarrassment be avoided?** Project aggregates and anonymous sequences. Avoid personal labels. Describe actions and consequences. The laboratory studies decisions under specific rules; it does not diagnose traits.

**Should the decision be graded?** Do not grade agreement with a prediction. Assess understanding: derive the benchmark, calculate a measure, explain a limitation, and design a comparison. Experimental incentives and academic assessment serve different purposes.

**How should a variant be chosen?** Begin with the mechanism to separate. Select from communication; high or low return; threshold with refund; punishment and reward; leadership; social information; take framing, state a direction and measure, and hold other elements constant. Do not run more conditions than can be analyzed.

**What conclusion is appropriate?** Use three sentences: what was observed, which mechanism it is consistent with, and what evidence is missing. The connection to collective finance, climate action, teamwork, and tax compliance should preserve those limits.

**What should students remember?** They should reconstruct the central tension, explain the benchmark, read the main denominator, and propose an institution that could change the outcome.

## 9.7 Diagnostic cases for interpretation practice

### 9.7.1 Agreement with the benchmark

The distribution is concentrated near the prediction derived from when the individual marginal return is below one, zero contribution is the material best response in a one-shot interaction; full contribution can be socially efficient when the group return exceeds one. Do not conclude that everyone shared the same motive. Some calculated, others followed a signal, and others chose intuitively. The evidence supports the aggregate prediction under session conditions but does not identify individual reasoning. Ask what belief, process, or response-time measure would distinguish those routes.

Then introduce a variant from communication; high or low return; threshold with refund; punishment and reward; leadership; social information; take framing. If the pattern remains when the seemingly obvious mechanism weakens, the original explanation needs revision. A correct prediction does not automatically validate all its assumptions.

### 9.7.2 Two groups with opposite behavior

Half the class is at one extreme and half at the other; the mean lies where almost nobody chose. Showing only the average would create a fictional description. Calculate the median, modes, range, and share in theoretical categories. Ask whether heterogeneity is related to role, round, treatment, or comprehension.

Consider altruism, inequality aversion, conditional cooperation, reciprocity, norms, communication, punishment, and learning. Write one additional observation for each. If it predicts role differences and none appear, it receives less relative support. If it predicts learning, inspect the trajectory. Do not fill missing measurement with a compelling story.

### 9.7.3 A large difference with few units

One treatment apparently doubles the main measure but contains two groups and the comparison contains three. Display each group before pooling. One extreme unit can create the difference. Twenty decisions nested in two groups are not twenty independent units.

Ask students to plan the next session: groups, assignment, primary measure, and exclusions. The answer should mention contribution rate relative to the endowment; total group contribution;

efficiency relative to the maximum; evolution and dispersion across members and incomplete data. The experience thereby introduces design and transparency.

#### 9.7.4 A null difference

Two conditions have the same mean. Before declaring that the manipulation does not matter, inspect compliance, comprehension, tails, and dispersion. Opposing subgroup effects can cancel. Define what range of differences would be pedagogically or economically meaningful and what size could distinguish it.

The cases teach four disciplines: do not infer motives from agreement, hide heterogeneity, confuse rows with units, or treat absence of evidence as evidence of absence.

### 9.8 Explanatory sequence for a complete class

#### 9.8.1 Step 1: pose the problem without labels

Present the decision as a concrete situation and ask what information is missing. Do not announce the name of the bias, equilibrium, or preference at the start. The question is how the tension between the private incentive not to contribute and the collective benefit of funding the public good is resolved. Collect private responses so the first speaker does not become a focal point.

#### 9.8.2 Step 2: reconstruct rules and incentives

Ask one student to describe actions and another to describe consequences. A third explains available information. Draw the sequence. In Public goods, the decision is to divide an endowment between a private account and a group account. Do not move to interpretation until the class can calculate a simple case.

#### 9.8.3 Step 3: derive the benchmark

Write when the individual marginal return is below one, zero contribution is the material best response in a one-shot interaction; full contribution can be socially efficient when the group return exceeds one. Underline each assumption. Ask what happens if one fails. Distinguish a logical derivation from an empirical expectation: an equilibrium strategy need not be played immediately by everyone.

#### 9.8.4 Step 4: record predictions

Request one prediction about the mean, another about the distribution, and a third about a variant. Predictions should use contribution rate relative to the endowment; total group contribution; efficiency relative to the maximum; evolution and dispersion across members. Preserve the record; later comparison reveals learning and reduces hindsight.

#### 9.8.5 Step 5: reveal in layers

Show coverage first, then distribution, measures, and comparisons. At every layer request description before explanation. If someone proposes altruism, inequality aversion, conditional

cooperation, reciprocity, norms, communication, punishment, and learning, ask what observation would distinguish it from another mechanism.

### 9.8.6 Step 6: work through one sequence

Use the worked example in this guide. Recalculate slowly and change one parameter. Ask each team to find one excessive conclusion and rewrite it with limited language. Editing claims is as important as calculation.

### 9.8.7 Step 7: compare institutions

Choose one condition from communication; high or low return; threshold with refund; punishment and reward; leadership; social information; take framing. Write a table with constant, change, prediction, and measure. If the variant changes several elements, acknowledge it. Ask whether a third treatment would separate explanations.

