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## Abstract

To examine the effect of group size on the stability of prosocial behavior we used standard one-shot public good experiments with two and four subjects, which were conducted repeatedly three times at intervals of one week. Partner and stranger treatments were employed to control for group composition effects. All the experiments were carried out without providing feedback and using a payment mechanism promoting stable behavior, which allows the referral of all observed differences in the dynamics of behavior to different group sizes. Our findings indicate that pairs are much better at establishing and stabilizing cooperation than groups of four. Unlike pairs, groups show very low contributions to the public good in the stranger treatment and a strong tendency to decrease cooperation in the partner treatment. The results in all treatments demonstrate that moral self-licensing is a stable pattern of behavior in dynamic social dilemma contexts.

JEL-Code: C910, C730.

Keywords: repeated public good experiments, partner versus stranger, group size effects, moral self-licensing.

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# 1 Introduction

In the last two decades experimental and theoretical work on "social preferences" has produced a vast number of interesting new insights. One of the focal points is the question of how to overcome the fundamental cooperation problem paradigmatically described by the prisoner's dilemma. Modern societies face this cooperation problem in many variations and very important contexts. Environmental problems, the stability of democratic systems, or more generally, the pursuit of efficiency gains in situations characterized by the fundamental conflict between individually rational, selfish behavior and collectively rational (efficient) behavior, are examples of social dilemmas. These types of cooperation problems always affect groups of people and the size of these groups ranges from two to seven billion (in cases where the whole of mankind is involved in a global public good problem). We can characterize cooperative behavior as a person's willingness to sacrifice individual benefit for the sake of increasing the group's prosperity. Therefore, the opposite of cooperative behavior is the readiness to withhold contributions while at the same time accepting the share of benefits created by the other group members' sacrifices. Thus, a group's success in solving a cooperation problem depends crucially on the willingness of its members to forego their own payoffs and to behave unselfishly.

Krupka and Weber (2013) found that unselfish behavior can be interpreted as an attempt to follow a relevant context-specific moral norm. Evidence from neuroscience also supports the conjecture that complying with moral norms is beneficial to the decision maker even if it implies material sacrifices (de Quervain et al. (2004), Spitzer et al. (2007)). Although the willingness to follow a social norm may not be the sole reason for people behaving unselfishly, it is conceivable that cooperative behavior is driven by social norms at least to some extent. The standard experimental setting in which cooperation is studied is the public good game, which has been conducted with various group sizes ranging from two to one hundred (Weimann et al. (2014)).

Our hypothesis is that the readiness of subjects to behave unselfishly in a public good experiment depends (amongst other factors) on the strength of the social (cooperation) norm that is at work in the particular group. We further assume that the strength of the cooperation norm depends on group size, group composition and the nature of the intragroup relationship (anonymity, possibility to communicate, etc.). This follows from the idea that the tie between a single group member and the group on the whole is highly relevant for an individual's willingness to behave cooperatively. There is an abundance of evidence supporting this conjecture. Simple face-to-face communication, for example, yields a massive increase in cooperation in the context of public good dilemmas (Brosig et al. (2003)). Another example is given by Chen and Li (2009) who demonstrated that determining group membership by something as arbitrary as even or odd numbers drawn in a lottery creates a group identity effect that boosts cooperative behavior significantly.

In this paper we investigate the question of whether pairs develop stronger norms for cooperation and stable prosocial behavior over time than groups with more than two members. This question is particularly interesting because two-person relationships with recurring cooperation problems play an important and peculiar role in the life of human beings. In most societies, for example, a couple starts a family and the partners remain in a two-person relationship throughout their lives. Two-person interactions are also important in market interactions, where most exchanges are made between *two* parties, albeit in this context people usually interact with many different partners. A peculiar kind of symmetry is characteristic for *pairs*: the "rest of the group" is "worth" as much as oneself. Our conjecture is that these peculiarities of a two-person relationship should be exceptionally powerful in the context of cooperation problems. Evidence for this conjecture can be taken from oligopoly experiments, which demonstrate that subjects in a duopoly situation are more likely to collude than subjects in markets of more than two firms (Fouraker and Siegel (1963), Holt (1995), Huck et al. (2004), Potters and Suetens (2013)). Marwell and Schmidt (1972) observed a higher degree of cooperation in pairs than in groups of three in the context of n-person prisoner's dilemma experiments. Nosenzo et al. (2013) conducted public good experiments with varying group size and reported that the average contribution to the public good is highest for pairs, followed by groups of four, three and eight. In the scope of our hypothesis, these findings suggest that the moral norm dictating cooperative behavior is relatively stronger in pair relationships than in groups of more than two members.

Despite these findings we cannot be sure that a stronger behavioral norm is indeed responsible for the high level of cooperation in pairs. The reason is that a variation of group size in cooperation dilemmas also forces an adjustment of other potentially relevant parameters in such a way that group size effects cannot easily be identified. In this study our aim was to design an experimental setup that would allow us to isolate the *pair effect* on cooperation as much as possible. To achieve this we used payoff functions for two (pair) and four (group) subjects playing standard linear public good experiments that are unlikely to cause differences in the cooperation levels in groups and pairs. We applied these payoff functions in a one-shot public good game that was used as a calibration device. In this way we were able to check the cooperation level of groups and pairs in order to establish a benchmark for the willingness to cooperate in both groups (2 and 4 subjects). Our research strategy was to carry out further treatments in which two possible effects influencing the willingness to cooperate are given some leeway, and to check whether or not these effects work similarly in groups and pairs.

First, we repeated the experiment three times with a time span of one week between repetitions (*waves*). As will be explained in detail in chapter two, the design of the experiments rules out any cause for behavioral dynamics except the *moral self-licensing* effect. This effect describes peoples' tendency to license themselves to behave more self-servingly after having behaved unselfishly previously (e.g. see Merritt et al. (2010) for a survey). Our conjecture is that if the social norm for cooperation in pairs is stronger than in groups, the moral self-licensing effect should be stronger in groups compared to pairs. Therefore, compared to the benchmark (the first one-shot experiment in the series of four waves), the contributions in the groups should decrease more strongly in the subsequent waves than in the pairs.

Second, we conducted each series of experiments in a partner and a stranger treatment. In the partner treatment, group/pair composition did not change over the course of the four waves, whereas in the stranger treatment our main participants were matched with three/one freshly recruited new subject(s) in each wave. It is conceivable that the group bonding and the resulting behavioral norm to contribute to the public good is slightly less strong in the stranger treatments. Thus, employing a partner vs. stranger design enabled us to vary the cooperation norm described above. Once again, the comparison with the benchmark treatment (partner, first of four waves) shows us where the easing of the cooperation norm has a stronger effect. Our conjecture is that subjects in pairs feel a stronger obligation to cooperate than subjects in groups even if they are matched with a newly recruited subject in each wave.

There is also another reason for conducting repeated experiments at considerably large time intervals between repetitions. When learning effects are irrelevant, it is conceivable that people behave identically in identical decision situations. In a number of recent studies this hypothesis was tested and rejected (Brosig et al. (2007), Sass et al. (2015), Sass and Weimann (2015), Schmitz (2013)). Sass and Weimann (2015) conducted a series of repeated trust game and mutual gift-giving game experiments and found strong evidence for a moral self-licensing effect. Sass et al. (2015) also reported evidence for self-licensing in the context of repeated dictator game experiments and showed that the resulting behavioral pattern is in fact covered by a social norm: those who act unselfishly are indeed "allowed" to behave more self-servingly the next time (as measured with Krupka and Weber's norm elicitation mechanism (2013)). The question we address here is whether moral self-licensing can also be found in public good experiments. This is a very important question because in real life, cooperation is very often not a one-shot task but a repeated game with considerable time between repetitions. If moral self-licensing takes place in this context, it follows that the cooperation we observe in non-repeated standard public good experiments is the upper bound of cooperation we could expect.

Chapter 2 provides a detailed explanation of our experimental design and exemplifies each aspect with respect to our research question. The results of our experiments are reported in chapter 3 and discussed in chapter 4.

