Cooperation in Diverse Teams: The Role of Temporary Group Membership

New title:

Public Good Provision in Blended Groups of Partners and Strangers

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Abstract:

We experimentally analyze cooperation in blended groups, where some group members stay together (partners) and others are switching groups (strangers). Our results reveal that teams consisting partly of members with strangers display a lower productivity compared to teams of permanent group members only. First, strangers cooperate less than partners in blended groups. Second, individual effort decisions increase with the number of group mates who are of the same type. This second effect holds for both strangers and partners and is neither driven by beliefs nor conditional willingness to cooperate. We argue that social identity plays a role here depending on group composition and the individuals' role in a group.

JEL Codes: C9, M5

Keywords: Cooperation, Economic experiment, Group, Public Good

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1. Introduction

The strategic challenge of cooperation within groups can be well captured by a social dilemma which is characterized by individuals whose self-interest is at odds with the group's interest, and which results in cooperation levels that are inefficiently low (e.g. Andreoni 1988). Due to the importance of cooperation in groups there is a vast experimental literature on particular levers of cooperation in groups stressing inter alia repeated interaction as one of the major determinants (e.g. Chaudhuri 2011).

However, economic experiments on the duration of group membership has so far been limited to comparisons between homogeneous groups consisting of either temporary members who all switch groups in each round (*strangers*) or permanent members staying in one group over repeated rounds (*partners*) and have shown rather mixed results (e.g. Andreoni 1988, Fehr and Gächter 2000). Though, the issue is highly relevant in practice as the duration of group membership may vary within work groups and these groups also rely on effective cooperation. For example, some employees may have temporary employment contracts or project members are only assigned to a work group for a specific period.

We close a gap in the literature by comparing blended groups consisting of different ratios of partners and strangers in a public good game with each other and the baseline setting with only partners and strangers.

2. Experimental Design and Procedure

We aim to explore the effects of blended groups with regard to the duration of group membership on cooperation by conducting adapted versions of the public good game of Fehr and Gächter (2000). In the experimental design, subjects form groups consisting of four subjects each. Each subject has to individually decide how much of her 20 ECU endowment she wants to invest into the public good project and how much she wants to put aside into her private account. Investments into the public good project are multiplied by 1.6, and the resulting amount is equally re-distributed to each of the four subjects. Savings to the private account remain stable in value and are paid out only to the subject to whom the private account belongs.

In every session, 28 individuals participated. In the Partner setting (PPPP), all four subjects form a stable group over the course of the 10 rounds of the experiment. In the Stranger setting (SSSS), all subjects are re-allocated to new group members after each round. We introduce two new treatments with blended groups in which (i) one group member is re-allocated randomly to a new group after each round, while three subjects remain together over the 10 rounds (PPPS) and (ii) two subjects randomly and independently from one another switch (PPSS).

In order to understand how different predispositions to cooperate relate to actual behavior in our experiment, we conducted a *pre-test*. In this task, each individual was randomly assigned to a group and was asked to make a one-shot public good decision, as described above. Individuals were asked about their contributions conditional on each possible mean of the other three players' contribution given by integers from 0 to 20.

All sessions took place between October 2013 and July 2014 at the AIXperiment laboratory located at RWTH Aachen University, Germany. Recruitment was made via ORSEE (Greiner 2004) and the experiment was conducted with z-Tree (Fischbacher 2007). Before the experiment started, subjects were informed about their own type (P or S) and also about their group composition (PPPP, PPPS, PPSS or SSSS). After each round, all participants were informed about their earnings.

In total, 336 students participated in the experiment. One session lasted for about 1.5 hours, and subjects earned about 12.64 Euros on average in addition to a show-up fee of 3 Euros. One round was randomly chosen to be relevant for the payoff.

3. Findings

Figure 1 illustrates the development of mean individual contributions by treatment and round, revealing that contributions decrease in all treatments from round 1 to round 10.

FIGURE 1

Cooperation is significantly highest in the partner setting PPPP with 5.95 on average compared to other treatments (p<0.001 for each pairwise test[1]). Comparing blended groups cooperation decreases with the number of strangers, i.e., contribution is higher in PPPS with 4.68 than in PPSS with 3.97 on average (p=0.072). Though, cooperation in blended groups does not significantly differ from the stranger setting SSSS, which yields an average of 4.23. All of these results are robust when only considering the first round of the experiment only.