### 9.8.8 Step 8: transfer and close

Connect the mechanism to collective finance, climate action, teamwork, and tax compliance. Identify two differences between the laboratory and the real context. End with an exit response: prediction, evidence, compatible mechanism, and limitation. This structure assesses understanding without rewarding a particular decision.

### 9.8.9 A short script to read aloud

“Describe what happened before explaining why. Identify the prediction and its assumptions. Compare the distribution with the mean. Propose two compatible mechanisms. Finally, state which treatment or additional evidence could distinguish them.” The script keeps discussion in a common sequence across families.

## 9.9 Assessment bank with solutions

**Exercise 1.** List actions, information, and payoffs. **Solution:** reconstruct divide an endowment between a private account and a group account without adding information unavailable to the participant.

**Exercise 2.** Derive the material benchmark. **Solution:** begin from when the individual marginal return is below one, zero contribution is the material best response in a one-shot interaction; full contribution can be socially efficient when the group return exceeds one and name at least two assumptions. For an interactive game, state best responses; for an individual task, state the decision rule.

**Exercise 3.** The report shows 40 percent. **Solution:** it cannot be interpreted without numerator, denominator, exclusions, and unit. Eligible people and completed decisions are alternative denominators.

**Exercise 4.** The mean matches the prediction. **Solution:** inspect the distribution. A correct mean can combine extremes, offsetting errors, or different strategies. Agreement does not identify reasoning.

**Exercise 5.** Select two mechanisms from altruism, inequality aversion, conditional cooperation, reciprocity, norms, communication, punishment, and learning. **Solution:** design a condition changing one prediction but not the other, with an outcome from contribution rate relative to the endowment; total group contribution; efficiency relative to the maximum; evolution and dispersion across members.

**Exercise 6.** Compare treatments of different sizes. **Solution:** report counts and shares, preserve the independent unit, and do not compensate for a small group by multiplying rounds.

**Exercise 7.** Mean differences are absent. **Solution:** inspect dispersion, tails, compliance, and comprehension; define a relevant difference. A broad null does not establish equivalence.

**Exercise 8.** Propose a figure. **Solution:** use histograms or dots for distributions, lines for rounds, separate bars for roles, and bivariate plots when a response depends on a prior action.

**Exercise 9.** Explain a variant from communication; high or low return; threshold with refund; punishment and reward; leadership; social information; take framing. **Solution:** identify what changes, what remains constant, predicted direction, and an interpretive threat.

**Exercise 10.** Transfer to collective finance, climate action, teamwork, and tax compliance. **Solution:** describe the common mechanism and two institutional differences. Do not claim that one session determines policy.

**Exercise 11.** Write a three-sentence conclusion. **Solution:** observation with denominator; compatible mechanisms; evidence needed to distinguish them.

**Exercise 12.** Design a replication. **Solution:** preserve parameters, record assignment, announce the primary measure, set exclusions, and archive the export.

A twelve-point rubric awards one point for each correct component. For a short assignment use Exercises 2, 3, 5, and 11. For a project use all twelve and request a reproducible figure.

## 9.10 Advanced seminar: from evidence to mechanism

Divide the class into four teams: benchmark model, alternative preferences or beliefs, institutions, and identification critique. Each interprets the same report from its assigned role. The first derives when the individual marginal return is below one, zero contribution is the material best response in a one-shot interaction; full contribution can be socially efficient when the group return exceeds one; the second uses altruism, inequality aversion, conditional cooperation, reciprocity, norms, communication, punishment, and learning; the third selects a variant from communication; high or low return; threshold with refund; punishment and reward; leadership; social information; take framing; the fourth identifies missing evidence.

In a replication round, every team writes a quantitative prediction and a condition that could refute it. It exchanges the proposal with another team, which audits unit, denominator, and manipulation. A useful explanation does not merely accommodate past outcomes; it risks a prediction about new evidence.

End with a one-page memo containing question, benchmark, descriptive finding, two mechanisms, discriminating design, application to collective finance, climate action, teamwork, and tax compliance, and limitation. Grade causal clarity, technical correctness, use of evidence, and inferential restraint.

For a quantitative extension, export data and reproduce three figures: individual distribution, aggregate by independent unit, and treatment comparison. All three require titles, denominators,

and exclusion notes. Compare how the narrative changes when the correct unit is used.

An ethics extension asks which decisions should remain private, when an incentive is proportionate, and how to communicate results without turning group patterns into personal judgments. The answer should separate participant protection, instructional integrity, and analytical transparency.

## 9.11 Annotated bibliography

- [Marwell and Ames \(1979, 1980\)](#): foundational provision and provision-point experiments.
- [Ledyard \(1995\)](#): broad survey of experimental public goods research.
- [Isaac and Walker \(1988a,b\)](#): communication, group size, and returns.
- [Fischbacher et al. \(2001\)](#): conditional cooperation and the strategy method.
- [Fehr and Gächter \(2000, 2002\)](#): costly punishment and cooperation.
- [Potters et al. \(2007\)](#): leading by example.
- [Sefton et al. \(2007\)](#): comparison of rewards and sanctions.

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