## 2 Experimental Design

Public good games are the ideal means of creating a cooperation dilemma in the laboratory. We employed such a setup in this study using a voluntary contribution mechanism with a standard linear payoff function (see, e.g., Isaac et al. (1984)). Subjects are either interacting in pairs (N = 2) or groups (N = 4) with each subject receiving a monetary endowment of EUR 10. Subjects then decide on the fraction of the endowment they wish to contribute to a public account. The amount of money that is *not* contributed to the public account is paid out to the subjects at a rate of 1:1. For each EUR 1 contributed to the public account, each of the 2 (4) group members receives a payoff of EUR 0.80 (EUR 0.40). This individual return from contributing to the public account is called MPCR (marginal per capita return). The cooperation dilemma arises because the MPCR is smaller than the private return of not contributing (1 > 0.8 and 1 > 0.4), while at the same time N x MPCR is larger than the private return (2 x 0.8 > 1 and 4 x 0.4 > 1). Rational payoff-maximizing subjects will therefore not contribute to the public account, while total return to the group is maximized by contributing the entire endowment. Contributing is thusly interpreted as cooperative, prosocial behavior.

The individual payoff function for subject $i$ in EUR is given by:

$$\text{N=2:} \quad \pi_i = (10 - x_i) + 0{,}8 \sum_{j=1}^{2} x_j \qquad (1)$$

$$\text{N=4:} \quad \pi_i = (10 - x_i) + 0{,}4 \sum_{j=1}^{4} x_j, \qquad (2)$$

where $x_i$ denotes the amount of money contributed to the public account. (1) and (2) do not only differ with respect to group size, but also with respect to the MPCR. The MPCRs are chosen in a way that the extent of the efficiency gain from contributing to the public account is identical in both treatments (2 x 0.8 = 4 x 0.4). However, the private costs of contributing (1 – MPCR) are higher for N = 4 than for N = 2. On the other hand, leveling the private costs of contribution between treatments would lead to a significant difference with respect to the efficiency gain of contribution. Because of the interaction of group size, the MPCR and the effectiveness of contribution and the costs of contribution, it is not possible to create two or more treatments in a public good experiment that solely differ with respect to group size. While we cannot rule out that the lower costs of contribution do have a positive impact on the behavior of the pairs, Weimann et al. (2014) showed that even with very high cooperation costs (MPCR = 4 % of private return), high cooperation levels occur. This suggests that the level of the private costs of contributing to a public good appear to be relatively unimportant for the occurrence of prosocial behavior in public good experiments. Since our conjecture is that the stronger social norms developed in pairs lead to a stabilization of cooperative behavior, we are primarily interested in the behavioral dynamics. Thus, if contribution declined because of the moral self-licensing effect, the decay should appear stronger in groups than in pairs. To examine the behavioral dynamics over time, our experiments were repeated three times at intervals of one week between each *wave*.

The key feature of our design is a series of four *identical* one-shot experiments. Subjects live through the entire experience of taking part in an experiment in each wave, which includes coming to the laboratory, reading instructions and making choices within the very same decision context each time. The benefit of such a setup is that subjects are more likely to perceive all the experiments as completely independent events as compared to a setup where the same decision is made repeatedly within a single session. The downside is a loss of control, because we cannot know whether or not behavior is influenced by events happening outside the laboratory between waves. Under the premise that potentially relevant effects happen randomly, we therefore concentrated on treatment effects when interpreting our results.

All experiments were conducted at the MaXLab (Otto-von-Guericke-University of Magdeburg). ORSEE (Greiner (2004)) and hroot (Bock et al. (2012)) were used for the recruitment of subjects. In the invitation, subjects were asked to commit for the total duration of the series of experiments if they wished to participate and told that failure to show up for any wave would result in all earnings from the experiment being forfeited. Subjects were not told that they were to face the same decision situation in each wave.

In order to rule out systematic effects on behavior due to subjects discussing the experiments with each other, every subject was assigned an individual meeting point inside the faculty building, picked up by an experimenter and escorted to the laboratory. Subjects were then led into individual soundproof and opaque booths. After the end of each wave, all subjects left the laboratory on their own. This procedure ruled out the possibility that two subjects learned about each other's participation in the same experiment.

To avoid confusion on the subjects' behalf with regard to the actual public good game, every participant had to complete a set of control questions before the start of each experiment (see Appendices B1, B2). The experiments only started after each subject had answered all control questions correctly.

A total of four treatments were conducted. In the partner treatments, which were conducted for both N = 2 and N = 4, the composition of pairs and groups never changed over the course of the experiment. This was made known to all subjects through written instructions (see Appendices A1-A4). However, subjects never learned the identity of the other participants, which ensured total anonymity. In the stranger treatments, which were also conducted for both N = 2 and N = 4, the main participants who took part in all four waves were matched with freshly recruited new subjects in each wave. These subjects could only take part once and this was also made known to the main participants through written instructions. In contrast to other well-known experiments from the literature, we did not employ a partner vs. stranger design based on random rematching after each round of play, but instead recruited completely new subjects for each new wave. Total anonymity was ensured for everybody involved in the stranger treatments as well. Table 1 lists all treatments including the number of participants in all treatments and average earnings per wave.

| | | Group composition | |
|---|---|---|---|
| | | Partner treatments | Stranger treatments |
| Group size | N = 2 | Independent observations: 22<br>Ø Earnings per wave: EUR 12.71 | Independent observations: 24<br>Ø Earnings per wave: EUR 13.13 |
| | N = 4 | Independent observations: 25<br>Ø Earnings per wave: EUR 11.75 | Independent observations: 21<br>Ø Earnings per wave: EUR 13.09 |

Table 1: Treatment overview

In each wave a full set of conditional preferences was elicited from the subjects by using Selten's strategy elicitation method (1967). In the partner treatments we adopted the elicitation mechanism introduced for public good experiments by Fischbacher et al. (2001). The mechanism consists of two tasks. In the direct response task, subjects indicate their *unconditional* decision with respect to the amount of money contributed to the public account. In the second task, subjects indicate their preferred choices *conditional* upon the other subject's contribution (N = 2) or the other group members' average contribution (N = 4) accordingly. This second task requires eleven choices to be made, one for each possible level of (average) contribution chosen by the other subject (other group members) in the direct response task. In each treatment (N = 2 and N = 4), one subject is randomly determined for whom the actual contribution level is taken from the conditional response task, while for the other subject (all other group members) the choice made in the direct response task is relevant to the payoff.

In the stranger treatments there is no need for the direct response task. Therefore, the main participants only submit their set of conditional preferences with respect to the direct responses made by the freshly recruited subjects they are matched with in that particular wave. In any treatment, data collection is conducted with pencil & paper (see Appendices A1-A4).

In none of the treatments do the subjects learn the outcome of the experiment immediately after each wave. All information is only revealed after the end of the final wave. This procedure has many important advantages in regard to our research strategy. First of all, it rules out effects due to reputation building. Subjects also cannot learn the relevant moral norm through observation of other subjects' choices. Furthermore, subjects cannot update their beliefs based on the other subjects' behavior. This is a necessary pre-condition for exercising imperfect conditional preferences, which have shown to be a relevant factor in the context of public good experiments by Fischbacher and Gächter (2010). In combination with employing the strategy elicitation method, withholding feedback until after the end of the last experiment also rules out several other effects that are discussed in the literature with respect to cooperation levels and group size. Punishment, for example, is not possible and also the "bad apple" hypothesis (see, e.g., Gino (2009)) is rendered irrelevant, since bad apples do not become salient and preferences are stated conditionally anyway.

Withholding feedback necessarily requires withholding payment after each wave as well, since the amount of money paid out would otherwise serve as indirect feedback. For this reason, subjects are paid only after the end of the final wave. In doing so, we employed the following payment mechanism: subjects do not receive the sum of earnings from all waves, but instead receive the earnings from a randomly determined wave, which is multiplied by four. This mechanism rules out portfolio choices and increases the validity of our findings because the mechanism provides an incentive for stable behavior to risk-averse subjects.[1] A side benefit of this payoff mechanism is the credible threat of all earnings being forfeited in the case of failure to show up for one of the experiments. This resulted in a very low number of no-shows, which in turn rules out possible selection biases.

To summarize, by employing the strategy method, withholding feedback and using a payment mechanism promoting stable behavior, all possible causes for changing prosocial behavior except moral self-licensing were ruled out. Our hypothesis is that the moral norm for prosocial behavior is stronger in *pairs* than in *groups* of four. We therefore expect more stable behavior in pairs than in groups.