When considering differences in types over all treatments together, we observe that strangers contribute on average less to the public good than partners do (mean of P=5.54, mean of S=3.67, p<0.001).Comparing the decisions of strangers and partners within blended groups we find that strangers contribute significantly less than partners (P vs. S in PPPS, p<0.001 and in PPSS, p=0.065).

Figure 2 displays the mean contributions for each treatment and partners and strangers separately. Interestingly, partners in blended groups cooperate less than in the homogeneous setting PPPP (PPPP vs. P in PPPS, p=0.067 and PPPP vs. P in PPSS, p=0.085). Moreover, we observe that strangers' contribution increases with the number of other strangers in the group. Strangers in SSSS contribute significantly more than in the blended groups (SSSS vs. S in PPSS, p=0.058 and SSSS vs. S in PPPS, p<0.001) and in the two blended groups, strangers' cooperation is higher in PPSS than in PPPS (p=0.030). An equivalent result can be confirmed for partners who also contribute more the more partners are in the group (see results above and: P in PPPS vs. P in PPSS, p=0.084). This behavior leads to payoff differences for subjects across treatments (highest in PPPP) and between types of players within blended groups (higher for S than P in PPSS (p=0.008) and in PPPS (p=0.004)).

FIGURE 2

[1] Mann Whitney U-test is used for all treatment differences (two-tailed) while the Wilcoxon Signed rank test (also two-tailed) is applied to check for significant differences within the treatments.

In order to examine the various possible determinants of contributions together in a multivariate analysis, we apply tobit estimations and cluster at the group level. Table 1 shows the results of the analysis of individual contributions per round. We start by exploring differences in contributions by type (S or P) and by the number (0 to 3) of group members that are of the same type as oneself (Results are robust to estimations with dummy variables). We confirm our above result that strangers contribute significantly less than partners. Besides, we find, also in line with our non-parametric results, that contributions increase in the number of group members of the same type as oneself (model I).

The additional models serve as robustness checks. Differences in contributions across treatments and types may also be caused by differences in individuals' predisposition to cooperate. We differentiate between predispositions of individuals by using their conditional contribution stated in the pre-test. We calculate Spearman rank correlations for each individual between the own contribution and the given contributions of others as a measure for the *conditional willingness to cooperate*. We recode insignificant correlations to zero. Average values of this measure vary (not significantly) from 0.530 to 0.667 across types and group compositions in our experiment. This measure is added in model II, and we find a positive relation to contributions in our experiment. Moreover, we analyze whether the conditional willingness to cooperate, which can also be interpreted as a measure for the degree of reciprocity (Fischbacher et al. 2001), is differently related to contributions by S and by P. We therefore construct an interaction term with *stranger* and find that the positive relationship is particularly relevant for strangers and insignificant for partners (see model III).

TABLE 1

Model IV integrates the beliefs regarding others' contributions into the analysis. We find a highly significant and large effect on contribution. Moreover, subjects experience different levels of cooperation during the experiment. We implement group members' contributions in previous rounds instead of beliefs in model V. Subjects who experienced cooperation in the past, react with higher own contributions. Group members' contributions in the precedent round are highly correlated with beliefs in the current round (Spearman rho=0.82, p<0.001). This is even the case for strangers, who change groups over rounds (rho=0.77, p<0.001). Estimating a joint model (VI) with both variables reveals that both beliefs and experiences in the precedent round are significantly related to own contributions in the current round. Our major findings are all robust to these variations.

Further analyses show that in most cases, individuals contribute – given a particular belief – at least the amount they had stated in the pre-test on average. Particularly, individuals who are assigned the role of a partner in the experiment tend to contribute more than in the pre-test, which is not surprising, as behavior in a repeated setting typically results in higher cooperation levels. However, we also find negative deviations from the decisions in the pre-test for some of the players. A share of 15% of all participants reveal a willingness to cooperate in the pre-test but act as freeriders defined as contributing less than one ECU per round on average in the main experiment. This share varies with type and group composition and especially many strangers in PPPS groups freeride (38%), although they have had positive beliefs.

