

Supporting Online Material

(For Online Publication Only)

Peer-Punishment in a Cooperation and a Coordination Game

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1 Instructions

The set of instructions translated into English are found below. The German set of instructions are available upon request from the authors. The first part describes the *VCM* and the strategy method, while the second part describes the *WL* game.

General Instructions for Participants

You are about to take part in an economic experiment. If you read the following instructions carefully, you can earn a considerable amount of money, depending on your decisions and the decisions of the other participants. It is therefore important that you read these instructions carefully and understand them well.

During the experiment, communication is absolutely forbidden. If you have any questions, please ask only us. Raise your hand and we will come to you. Disobeying this rule will lead to exclusion from the experiment and from all payments.

This experiment consists of several independent parts. You will be randomly matched into groups of four in each part. **The make-up of your group of four will change as each new part begins.** Participants cannot be identified beyond the individual parts, and you do *not* interact with the same participants in each part of the experiment.

For your participation today, you will initially receive a show-up fee of 5€. This amount increases by your earnings from the individual parts of the experiment. During the experiment, however, we will not speak of Dollar, but of Token. Your total earnings are therefore initially calculated in Token. The total amount of Token you earn in the course of the experiment will be converted into Dollar at the end and paid to you in cash. The exchange rate of Token to Dollar will be told to you at the beginning of each part.

Now you will receive a description of the first part. You will receive the descriptions for the other parts later.

General Information for the First Part of the Experiment

In the first part of the experiment the exchange rate from Euro to Token is: 50 Token = 1€.

The first part of the experiment consists of **ten periods**. At the beginning of the first part, you will be randomly assigned to a group of four participants. Thus, there are 3 other participants in the group, excluding you. The composition in all ten periods stays the same, which means **you will interact with the same participants in each of the 10 periods**.

Each period consists of 2 stages:

STAGE ONE

At the beginning of each period, each participant receives 20 Token. It is your task to decide how to use your 20 Token. You can contribute all or a part of your 20 Token to a project, or put them in a private account. Every Token that you do not contribute to the project is automatically put in your private account. For example, if your contribution to the project is 5 Token, then 15 Token are put in your private account.

Income from the private account:

For every Token that you put in your private account, you will earn exactly 1 Token. For example, if you put 20 Token in your private account, thus contributing nothing to the project, you will earn exactly 20 Token from the private account. If, for example, you contribute 12 Token to the project (and therefore put 8 Token in the private account), you will earn 8 Token from your private account. *Nobody except you receives earnings from your private account.*

Income from the project:

For every Token that you or another participant from your group contributes to the project, *you and all the other participants in your group* will earn 0.4 Token *each*. The income of each participant in your group from the project is therefore determined as follows:

$$\text{Income from the project} = \text{Sum of contributions to the project} * 0.4$$

Examples: If the sum of contributions of all participants to the project is 20 Token (e.g., if you and the three other participants each contribute 5 Token), then you and all the other participants in your group earn $20 * 0.4 = 8$ Token from the project. If the sum of contributions to the project

is 10 Token in total, then you and all the other participants earn $10 * 0.4 = 4$ Token from the project.

Your income at the end of stage 1 is the sum of your income from your private account plus your income from the project. Therefore:

$$\frac{\text{Income from your private account (= 20 - Contribution to the project)} + \text{Income from the project (= 0.4 * Sum of contributions to the project)}}{\text{Income from the end of stage 1}}$$

The calculations can be illustrated easily with an example:

You contribute 15 Token to the project, as do the other participants. The total sum of contributions to the project is therefore $15 + 15 + 15 + 15 = 60$ Token. In this example, your income at the end of stage 1 would be:

$$\underline{5 \text{ Token}} \text{ from your private account} + \underline{0.4 * 60 \text{ Token}} \text{ from the project} = 5 + 24 = \underline{29 \text{ Token}}.$$

If, on the other hand, you contributed 0 Token to the project, then the total sum of contributions to the project would be $15 + 15 + 15 + 0 = 45$ Token. Your income would therefore be:

$$\underline{20 \text{ Token}} \text{ from your private account} + \underline{0.4 * 45 \text{ Token}} \text{ from the project} = 20 + 18 = \underline{38 \text{ Token}}.$$

The income from stage 1 is calculated in the same way for the other participants.

STAGE TWO

At the beginning of the second stage, you will learn how many Token the other participants in your group have contributed to the project. You will then have the opportunity to **reduce** the stage 1 income of **each one** of the other participants in your group. The other participants can similarly reduce **your** earnings, if they want to.

To reduce the income of a specific participant, you can assign so-called **points** to this participant. For each point that you assign to a participant in your group, you reduce this participant's income by 3 Token. Thus, if you assign 1 point to a participant, you reduce this participant's income by 3 Token. If you assign 2 points to this participant, you reduce this participant's income by 6 Token, etc. If you do not want to reduce the earnings of a participant, you assign 0 points to this participant.