## 3 Results

Figures 1-4 show the extent of conditional cooperation over the course of the four waves in all four treatments of our experiment. Figure 5 summarizes the average conditional cooperation in all 16 waves of our experiment.

The results are very conclusive. Focusing on our benchmark, which was the first wave of the partner experiments, we found that the extent of prosocial behavior was almost identical in both partner treatments (EUR 3.60 contributed to the public account is the average level for N = 2, EUR 3.62 is the average for N = 4, see Table 2a for statistical significance). While cooperation levels in the first wave of the stranger experiments did not differ between the two N = 2 treatments (Table 2c), we found that cooperation was significantly weaker in the stranger condition of the two N = 4 treatments (Table 2d). When subjects in groups knew that they would be matched with freshly recruited new subjects in the next waves, the extent of prosocial behavior in the first wave was much smaller than in the partner treatment (EUR 3.62 in the partner treatment and EUR 2.04 in the stranger treatment).

| | Ø = 0 | Ø = 1 | Ø = 2 | Ø = 3 | Ø = 4 | Ø = 5 | Ø = 6 | Ø = 7 | Ø = 8 | Ø = 9 | Ø = 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|

[1] We tested this stabilizing effect with a series of four repeated dictator game experiments at intervals of one week, once using the payoff mechanism described above and once paying subjects immediately after each wave. Prosocial behavior was indeed significantly more stable when the payoff mechanism “one out of four” was used.

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a) | N=2 partner vs. N=4 partner | .869 | .789 | .406 | .149 | .389 | .333 | .679 | .862 | .957 | .905 | .212 |
| b) | N=2 stranger vs. N=4 stranger | .196 | .313 | .298 | .009 | .046 | .016 | .040 | .027 | .108 | .118 | .031 |
| c) | N=2 partner vs. N=2 stranger | .686 | .560 | .536 | .332 | .536 | .775 | .599 | .780 | .425 | .328 | .455 |
| d) | N=4 partner vs. N=4 stranger | .404 | .430 | .162 | .001 | .010 | .001 | .001 | .008 | .007 | .021 | .109 |

Table 2: Statistical significance for pairwise comparisons of first wave behavior
(Mann-Whitney U tests)

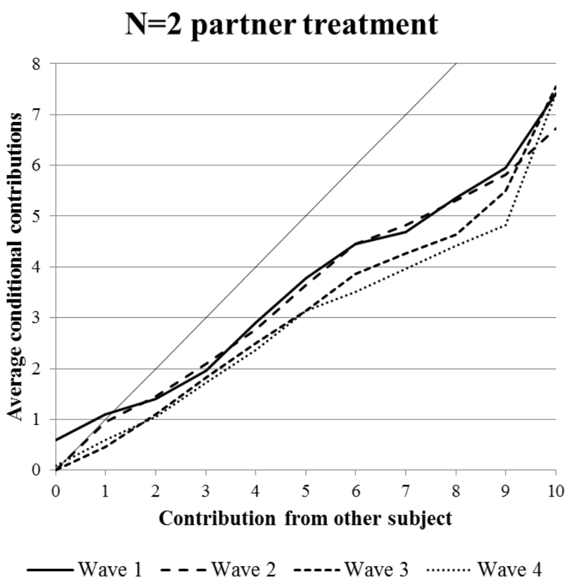


Figure 1: Results N = 2 partner treatment

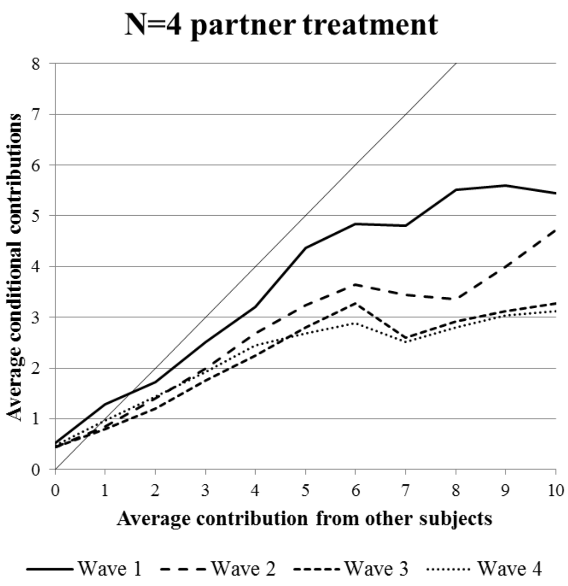


Figure 2: Results N = 4 partner treatment

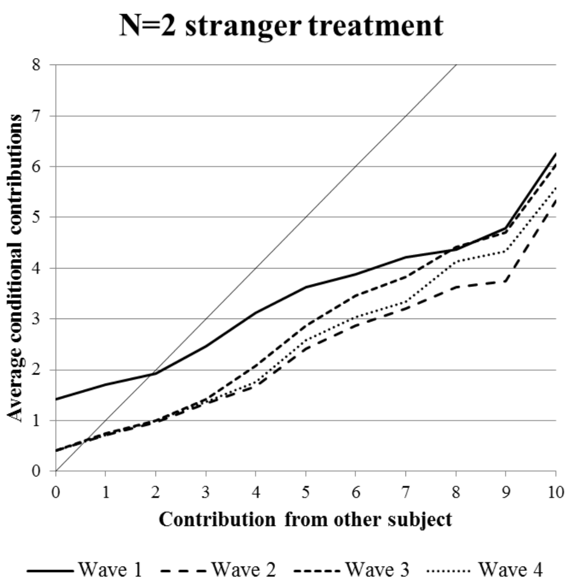


Figure 3: Results N = 2 stranger treatment

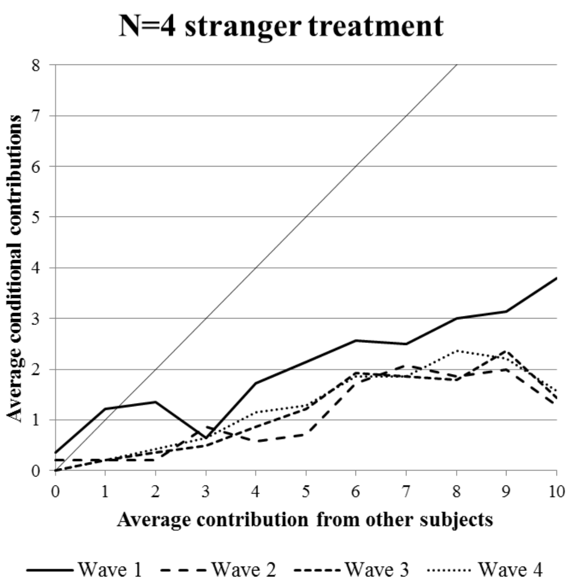


Figure 4: Results N = 4 stranger treatment

It is worthwhile noting that the low extent of cooperative behavior in the first wave of the N = 4 stranger treatment cannot be explained by the lack of opportunity for reputation building because attempts to trigger high cooperation through one's own substantial sacrifices are also ruled out in the N = 4 partner treatment by withholding feedback. It can be concluded that a lesser extent of bonding lowers the willingness to cooperate in the N = 4 stranger treatment. Contrarily, no such partner vs. stranger effect can be found in the N = 2 treatment, which indicates a strong bond in pairs regardless of group composition.