4. Conclusion

Some of our results may be interpreted with the help of social identity theory going back to Tajfel and Turner (1979). The type of group membership may well serve as a means to categorize participants into two groups. In homogeneous groups, where all group members are either permanently or temporarily assigned to the group, participants might perceive themselves as members of the same "social category." Thus, they may develop a sense of identification with the group which may induce them to cooperate. Direct reciprocity may additionally enhance cooperation whenever there are at least two partners in a group and this reciprocity may increase in the number of partners.

In blended groups, however, participants may be in a conflict between a higher tendency to cooperate with in-group members and a lower tendency to cooperate with members perceived as out-group. Thus, in groups of three permanent members, group identity only evolves among permanent members with the only temporary member being an out-group participant who in fact contributes much less. In groups of two partners and two strangers, two sub-groups are created; both being confronted with cooperation decisions towards one in-group member and two out-group participants. Moreover, cooperation levels of partners are somewhat lower in groups with only one in-group member (PPSS) than in groups with two in-group members (PPPS). Alike, strangers cooperate more, the more strangers are in their group.

Interestingly, a surprisingly large share of individuals who have an initial tendency to conditionally cooperate act like freeriders once they are allocated to being a stranger in a blended group. This is particularly the case if there is only one stranger in a group. This is in line with our interpretation above in the light of social identity theory. Like in the experiment of Fischbacher and Gächter (2010), we observe for this subset of individuals that not solely beliefs are driving behavior. Particularly, strangers confronted with three partners may feel like out-group participants belonging to a different category and may, thus, resign from cooperation although they have relatively high beliefs about the contributions of others.

Our results imply that the duration of own group membership and its deviation from other group members impact cooperation. Temporal horizon of cooperation may induce participants to identify with similar group members and can create sub-groups within one larger group.