The more points you assign to a participant, the larger is the reduction in the earnings of this participant. However, your own earnings are reduced with every point that you assign to a participant. For each point that you assign, your earnings are reduced by 1 Token. For example, if you assign 2 points to a participant, you will incur costs of 2 Token; if you assign 4 points to a participant, you will incur costs of 4 Token; if you assign 0 points to a participant, you will incur no costs for this.

You decide for **each** participant in your group by how many Token you want to reduce his earnings. You may assign a maximum of 10 points to each participant.

If and how many Token in total are deducted from a participant's earnings depends not only on how many points you assigned to this participant, but also how many points he received from the other participants. For example, if a participant receives 1, 0, and 2 points, respectively, from the other three participants in the group, his earnings are reduced by $(1 + 0 + 2) * 3 = 9$ Token. Simultaneously, the earnings of the other participants are reduced by the costs incurred by assigning the points (i.e., by 1, 0, and 2 Token).

YOUR PAYOFF

Your payoff is thus determined as follows:

<p><i>Income from stage 1</i></p> <ul style="list-style-type: none"> – $3 \times$ (The number of points from stage 2 that have been assigned to you) – The number of points from stage 2 that you have assigned to others <hr style="border: 0.5px solid black;"/> <p style="text-align: center;"><u><i>Payoff</i></u></p>

Do you have any questions? If you do, please raise your hand now.

Additional Instructions for the First Part of the Experiment

The general decision situation is the same in each period, i.e., you will decide, in stage 1, how many Token you wish to contribute to a project; and in the second stage, you can assign points to the other participants in your group. For each point that you assign to a participant, you reduce the earnings of this participant by 3 Token and your own earnings by 1 Token. However, the process differs across periods:

Period 1:

First, you decide exactly *once* how many Token you wish to contribute to the project in the first stage.

In the second stage, you will be confronted with a number of decision situations. In each decision situation, a combination of **possible** contributions by the other participants in your group is presented. Above, we described how you will learn, in stage 2, the precise contributions of the other participants in your group – and after that you can assign points to each participant. However, in the first period, the three presented contributions might possibly be fictitious and do not present the actual contributions of the other three participants.

After you have decided on the assignment of points to the presented contributions, you will be presented with a (possibly fictitious) new combination of contributions by the other participants in your group. For this decision situation, you also have to decide how many points you want to assign to each participant.

In total, you will be presented with **eleven** decision situations. Ten of the eleven decision situations are fictitious. In **exactly one** situation, you will be presented with the **actual** contributions of the other three participants in your group. How many points you assign to the other three participants in your group and how large your payoff is will only be determined by the decisions in this one decision situation. The chosen assignment of points in the fictitious situations has no influence on your payoff or that of the other participants. When deciding on the assignment of points in the decision situations, you will not know if the presented contributions are the actual contributions. Therefore you have to consider your assignment of points in every decision situation, as every situation might be relevant for you.

At the end of the first period, all participants in your group will learn how many points they have received from the other participants.

Periods 2 to 10:

In the **subsequent nine periods**, you will interact another nine times with the **same** participants. However, in the subsequent nine periods, you will **only be confronted with the actual** decision situation in the second stage.

After each of the ten periods, each participant will learn how many points he has received from the other participants in the group. Furthermore, he will learn his payoff from this period. After this, each participant receives a new, random number. You are therefore always matched with the same participants in one group, but cannot identify individual participants from round to round.

Do you have questions? If so, please raise your hand now.

General Information for the Second Part of the Experiment

In the second part of the experiment the exchange rate from Euro to Token is: 50 Token = 1€.

The second part of the experiment consists of **ten periods**. At the beginning of the second part, you will be randomly assigned to a group of four participants. Thus, there are 3 other participants in the group, excluding you. The composition in all ten periods stays the same, which means **you will interact with the same participants in each of the 10 periods**.

The general decision situation is the same in each period, i.e., as before, you will decide, in stage 1, how much effort you want to spend on the project in terms of Token. (We do not talk of “contribution”, in this part of the study, but of “effort” for the project.)

At the beginning of each period, each participant receives 20 Token. It is your task to decide how to use your 20 Token. The tokens you spent, now, represent your personal **effort** for the project. Every Token that you do not spend as effort on the project is automatically put in your private account.

Income from the private account:

For every Token that you put in your private account, you will earn exactly 1 Token. For example, if you put 20 Token in your private account, thus spend no effort on the project, you will earn exactly 20 Token from the private account. If, for example, you spend 12 Token of effort on the project (and therefore put 8 Token in the private account), you will earn 8 Token from your private account. *Nobody except you receives earnings from your private account.*

Income from the project:

For the income from the project holds: The lowest effort spent in terms of Tokens on the project in the group determines the income from the project. For every Token of the lowest effort spent on the project, *you and all the other participants in your group* will earn 1.6 Token. Any Token effort spent that is larger than the lowest Token effort, will not be reimbursed

$$\text{Income from the project} = \text{lowest Token effort spent on the project} * 1.6$$

Your income at the end of stage 1 is the sum of your income from your private account plus your income from the project. Therefore:

$$\frac{\text{Income from your private account (= 20 - Token effort spent on the project)} + \text{Income from the project (= 1.6 * lowest Token effort spent in the group)}}{\text{Income from the end of stage 1}}$$

In the enclosed table you can look up your income from stage 1 (Income from your private account + income from the project) depending on your effort spent on the project and the lowest effort spent on the project in the group. For the following 2 examples the table will be displayed for you on the screen and the field relevant for your payment highlighted with colors.