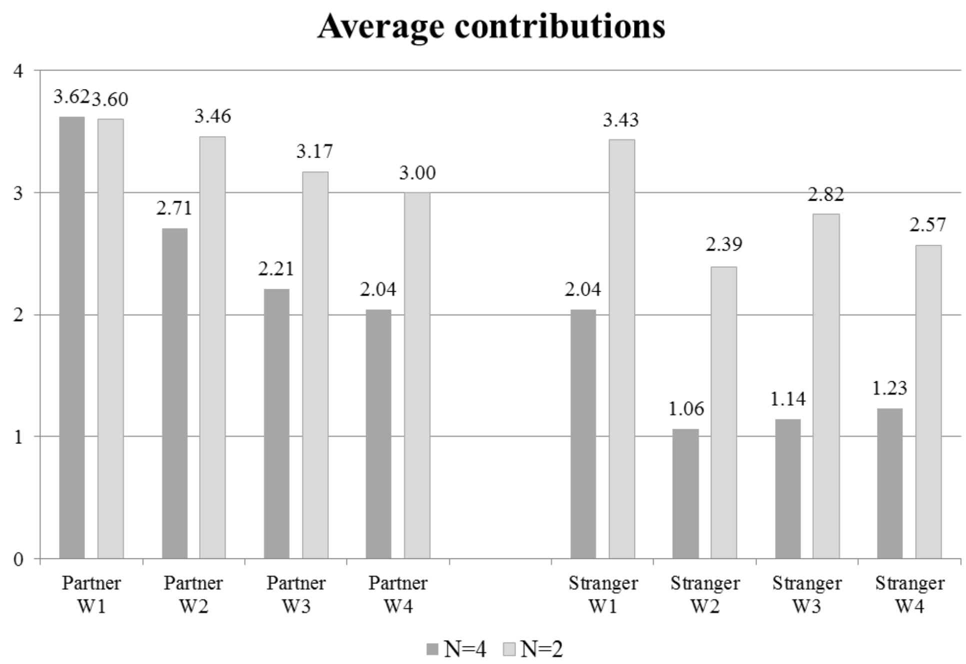


Figure 5: Average contributions in all treatments

Regarding the behavioral dynamics, we observed a monotonous but statistically insignificant and economically negligible decline in prosocial behavior over time in the N = 2 partner treatment (Table 3f) as the average contribution dropped from EUR 3.60 in the first wave to EUR 3.00 in the fourth wave. In stark contrast, cooperative behavior in the N = 4 partner treatment declined substantially by 39 percent from the first wave to the last wave (from EUR 3.62 to EUR 2.21). The decline over time is statistically significant (Table 4f) and is most pronounced from the first to the second wave (EUR 3.62 to EUR 2.71, Table 4a). The later decline in the third and fourth waves is also insignificant (Tables 4b, 4c). The results show that pairs achieve much more stable cooperation than groups in the partner treatment condition, indicating a stronger moral norm demanding stable cooperation in pairs than in groups.

| | | ∅ = 0 | ∅ = 1 | ∅ = 2 | ∅ = 3 | ∅ = 4 | ∅ = 5 | ∅ = 6 | ∅ = 7 | ∅ = 8 | ∅ = 9 | ∅ = 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a) | W1 vs. W2 | .084↓ | .894 | .985 | .741 | .753 | .985 | .769 | .741 | .752 | .504 | .900 |
| b) | W2 vs. W3 | 1.000 | .099↓ | .259 | .171 | .095↓ | .052↓ | .015↓ | .046↓ | .026↓ | .123 | .900 |
| c) | W3 vs. W4 | .317 | .306 | .961 | .961 | .755 | .478 | .851 | .859 | .828 | .927 | .602 |
| d) | W1 vs. W3 | .084↓ | .091↓ | .805 | .898 | .714 | .476 | .426 | .663 | .448 | .917 | .721 |
| e) | W2 vs. W4 | .317 | .083↓ | .284 | .167 | .348 | .251 | .048↓ | .099↓ | .108 | .227 | .330 |
| f) | W1 vs. W4 | .528 | .579 | .791 | .844 | .475 | .638 | .402 | .454 | .329 | .541 | .491 |

↓ Statistically significant decline of prosocial behavior

Table 3: Statistical significance in the N = 2 partner treatment (Wilcoxon signed-rank test)

| | | ∅ = 0 | ∅ = 1 | ∅ = 2 | ∅ = 3 | ∅ = 4 | ∅ = 5 | ∅ = 6 | ∅ = 7 | ∅ = 8 | ∅ = 9 | ∅ = 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a) | W1 vs. W2 | .157 | .026↓ | .089↓ | .028↓ | .052↓ | .001↓ | .010↓ | .015↓ | .007↓ | .036↓ | .830 |
| b) | W2 vs. W3 | 1.000 | .564 | .207 | .432 | .233 | .141 | .204 | .070↓ | .596 | .368 | .078↓ |
| c) | W3 vs. W4 | .977 | .548 | .328 | .641 | .632 | .957 | .844 | .712 | .655 | .986 | .564 |
| d) | W1 vs. W3 | .157 | .008↓ | .016↓ | .009↓ | .003↓ | .000↓ | .004↓ | .001↓ | .003↓ | .005↓ | .144 |
| e) | W2 vs. W4 | .977 | .966 | .655 | .681 | .426 | .418 | .169 | .066↓ | .238 | .257 | .219 |
| f) | W1 vs. W4 | .580 | .069↓ | .075↓ | .015↓ | .017↓ | .003↓ | .002↓ | .002↓ | .003↓ | .016↓ | .139 |

↓ Statistically significant decline of prosocial behavior

Table 4: Statistical significance in the N = 4 partner treatment (Wilcoxon signed-rank test)

This conjecture is backed up by the behavioral dynamics in the stranger treatments. In both the pairs and the groups, contribution to the public account declined strongly and significantly from the first wave to the second wave (Tables 5a, 6a). However, it should also be noted that the decline was more pronounced in the N = 4 stranger treatment (48 percent) than in the N = 2 condition (30 percent). Neither the third or fourth wave differed significantly from the second wave in the N = 2 or the N = 4 stranger treatments (Tables 5b, 5e and Tables 6b, 6b respectively). This indicates that moral self-licensing also becomes a factor in pairs when there is a new partner in the next wave to cooperate with. Strictly taken, however, pairs maintained a significantly higher level of cooperation than groups in which cooperation was extremely weak through waves two to four.

| | | ∅ = 0 | ∅ = 1 | ∅ = 2 | ∅ = 3 | ∅ = 4 | ∅ = 5 | ∅ = 6 | ∅ = 7 | ∅ = 8 | ∅ = 9 | ∅ = 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a) | W1 vs. W2 | .083↓ | .044↓ | .056↓ | .055↓ | .024↓ | .013↓ | .059↓ | .040↓ | .111 | .083↓ | .401 |
| b) | W2 vs. W3 | 1.000 | .564 | .965 | .655 | .150 | .275 | .060↑ | .072↑ | .091↑ | .145 | .307 |
| c) | W3 vs. W4 | 1.000 | .564 | 1.000 | .564 | .096↓ | .099↓ | .032↓ | .031↓ | .096↓ | .026↓ | .046↓ |
| d) | W1 vs. W3 | .083↓ | .084↓ | .065↓ | .039↓ | .091↓ | .114 | .575 | .432 | .656 | .471 | .728 |
| e) | W2 vs. W4 | 1.000 | 1.000 | .581 | .581 | .581 | .680 | .563 | .779 | .290 | .410 | .598 |
| f) | W1 vs. W4 | .083↓ | .027↓ | .037↓ | .034↓ | .014↓ | .057↓ | .209 | .160 | .459 | .311 | .643 |

↓ Statistically significant decline of prosocial behavior, ↑ Statistically significant increase of prosocial behavior

Table 5: Statistical significance in the N = 2 stranger treatment (Wilcoxon signed-rank test)

| | | Ø = 0 | Ø = 1 | Ø = 2 | Ø = 3 | Ø = 4 | Ø = 5 | Ø = 6 | Ø = 7 | Ø = 8 | Ø = 9 | Ø = 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a) | W1 vs. W2 | .604 | .026↓ | .026↓ | .959 | .009↓ | .123 | .155 | .133 | .070↓ | .181 | .491 |
| b) | W2 vs. W3 | .157 | 1.000 | .317 | .046↓ | .046↑ | .895 | .589 | .416 | .547 | .834 | .631 |
| c) | W3 vs. W4 | 1.000 | 1.000 | .564 | .545 | .622 | .672 | .786 | .277 | .323 | .414 | 1.000 |
| d) | W1 vs. W3 | .3173 | .026↓ | .026↓ | .046↓ | .368 | .450 | .303 | .103 | .087↓ | .408 | .200 |
| e) | W2 vs. W4 | .157 | 1.000 | .545 | .106 | .166 | .251 | .296 | .747 | .240 | .468 | .446 |
| f) | W1 vs. W4 | .317 | .026↓ | .026↓ | .213 | .600 | .508 | .453 | .587 | .719 | .139 | .050↓ |

↓ Statistically significant decline of prosocial behavior, ↑ Statistically significant increase of prosocial behavior

Table 6: Statistical significance in the N = 4 stranger treatment (Wilcoxon signed-rank test)

Thus far the results support our hypotheses:

1. Despite having designed the experiment in a way that promotes stable behavior, we generally find declining prosocial behavior in all treatments. This is in favor of the existence of the moral self-licensing effect.
2. There is a strong norm demanding subjects to engage in cooperative behavior in the first wave. Under partner conditions this norm is similar in groups and pairs. Under stranger conditions this norm is stronger in pairs.
3. The norm mentioned in 2 apparently allows pairs a much more stable cooperation over time in both the partner and the stranger treatment.