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Figures and Tables

Figure 1: Mean contribution over rounds in homogeneous and heterogeneous groups

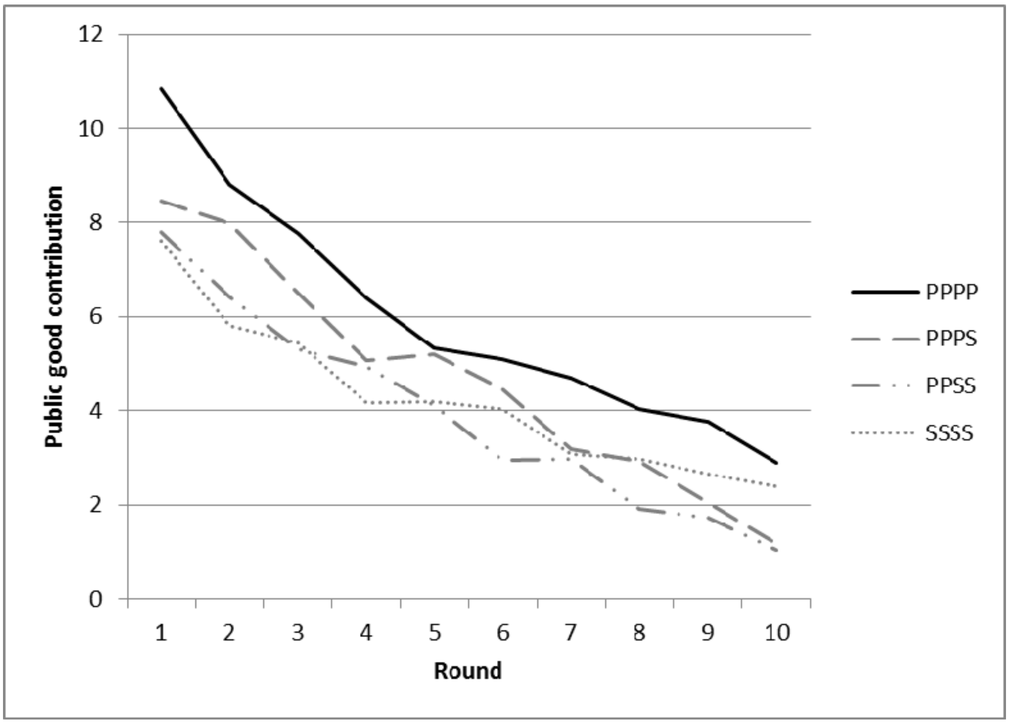

Figure 2: Mean contribution by group composition and type of group membership

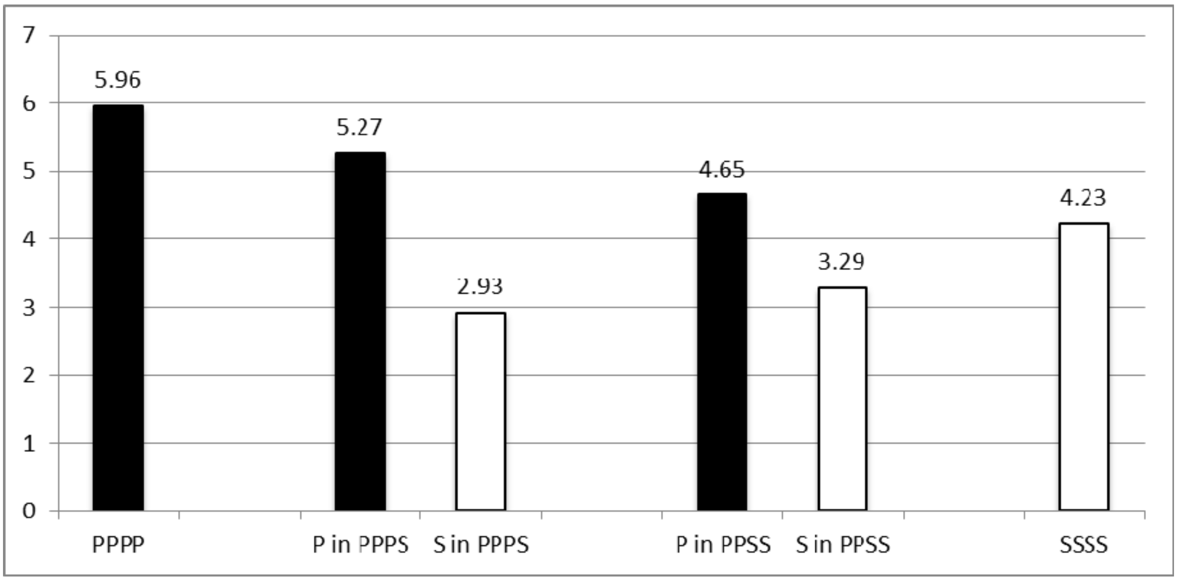

Table 1: Tobit regressions on individual contributions

	I	II	III	IV	V	VI
Stranger (1=yes)	-2.664*** (0.975)	-2.696*** (0.970)	-5.132*** (1.697)	-4.167*** (1.153)	-2.951** (1.112)	-3.113*** (1.105)
# of group members of the same type	1.342*** (0.491)	1.201** (0.472)	1.155** (0.478)	0.854*** (0.269)	0.552** (0.250)	0.676*** (0.260)
Conditional willingness to cooperate		3.605*** (1.195)	2.471 (1.658)	1.346 (1.062)	0.857 (1.063)	0.999 (1.052)
Conditional cooperation × Stranger			3.611* (1.939)	3.685*** (1.402)	3.477** (1.383)	3.324** (1.364)
Belief about group members' contribution				1.418*** (0.069)		0.967*** (0.082)
Group members' contributions precedent round					1.431*** (0.076)	0.603*** (0.097)
Round	-1.465*** (0.120)	-1.457*** (0.119)	-1.458*** (0.119)	-0.378*** (0.073)	-0.169** (0.080)	-0.116 (0.074)
Constant	7.100*** (1.330)	5.038*** (1.635)	5.931*** (1.884)	-7.244*** (1.395)	-7.161*** (1.244)	-8.977*** (1.272)
# Observations	3,360	3,360	3,360	3,360	3,024	3,024
McFadden's Pseudo R^2	0.030	0.034	0.035	0.119	0.094	0.115

Notes: Robust and clustered standard errors of 84 groups (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

Experimental instructions

(English translation, the original instructions were given in German. Part 1, part 2, and part 3 were distributed among subjects consecutively after the preceding part of the experiment was finished.