Example 1: Assume you choose an effort level of 10 Token. The Token effort of the other three participants is 12, 5 and 17 Token. Then, the lowest Token effort spent on the project of all participants in your group is 5 Token and hence is the effort level relevant for payment. Thus, your income at the end of stage 1 = 18 Token (20 – 10 (your effort) + 1,6 * 5 (lowest effort)).

Example 2: Assume you choose an effort level of 10 Token. The Token effort of the other three participants is 19, 11 and 13 Token. Then, the lowest Token effort spent on the project of all participants in your group is 10 Token. Your income at the end of stage 1 equals 26 Token (20 – 10 (your effort) + 1,6 * 10 (lowest effort)).

STAGE TWO

At the beginning of the second stage, you will learn how much Token effort the other participants in your group have spent on the project. You will then have the opportunity to **reduce** the stage 1 income of **each one** of the other participants in your group. The other participants can similarly reduce **your** earnings, if they want to. You are familiar with this from the previous part of the study.

To reduce the income of a specific participant, you can assign so-called **points** to this participant. For each point that you assign to a participant in your group, you reduce this participant's income by 3 Token. For each point that you assign, your earnings are reduced by 1 Token.

YOUR PAYOFF

Your payoff is thus determined as follows:

<p><i>Income from stage 1</i></p> <ul style="list-style-type: none">– $3x$ (<i>The number of points from stage 2 that have been assigned to you</i>)– <i>The number of points from stage 2 that you have assigned to others</i> <hr/> <p><u><i>Payoff</i></u></p>

Do you have any questions? If you do, please raise your hand now.

Additional Instructions for the Second Part of the Experiment

In the first period you will in the second stage again be presented with **eleven** decision situations. Ten of the eleven decision situations are fictitious. In **exactly one** situation, you will be presented with the **actual** effort of the other three participants in your group in the first period. Your income at the end of the first period will only be determined by the decision from that single decision situation. You are familiar with this from the previous part of the study.

At the end of the first period, all participants in your group will learn how many points they have received from the other participants.

In the **subsequent nine periods**, you will interact another nine times with the **same** participants. However, in the subsequent nine periods, you will **only be confronted with the actual** decision situation in the second stage.

After each of the ten periods, each participant will learn how many points he has received from the other participants in the group. Furthermore, he will learn his payoff from this period. After this, each participant receives a new, random number. You are therefore always matched with the same participants in one group, but cannot identify individual participants from round to round.

Do you have questions? If so, please raise your hand now.

2 Using Contribution rather than Payoff

Outcome-based theories of social preferences stress the importance of individual payoffs of oneself and others as the reference point for the evaluation of fairness (e.g., (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000)). It would therefore be straightforward to classify subjects according to individual payoffs. However, initial estimations, shown in Table 1, indicate weaker explanatory power of models with individual payoffs π_i (adj. $R^2_{VCM} = 0.098$; adj. $R^2_{WL} = 0.098$) compared to models based on game tokens that are not contributed ($20 - g_j$) (adj. $R^2_{VCM} = 0.222$; adj. $R^2_{WL} = 0.251$). We therefore, following Albrecht *et al.* (2018), classified subjects using the latter rather than using individual payoffs.

Table 1: Contribution versus payoff as explanatory variables.

	<i>Individually Assigned Punishment d_{ij}</i>			
	VCM		WL	
	(1)	(2)	(3)	(4)
$(20 - g_j)$	0.068 *** (0.007)		0.085 *** (0.007)	
π_j		0.062 *** (0.006)		0.038 *** (0.003)
Intercept	-0.005 (0.067)	-0.962 *** (0.158)	-0.019 (0.070)	0.182 *** (0.057)
Observations	6840	6840	6840	6840
Adjusted R^2	0.222	0.098	0.251	0.048
AIC	18,036	19,054	19,974	21,619
BIC	18,043	19,061	19,980	21,626

Note: Individual level fixed effects estimation for 228 subjects. Screen order is used as time variance to capture potential ordering effects. Columns 1, 3, and 5 are only RP game observations; and Columns 2, 4, and 6 are only WP game observations with 30 observations per subjects in each game. Cluster robust standard errors in parentheses. *, **, and *** represent $p \leq 0.1$, $p \leq 0.05$, and $p \leq 0.01$, respectively.

References

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