We shall note another observation backing up our findings up to this point. Examining the behavioral dynamics in Figures 1-4, we find that in the N = 4 treatments, contributions in six cases (waves two to four in both the stranger and the partner treatment) do not increase any further when the average contribution from the other group members is ≥ EUR 6. Conditional responses to an average cooperation level ≥ EUR 6 are constant at approximately EUR 3 in the partner treatment and approximately EUR 2 in the stranger condition. Contrarily, contribution in the pair treatments is also positively correlated with a high average contribution from the partner in each of the eight waves in the N = 2 treatments (Table 7).

| | Wave 1 | Wave 2 | Wave 3 | Wave 4 |
|---|---|---|---|---|
| N=2 Stranger | .909** | .912** | .961*** | .966*** |
| N=2 Partner | .959*** | .985*** | .930** | .898** |
| N=4 Stranger | .938** | -.467 | -.237 | -0.116 |
| N=4 Partner | .815* | .776 | .286 | .676 |

*** p < .01; ** p < .05; * p < .1

Table 7: Correlation of average conditional contribution and contribution from other group member(s) when contribution from other group member(s) ≥ 6

This allows the conclusion that members of a group of four are much more willing to engage in uncooperative behavior than partners in pairs. Choosing low levels of contribution in cases of high contribution by others underlines a strong readiness to benefit from the other group members' sacrifices without contributing to the cause oneself. This particular behavior is prevalent in those waves where we suspected a weak cooperation norm and moral self-licensing to be particularly relevant.

# 4 Discussion

Two main conclusions can be taken from this study. First, moral self-licensing was once again found to trigger a behavioral pattern of declining prosocial behavior also reported in other contexts where cooperative or altruistic behavior plays an important role (Sass and Weimann (2015) and Sass et al. (2015)). The extent of prosocial behavior found in non-repeated experiments should therefore be seen as the *upper bound* of cooperative behavior. In real world situations, where people are repeatedly put in similar cooperation dilemma contexts, moral self-licensing needs to be accounted for.

Second, the mechanics of cooperation in pairs differ significantly from those in groups. The peculiar characteristics of two-person interactions highlighted in the introduction apparently promote stable cooperative behavior. Our results are in line with findings recently reported by Nosenzo et al. (2013) who also found that cooperation in their public good experiments was strongest for N = 2, followed by N = 4 and N = 3.

Weimann et al. (2014) showed in a recent study that the so-called *MPCR-distance* $(d)$, which measures the salience of a cooperation dilemma, is a crucial parameter in explaining the level of cooperation in public good experiments. $d$ is defined as the difference between the actual MPCR chosen in the experiment and the minimal MPCR necessary to create a cooperation dilemma. Where $p$ denotes the private return of *not* contributing to the public account and $N$ denotes the number of group members, a public good cooperation dilemma occurs only if $MPCR > p/N$. MPCR-distance is thus defined as $d = MPCR - p/N$. Weimann et al. (2014) showed that in experiments with large groups (N = 60; N = 100), a sufficiently high salience triggers cooperative behavior in the first round of standard public good experiments even when the MPCR is very small and the private costs of contribution are very high ($p = 1$, *MPCR = 0.04*). Applying this explanation of first round contributions to the experiments conducted by Nosenzo et al. (2013) it turns out that the MPCR-distance explains the first round contributions quite well – except in the case of N = 2 (see Table 8 and Figure 6).

| Treatment | Group size | min MPCR necessary for public good dilemma (*p* normalized to 1) | Actual MPCR used in treatment | MPCR-distance *d* | 1st round contribution (percentage of endowment) |
|---|---|---|---|---|---|
| Low 4 | 4 | .25 | .30 | .05 | .40 |
| Low 8 | 8 | .125 | .30 | .175 | .52 |
| High 2 | 2 | .50 | .75 | .25 | .78 |
| High 4 | 4 | .25 | .75 | .5 | .72 |
| High 8 | 8 | .125 | .75 | .625 | .72 |

Table 8: Treatments, MPCR-distances and (first round) contribution levels in Nosenzo et al. (2013)

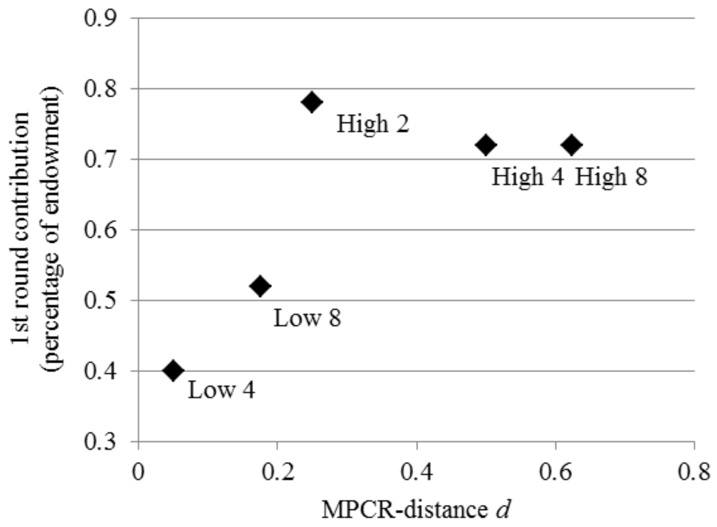


Figure 6: Treatments, MPCR-distances and (first round) contribution levels in Nosenzo et al. (2013)

A positive but decreasing effect of dilemma salience on (first round) contribution to the public good reported by Weimann et al. (2014) is also found in Nosenzo et al. (2013). The only treatment not quite in line with all other treatments is *High 2* where N = 2. Salience in this treatment is smaller than in both *High 4* and *High 8*, yet the cooperation level in *High 2* exceeds the cooperation achieved in the other two treatments.

We can only speculate on the underlying foundations of pairs being able to achieve and maintain such high levels of cooperation. One might reason, for example, that people, who constantly experience and therefore learn the mutual benefits of anonymous two-person trade interactions typical for market-oriented economies, internalize a behavioral norm demanding cooperation in other contexts as well. Irrespective of whether or not such an explanation is indeed true, our findings illustrate that partners in pairs achieve cooperation quite successfully, which in turn supports the hypothesis that institutional arrangements based on two-person interactions allow for particularly stable cooperation. We can therefore expect that market interactions can be functional even in the absence of regulative interventions designed to enforce cooperation.

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## Appendix A1: Instructions & data sheet N=4 partner treatment

***The following instructions are the English translation of the original German instructions. The original instructions are available from the corresponding author.***

- You will now take part in an experiment within the context of experimental economics. In this experiment you can earn money that will be paid out to you in cash at the end of the experiment. The amount of money depends on your decisions and the decisions of other subjects.
- The experiment has a duration of **four weeks**. The peculiarities that result from this experimental setup are explained in detail in the following instructions. Please read them carefully. Thank you!
- You and three other subjects are part of the following decision situation. You will be interacting with the **exact same three other subjects** each week. The other subjects' identities will not be revealed to you at any point in time. Likewise, your identity will not be revealed to the other subjects. Thus, the interaction is always completely anonymous.

**The decision situation of today's experiment**

- The decision situation is **completely symmetrical**, so the exact same information and choices are available to you and the other subjects.
- You and the other subjects each receive a monetary endowment of EUR 10.
- You and the other subjects each decide individually on how much of this endowment (integer values only) you wish to contribute to a public account for all four subjects. In the first step you will be asked to indicate this amount directly. In the second step you will be asked to indicate your preferred choice of contribution subject to the level of average contribution by the other three subjects (please also note the instruction on the data sheet).
- For each EUR 1 contributed by any group member to the public account, **every** group member will **each** receive a payoff of EUR 0.40. Each EUR 1 contributed to the public account thus yields a payoff of 4 x 0.40 EUR = EUR 1.60 to the group in total. Each group member will receive the same share of EUR 0.40.
- For each EUR 1 **not** contributed to the public account, you will receive EUR 1 at the end of the experiment.