Note: The experiment consisted of two more tasks which were conducted after the tasks used for this paper. The additional two tasks are not related to the research question addressed in this paper)

Part 1: Experimental Instruction

Welcome and thank you for participating in this experiment. If you read the following instructions carefully, you can, depending on your decisions, earn a considerable amount of money. It is therefore very important that you read these instructions with care.

The instructions which we have distributed to you are solely for your private information. It is prohibited to communicate with the other participants during the experiment. Please make sure that you switched off your mobile devices. Should you have any questions, please ask us. If you violate this rule, we shall have to exclude you from the experiment and from all payments.

During the experiment, we will not speak of Euros but rather of points. During the experiment your entire earnings will be calculated in ECU (Experimental Currency Units). At the end of the experiment the total amount of ECUs you have earned will be converted to Euros at the following rate:

1 ECU = 0.15 €

Your earning plus a show-up fee of 3 Euros will be paid in cash to you after the experiment.

Nobody will learn about your earnings or your decisions. Please do also not discuss your decisions with other participants after the experiment.

The decision situation

You will learn later on how the experiment will be conducted. We first introduce you to the basic decision situation. At the end of the description of the decision situation, you will find control questions that will help you to gain an understanding of the decision situation.

You will be **a member of a group of 4 people**. Each member has to decide on the division of 20 ECUs. You can put these 20 ECUs on a private account or you can invest them fully or partially into a project. Each ECU you do not invest into the project will automatically be transferred to your private account.

Your income from the private account

For each ECU you put on your private account you will earn exactly one point. For example, if you put twenty ECUs on your private account (which implies that you do not invest anything into the project) you will earn exactly twenty ECUs from the private account. If you put 6 ECUs into the private account, you will receive an income of 6 ECUs from the private account. **Nobody except you** earns something from your **private** account.

Your income from the project

From the ECU amount you invest into the project each group member will get the same payoff. Of course, you will also get a payoff from the ECUs the other group members invest into the project. **Each ECU that is invested into the project will be multiplied by 1.6 and be equally distributed among all members of a group**. That means that for each ECU invested in the project every member earns 0.4 ECUs, no matter which member of the group invested the ECU. For each group member the income from the project will be determined as follows:

***Income from the project = sum of contributions to the project* x 0.4**

For example, if the sum of all contributions on the project is 60 ECUs, then you and all other group members will get a payoff of 60 x 0.4 = 24 ECUs from the project. If the four group members together contribute 10 ECUs to the project, you and all others will get a payoff of 10 x 0.4 = 4 ECUs from the projects.

Your total income

Your **total income** results from the **sum** of your income from the **private account** and your income from the **project**.

Income from the private account (= 20 – Contribution to the project) + Income from the project (= 0.4 x Sum of contributions to the project) = Total income

Control questions

Please answer the following control questions. Their purpose is to make you familiar with the calculation of the incomes that accrue from different decisions about the allocation of the 20 ECUS.

1. Each group member has 20 ECUs in his or her disposal. Assume that none of the four group members (including you) contributes anything to the project. What will your total income be?

____________ ECUs

What is the total income of the other group members?

_______________ECUs

2. Each group member has 20 ECUs at his or her disposal. Assume that you invest 20 ECUs into the project and each of the other group members also invests 20 ECUs. What will be your total income?

_____________ECUs

What is the total income of the other group members?

____________ECUs

3. Each group member has 20 ECUs at his or her disposal. Assume that the other three group members together contribute 30 ECUs to the project.

What is your total income if you – in addition to the 30 ECUs – contribute 0 ECUs to the project?

____________________ECUs

What is your total income if you – in addition to the 30 ECUs – contribute 15 ECUs to the project?

___________________ECU

If you finish these questions before the others, we advise you to think about the additional examples to further familiarize yourself with the decision situation.

Part 2

This part of the experiment contains the decision situation that we have just described to you. At the end of the experiment you will get paid according to the decisions you make in this experiment. The experiment will only be conducted **once**.

As you know you will have 20 ECUs at your disposal. You can put them into a private account or you can invest them into a project. In this experiment each subject has to make **two types of decisions**. In the following we will call them **“unconditional contribution“** and **“contribution table“**.