- Each group member's individual payoff (in EUR) is thus calculated as follows:

  **10 – contribution to public account +**

  **0.40 x sum of all contributions to public account**

- **A few numeric examples**
  - The other three subjects contribute on average EUR 5 to the public account. You contribute EUR 3 to the public account. Total contribution to the public account is therefore 3 x EUR 5 + 1 x EUR 3 = EUR 18.
    - Your payoff: 10 – 3 + 0.40 x 18 = EUR 14.20
    - Average payoff to other subjects: 10 – 5 + 0.40 x 18 = EUR 12.20

  - All subjects (including you) contribute EUR 10 each to the public account. Total contribution to the public account is therefore 4 x EUR 10 = EUR 40.
    - Payoff to each subject: 10 – 10 + 0.40 x 40 = EUR 16

  - All subjects (including you) contribute EUR 0 each to the public account. Total contribution to the public account is therefore EUR 0.
    - Payoff to each subject: 10 – 0 + 0.40 x 0 = EUR 10

  - The other three subjects contribute EUR 10 each to the public account. You contribute EUR 0 to the public account. Total contribution to the public account is therefore 3 x EUR 10 + 1 x EUR 0 = EUR 30.
    - Your payoff: 10 – 0 + 0.40 x 30 = EUR 22
    - Payoff to other subjects: 10 – 10 + 0.40 x 30 = EUR 12

**Payment mechanism & feedback**

- You will receive **no information** on what the other subjects did until after the end of the four week experiment. The same applies to all other subjects.
- Likewise, you will not receive your payment until after the end of the experiment, i.e. you will only be paid when the final experiment is completed. The same applies to all other subjects.
- **At the end of the experiment you will not receive the sum of the earnings from all the individual weeks. Instead, an individual week will be randomly drawn to be**

**payoff relevant. The payment from that week will be multiplied by four and paid out to you in cash.**

- It is important to us that you show up for all four experiments. If you fail to show up for any of the experiments, you forfeit all earnings.
- Example 1:
  - You took part in all four weeks of the experiment. Your earnings were EUR 10 in week 1, EUR 14 in week 2, EUR 18 in week 3 and EUR 22 in week 4. The draw determines that you will be paid the earnings from week 3 multiplied by four. Your total payment in this illustrative example is thus 4 x EUR 18 = EUR 72.
- Example 2:
  - You took part in the first three weeks of the experiment, but you failed to show up in week 4. In this case, you forfeit all earnings. Your total payment in this illustrative example is thus EUR 0.

***The subjects filled out the following data sheet. Each data sheet contained a serial number, which made it possible to track the individual behavior of each participant over the course of the experiment.***

**Step 1**

Please indicate in this first step how much you wish to contribute to the public account: ________________________ EUR.

**Step 2**

Please now indicate your preferred choice of contribution to the public account subject to the average level of contribution to the public account by the other three subjects. In each case you can contribute any integer value ranging from EUR 0 to EUR 10 (0 and 10 included).

1. If the other three subjects contribute **EUR 0** on average, I contribute: ___________.
2. If the other three subjects contribute **EUR 1** on average, I contribute: ___________.
3. If the other three subjects contribute **EUR 2** on average, I contribute: ___________.
4. If the other three subjects contribute **EUR 3** on average, I contribute: ___________.
5. If the other three subjects contribute **EUR 4** on average, I contribute: ___________.
6. If the other three subjects contribute **EUR 5** on average, I contribute: ___________.
7. If the other three subjects contribute **EUR 6** on average, I contribute: ___________.
8. If the other three subjects contribute **EUR 7** on average, I contribute: ___________.
9. If the other three subjects contribute **EUR 8** on average, I contribute: ___________.
10. If the other three subjects contribute **EUR 9** on average, I contribute: ___________.
11. If the other three subjects contribute **EUR 10** on average, I contribute: ___________.

**Note regarding payoff calculation**: For 3 out of 4 group members, actual contribution to the public account is taken from the response made in step 1. For the randomly determined fourth group member, contribution is taken from the responses made in step 2. In doing so, the average contribution by the other three subjects from the step 1 responses (rounded to integers) is calculated. The fourth group member's contribution is then taken from the according response made in step 2. Example: The other three subjects contributed EUR 2 on average. In this case, the fourth group member's contribution is taken from row 3 of the step 2 responses ("3. If the other three subjects contribute EUR 2 on average …"). The total sum of contributions to the public account is then known and individual payoffs are calculated as explained in the instructions.

**Please note:** If we detect an inconsistency regarding your decisions in step 1 and step 2, you might be excluded from the experiment, in which case you also forfeit all earnings. Please make sure that your choices made in step 1 and step 2 do not contradict each other. Thank you!

## Appendix A2: Instructions & data sheet N=4 stranger treatment

***The following instructions are the English translation of the original German instructions. The original instructions are available from the corresponding author.***

- You will now take part in an experiment within the context of experimental economics. In this experiment, you can earn money that will be paid out to you in cash at the end of the experiment. The amount of money depends on your decisions and the decisions of other subjects.
- The experiment has a duration of **four weeks**. The peculiarities that result from this experimental setup are explained in detail in the following instructions. Please read them carefully. Thank you!
- You and three other subjects are part of the following decision situation. In each weak, you will be matched with three freshly recruited new subjects, who will only take part once in this experiment. Thus, you will be interacting with three freshly recruited new subjects in each weak. The other subjects' identities will not be revealed to you at any point in time. Likewise, your identity will not revealed to the other subjects. Thus, the interaction is always completely anonymous.

### The decision situation of today's experiment

- The decision situation is **completely symmetrical**, so the exact same information and choices are available to you and the other subjects.
- You and the other subjects each receive a monetary endowment of EUR 10.
- You and the other subjects each decide individually on how much of this endowment (integer values only) you wish to contribute to a public account of all four subjects. Each of the other subjects will indicate their choice directly. You on the other hand will be asked to indicate your preferred choice of contribution subject to the level of average contribution by the other three subjects (please also note the instructions on the data sheet).
- For each EUR 1 contributed by any group member to the public account, **every** group member will **each** receive a payoff of EUR 0.40. Each EUR 1 contributed to the public account thus yields a payoff of 4 x 0.40 EUR = EUR 1.60 to the group in total. Each group member will receive the same share of EUR 0.40.

- For each EUR 1 **not** contributed to the public account, you will receive EUR 1 at the end of the experiment.
- Each group member's individual payoff (in EUR) is thus calculated as follows:

**10 – contribution to public account +**

**0.40 x sum of all contributions to public account**

- **A few numeric examples**
    - The other three subjects contribute on average EUR 5 to the public account. You contribute EUR 3 to the public account. Total contribution to the public account thus is 3 x EUR 5 + 1 x EUR 3 = EUR 18.
        - Your payoff: 10 – 3 + 0.40 x 18 = EUR 14.20
        - Average payoff of other subjects: 10 – 5 + 0.40 x 18 = EUR 12.20

    - All subjects (including you) contribute EUR 10 each to the public account. Total contribution to the public account thus is 4 x EUR 10 = EUR 40.
        - All subject's payoff: 10 – 10 + 0.40 x 40 = EUR 16

    - All subjects (including you) contribute EUR 0 each to the public account. Total contribution to the public account thus is EUR 0.
        - All subject's payoff: 10 – 0 + 0.40 x 0 = EUR 10

    - The other three subjects contribute EUR 10 each to the public account. You contribute EUR 0 to the public account. Total contribution to the public account thus is 3 x EUR 10 + 1 x EUR 0 = EUR 30.
        - Your payoff: 10 – 0 + 0.40 x 30 = EUR 22
        - Payoff of other subjects: 10 – 10 + 0.40 x 30 = EUR 12

**Payment mechanism & feedback**

- You will receive **no information** on what the other subjects did until after the end of the four week long experiment.
- Likewise, you will not receive your payment until after the end of the experiment. Only after the end of the final experiment you will be paid.

- The other subjects receive their payment at the end of today's experiment, since (unlike you) they only take part once in this experiment.
- **At the end of the experiment, you will not receive the sum of the earnings from all the individual weeks. Instead, an individual week will be randomly drawn to be payoff relevant. The payment from that week will be multiplied by four and paid out to you in cash.**
- **It is important to us that you show up for all four experiments. If you fail to show up for any of the experiments, you forfeit all earnings.**
- Example 1:
  - You took part in all four weeks of the experiment. Your earnings were EUR 10 in week 1, EUR 14 in week 2, EUR 18 in week 3 and EUR 22 in week 4. The draw determines that you will be paid the earnings from week 3 multiplied by four. Your total payment in this illustrative example is thus 4 x EUR 18 = EUR 72.
- Example 2:
  - You took part in the first three weeks of the experiment, but you failed to show up in week 4. In this case, you forfeit all earnings. Your total payment in this illustrative example is thus EUR 0.

***The subjects filled out the following data sheet. Each data sheet contained a serial number, which made it possible to track individual behavior of each participant over the course of the experiment.***

Please now indicate your preferred choice of contribution to the public account subject to the average level of contribution to the public account by the other three subjects. In each case you can contribute any integer value ranging from EUR 0 to EUR 10 (0 and 10 included).

1. If the other three subjects contribute **EUR 0** on average, I contribute: ___________.
2. If the other three subjects contribute **EUR 1** on average, I contribute: ___________.
3. If the other three subjects contribute **EUR 2** on average, I contribute: ___________.
4. If the other three subjects contribute **EUR 3** on average, I contribute: ___________.
5. If the other three subjects contribute **EUR 4** on average, I contribute: ___________.
6. If the other three subjects contribute **EUR 5** on average, I contribute: ___________.
7. If the other three subjects contribute **EUR 6** on average, I contribute: ___________.
8. If the other three subjects contribute **EUR 7** on average, I contribute: ___________.
9. If the other three subjects contribute **EUR 8** on average, I contribute: ___________.
10. If the other three subjects contribute **EUR 9** on average, I contribute: ___________.
11. If the other three subjects contribute **EUR 10** on average, I contribute: ___________.

**Note regarding payoff calculation**: Unlike you, the other three subjects indicate their choice of contribution to the public account directly. The average contribution by the other three subjects (rounded to integers) is then calculated. Your contribution to the public account is then taken from the according response made in this data sheet.

Example: The other three subjects contributed EUR 2 on average. In this case, your response from row 3 is taken as your contribution ("3. If the other three subjects contribute EUR 2 on average …"). Total sum of contributions to the public account is then known and individual payoffs are calculated as explained in the instructions.

**Please note:** If we detect an inconsistency regarding your decisions in step 1 and step 2, you might be excluded from the experiment, in which case you also forfeit all earnings. Please make sure that your choices made in step 1 and step 2 do not contradict each other. Thank you!

## Appendix A3: Instructions & data sheet N=2 partner treatment

***The following instructions are the English translation of the original German instructions. The original instructions are available from the corresponding author.***

- You will now take part in an experiment within the context of experimental economics. In this experiment, you can earn money that will be paid out to you in cash at the end of the experiment. The amount of money depends on your decisions and the decisions of other subjects.
- The experiment has a duration of **four weeks**. The peculiarities that result from this experimental setup are explained in detail in the following instructions. Please read them carefully. Thank you!
- You and another subject are part of the following decision situation. You will be interacting with the **exact same other subject** in each week. The other subject's identity will not be revealed to you at any point in time. Likewise, your identity will not be revealed to the other subject. Thus, the interaction is always completely anonymous.

**The decision situation of today's experiment**

- The decision situation is **completely symmetrical**, so the exact same information and choices are available to you and the other subject.
- You and the other subject each receive a monetary endowment of EUR 10.
- You and the other subject each decide individually on how much of this endowment (integer values only) you wish to contribute to a public account of both subjects. In a first step, you will be asked to indicate this amount directly. In a second step, you will be asked to indicate your preferred choice of contribution subject to the level of contribution by the other subject (please also note the instructions on the data sheet).
- For each EUR 1 contributed by you or the other subject to the public account, **you and the other subject** will **each** receive a payoff of EUR 0.80. Each EUR 1 contributed to the public account thus yields a payoff of 2 x 0.80 EUR = EUR 1.60 to you and the other subject in total. Each subject will receive the same share of EUR 0.80.
- For each EUR 1 **not** contributed to the public account, you will receive EUR 1 at the end of the experiment.
- Individual payoff for you and the other subject (in EUR) is thus calculated as follows:

**10 – contribution to public account +**

**0.80 x sum of all contributions to public account**

- **A few numeric examples**
  - The other subject contributes EUR 5 to the public account. You contribute EUR 3 to the public account. Total contribution to the public account thus is EUR 5 + EUR 3 = EUR 8.
    - Your payoff: 10 – 3 + 0.80 x 8 = EUR 13.40
    - Others subject's payoff: 10 – 5 + 0.80 x 8 = EUR 11.40

  - Both you and the other subject contribute EUR 10 each to the public account. Total contribution to the public account thus is 2 x EUR 10 = EUR 20.
    - Your payoff and payoff of other subject: 10 – 10 + 0.80 x 20 = EUR 16

  - Both you and the other subject contribute EUR 0 each to the public account. Total contribution to the public account thus is EUR 0.
    - Your payoff and payoff of other subject: 10 – 0 + 0.80 x 0 = EUR 10

  - The other subject contributes EUR 10 to the public account. You contribute EUR 0 to the public account. Total contribution to the public account thus is EUR 10 + EUR 0 = EUR 10.
    - Your payoff: 10 – 0 + 0.80 x 10 = EUR 18
    - Others subject's payoff: 10 – 10 + 0.80 x 10 = EUR 8

**Payment mechanism & feedback**

- You will receive **no information** on what the other subjects did until after the end of the four week long experiment. The same applies to the other subject.
- Likewise, you will not receive your payment until after the end of the experiment. Only after the end of the final experiment you will be paid. The same applies to the other subject.
- **At the end of the experiment, you will not receive the sum of the earnings from all the individual weeks. Instead, an individual week will be randomly drawn to be**

**payoff relevant. The payment from that week will be multiplied by four and paid out to you in cash.**

- **It is important to us that you show up for all four experiments. If you fail to show up for any of the experiments, you forfeit all earnings.**
- Example 1:
    - You took part in all four weeks of the experiment. Your earnings were EUR 10 in week 1, EUR 12 in week 2, EUR 14 in week 3 and EUR 16 in week 4. The draw determines that you will be paid the earnings from week 3 multiplied by four. Your total payment in this illustrative example is thus 4 x EUR 14 = EUR 56.
- Example 2:
    - You took part in the first three weeks of the experiment, but you failed to show up in week 4. In this case, you forfeit all earnings. Your total payment in this illustrative example is thus EUR 0.

***The subjects filled out the following data sheet. Each data sheet contained a serial number, which made it possible to track individual behavior of each participant over the course of the experiment.***

**Step 1**

Please indicate in this first step directly, how much you wish to contribute to the public account: _________________________ EUR.

**Step 2**

Please now indicate your preferred choice of contribution to the public account subject to the level of contribution to the public account by the other subject. In each case you can contribute any integer value ranging from EUR 0 to EUR 10 (0 and 10 included).

1. If the other subject contributes **EUR 0**, I contribute: ____________.
2. If the other subject contributes **EUR 1**, I contribute: ____________.
3. If the other subject contributes **EUR 2**, I contribute: ____________.
4. If the other subject contributes **EUR 3**, I contribute: ____________.
5. If the other subject contributes **EUR 4**, I contribute: ____________.
6. If the other subject contributes **EUR 5**, I contribute: ____________.
7. If the other subject contributes **EUR 6**, I contribute: ____________.
8. If the other subject contributes **EUR 7**, I contribute: ____________.
9. If the other subject contributes **EUR 8**, I contribute: ____________.
10. If the other subject contributes **EUR 9**, I contribute: ____________.
11. If the other subject contributes **EUR 10**, I contribute: ____________.

**Note regarding payoff calculation**: For one subject, actual contribution to the public account is taken from the response made in step 1. For the other subject, contribution is taken from the responses made in step 2. It is randomly determined for which subject the responses made in step 1 are used for payoff calculation and for which subject the responses made in step 2 are used for payoff calculation.

**Please note:** If we detect an inconsistency regarding your decisions in step 1 and step 2, you might be excluded from the experiment, in which case you also forfeit all earnings. Please make sure that your choices made in step 1 and step 2 do not contradict each other. Thank you!