“Unconditional contribution“

With the unconditional contributions to the project you have to decide how many of the 20 ECUs you want to invest into the project.

After you have determined your unconditional contribution you press the “OK”-button.

“Contribution table“

Your second task is to fill out a “contribution table“. In the contribution table you have to indicate for each possible average contribution of the other group members (rounded to the next integer) how many ECUs you want to contribute to the project. You can condition your contribution on the contribution of the other group members.
The numbers next to the input boxes are the possible (rounded) average contribution of the other group members to the project. You simply have to insert into each input box how many ECUs you will contribute to the project – conditional on indicated average contribution. You have to make an entry into each input box. For example, you will have to indicate how much you contribute to the project if the others contribute 0 ECUs to the project, how much you contribute if the others contribute 1, 2 or 3 ECUs etc. In each input box you can insert all integer numbers from 0 to 20. If you have made an entry in each input box, press the “OK”-button.

Income

After all participants of the experiment have made an unconditional contribution and filled out their contribution table, in each group a random mechanism will select a group member.
For the randomly determined subject only the contribution only the contribution table will be the payoff-relevant decision. For the other three group members who are not selected by the random mechanism, only the unconditional contribution will be the payoff-relevant decision. When you make your unconditional contribution and when you fill out the contribution table you of course do not know whether you will be selected by the random mechanism. You will therefore have to think carefully about both types of decisions because both can become relevant for you.
The random selection of the participants will be implemented as follows. Each group member is assigned a number between 1 and 4. One individual will be randomly selected by the computer. For this individual, the chosen number in the contribution table will determine the pay off. For the other three (non-selected) individuals, the chosen number from the unconditional contribution will be relevant for the pay offs.

Please raise your hand if you have any questions about the experiment, we will then come to you to answer your questions. When no participant still has any questions we will start the computer program. Please wait quietly in your seat after you have made you decision as more tasks will follow shortly.

Part 3

In the following experiment you will again be asked to make a decision as described above. You will again have 20 ECUs at your disposal and you have to decide how much you want to contribute to the project. The ECUs that you do not invest will be transferred to your private account.
Your income will again be calculated as follows:

Income from your private account
(= 20 – contribution to the project)
+
Income from the project
(= 0.4 x Sum of contributions to the project)
=
Total income

The following experiment will be played for **10 rounds**. You will therefore be asked to decide on how to invest your 20 ECUs 10 times in a row.
Before part 2 starts, all groups will be recombined by a random mechanism. That means that
you will form a group with participants who you have not been in a group with before. A group consists of players A, B, C and D.
There are 2 types of group members: type X and type Y. Type X players will always stay in a group while a type Y players changes groups after each round. The screen will inform you about your own allocated type as well as the types of the other members in the group.

Please insert into each input box how many ECUs you want to invest into the project and press “OK” to confirm.
After each of your contribution decisions you will be asked to **estimate** how many ECUs each of your group members invested into the project.
The contribution table in which you will enter your estimates will look like this:

Player	A	B	C	D
Type of player	X	X	X	Y
Estimate	YOU	[ ]	[ ]	[ ]

In addition the program will indicate the average value of your estimates. Please confirm your estimates with “OK”.

If you make a good estimate, you will receive an income. This income is the result of 10 ECUs minus the deviation of your estimate and the actual average:

Income = 10 ECUs - |deviation|.

If your estimate was wrong by 10 ECUs or more, you will not receive any income. However, no ECUs will be taken from you, which implies that you cannot lose anything at this point.
Your income from the estimate will be transferred to your private account but you cannot invest these ECUs in the following rounds. Regardless of your estimate you will again have 20 ECUs in the next round that you can invest.
At the end of the second part a participant will randomly draw a piece of paper with a number between 1 and 10 from an urn. The number that is drawn indicates the round that will be payoff-relevant for this experiment. If for example a participant draws a piece of paper with the number “3” from the urn, your result from the third round is payoff-relevant.
Please raise your hand if you have any questions about the experiment, we will then come to you to answer your questions. When no participant still has any questions we will start the computer program. Please wait quietly in your seat after you have made you decision as more tasks will follow shortly.