## Appendix A4: Instructions & data sheet N=2 stranger treatment

***The following instructions are the English translation of the original German instructions. The original instructions are available from the corresponding author.***

- You will now take part in an experiment within the context of experimental economics. In this experiment, you can earn money that will be paid out to you in cash at the end of the experiment. The amount of money depends on your decisions and the decisions of other subjects.
- The experiment has a duration of **four weeks**. The peculiarities that result from this experimental setup are explained in detail in the following instructions. Please read them carefully. Thank you!
- You and another subject are part of the following decision situation. In each weak, you will be interacting with a freshly recruited new subject in each week, who will only take part once in this experiment. Thus, you will be interacting with a different, new subject in each weak. The other subjects' identities will not be revealed to you at any point in time. Likewise, your identity will not be revealed to the other subjects. Thus, the interaction is always completely anonymous.

**The decision situation of today's experiment**

- The decision situation is **completely symmetrical**, so the exact same information and choices are available to you and the other subject.
- You and the other subject each receive a monetary endowment of EUR 10.
- You and the other subject each decide individually on how much of this endowment (integer values only) you wish to contribute to a public account of both subjects. The others subject will indicate his or her choice directly. You on the other hand will be asked to indicate your preferred choice of contribution subject to the level of contribution by the other subject (please also note the instructions on the data sheet).
- For each EUR 1 contributed by you or the other subject to the public account, **you and the other subject** will **each** receive a payoff of EUR 0.80. Each EUR 1 contributed to the public account thus yields a payoff of 2 x 0.80 EUR = EUR 1.60 to you and the other subject in total. Each subject will receive the same share of EUR 0.80.
- For each EUR 1 **not** contributed to the public account, you will receive EUR 1 at the end of the experiment.

- Individual payoff for you and the other subject (in EUR) is thus calculated as follows:

  **10 – contribution to public account +**

  **0.80 x sum of all contributions to public account**

- **A few numeric examples**
  - The other subject contributes EUR 5 to the public account. You contribute EUR 3 to the public account. Total contribution to the public account thus is EUR 5 + EUR 3 = EUR 8.
    - Your payoff: 10 – 3 + 0.80 x 8 = EUR 13.40
    - Others subject's payoff: 10 – 5 + 0.80 x 8 = EUR 11.40

  - Both you and the other subject contribute EUR 10 each to the public account. Total contribution to the public account thus is 2 x EUR 10 = EUR 20.
    - Your payoff and payoff of other subject: 10 – 10 + 0.80 x 20 = EUR 16

  - Both you and the other subject contribute EUR 0 each to the public account. Total contribution to the public account thus is EUR 0.
    - Your payoff and payoff of other subject: 10 – 0 + 0.80 x 0 = EUR 10

  - The other subject contributes EUR 10 to the public account. You contribute EUR 0 to the public account. Total contribution to the public account thus is EUR 10 + EUR 0 = EUR 10.
    - Your payoff: 10 – 0 + 0.80 x 10 = EUR 18
    - Others subject's payoff: 10 – 10 + 0.80 x 10 = EUR 8

**Payment mechanism & feedback**

- You will receive **no information** on what the other subjects did until after the end of the four week long experiment. The same applies to the other subject.
- Likewise, you will not receive your payment until after the end of the experiment. Only after the end of the final experiment you will be paid. The same applies to the other subject.
- The other subject receives his or her payment at the end of today's experiment, since (unlike you) he or she only takes part once in this experiment.

- **At the end of the experiment, you will not receive the sum of the earnings from all the individual weeks. Instead, an individual week will be randomly drawn to be payoff relevant. The payment from that week will be multiplied by four and paid out to you in cash.**
- **It is important to us that you show up for all four experiments. If you fail to show up for any of the experiments, you forfeit all earnings.**
- Example 1:
    - You took part in all four weeks of the experiment. Your earnings were EUR 10 in week 1, EUR 12 in week 2, EUR 14 in week 3 and EUR 16 in week 4. The draw determines that you will be paid the earnings from week 3 multiplied by four. Your total payment in this illustrative example is thus 4 x EUR 14 = EUR 56.
- Example 2:
    - You took part in the first three weeks of the experiment, but you failed to show up in week 4. In this case, you forfeit all earnings. Your total payment in this illustrative example is thus EUR 0.

***The subjects filled out the following data sheet. Each data sheet contained a serial number, which made it possible to track individual behavior of each participant over the course of the experiment.***

Please now indicate your preferred choice of contribution to the public account subject to the level of contribution to the public account by the other subject. In each case you can contribute any integer value ranging from EUR 0 to EUR 10 (0 and 10 included).

1. If the other subject contributes **EUR 0**, I contribute: ___________.
2. If the other subject contributes **EUR 1**, I contribute: ___________.
3. If the other subject contributes **EUR 2**, I contribute: ___________.
4. If the other subject contributes **EUR 3**, I contribute: ___________.
5. If the other subject contributes **EUR 4**, I contribute: ___________.
6. If the other subject contributes **EUR 5**, I contribute: ___________.
7. If the other subject contributes **EUR 6**, I contribute: ___________.
8. If the other subject contributes **EUR 7**, I contribute: ___________.
9. If the other subject contributes **EUR 8**, I contribute: ___________.
10. If the other subject contributes **EUR 9**, I contribute: ___________.
11. If the other subject contributes **EUR 10**, I contribute: ___________.

**Note regarding payoff calculation**: Unlike you, the other subject indicates his or her choice of contribution to the public account directly. Your contribution to the public account is then taken from the according response made in this data sheet.

Example: The other subjects contributed EUR 2. In this case, your response from row 3 is taken as your contribution ("3. If the other subject contributes EUR 2 …"). Total sum of contributions to the public account is then known and individual payoffs are calculated as explained in the instructions.

## Appendix B1: Control questions N=4 treatments

***The following control questions are the English translation of the original German control questions. The original control questions are available from the corresponding author.***

1. Each member of your group is given an endowment of EUR 10. Suppose that nobody (including you) contributes to the public account.
   What is your payoff? EUR ___________________
   What is the payoff of all other group members? EUR ___________________

2. Each member of your group is given an endowment of EUR 10. Suppose that everybody (including you) contributes EUR 10 to the public account.
   What is your payoff? EUR ___________________
   What is the payoff of all other group members? EUR ___________________

3. Each member of your group is given an endowment of EUR 10. Suppose that each of the other group members contributes EUR 10 to the public account, whereas you contribute EUR 0.
   What is your payoff? EUR ___________________
   What is the payoff of all other group members? EUR ___________________

4. Each member of your group is given an endowment of EUR 10. Suppose that each of the other group members contributes EUR 0 to the public account, whereas you contribute EUR 10.
   What is your payoff? EUR ___________________
   What is the payoff of all other group members? EUR ___________________

5. Each member of your group is given an endowment of EUR 10. Suppose that the other group members contribute EUR 10 in total to the public account.
   What is your payoff if you contribute EUR 0?
   EUR ___________________
   What is your payoff if you contribute EUR 5?
   EUR ___________________
   What is your payoff if you contribute EUR 10?
   EUR ___________________

## Appendix B2: Control questions N=2 treatments

***The following control questions are the English translation of the original German control questions. The original control questions are available from the corresponding author.***

1. You and the other subject are given an endowment of EUR 10. Suppose that neither you nor the other subject contributes to the public account.
   What is your payoff? EUR ___________________
   What is the payoff of the other subject? EUR ___________________

2. You and the other subject are given an endowment of EUR 10. Suppose both you and the other subject each contribute EUR 10 to the public account.
   What is your payoff? EUR ___________________
   What is the payoff of the other subject? EUR ___________________

3. You and the other subject are given an endowment of EUR 10. Suppose that the other subject contributes EUR 10 to the public account, whereas you contribute EUR 0.
   What is your payoff? EUR ___________________
   What is the payoff of the other subject? EUR ___________________

4. You and the other subject are given an endowment of EUR 10. Suppose that the other subject contributes EUR 0 to the public account, whereas you contribute EUR 10.
   What is your payoff? EUR ___________________
   What is the payoff of the other subject? EUR ___________________

5. You and the other subject are given an endowment of EUR 10. Suppose that the other group members contribute EUR 5 to the public account.
   What is your payoff if you contribute EUR 0?
   EUR ___________________
   What is your payoff if you contribute EUR 5?
   EUR ___________________
   What is your payoff if you contribute EUR 10?
   EUR ___________________