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Ostracism in alliances of teams and individuals: Voting, exclusion, contribution, and earnings*

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Abstract

Alliances often provide a collective good among their allies. This article offers laboratory experimental evidence that the possibility to vote for the exclusion of non-cooperating allies, i.e. ostracism, can be a powerful negative referendum to increase allies' contributions to the collective good. However, it is found that ostracism does not necessarily increase earnings in a public goods game. In particular, it is shown that the ostracism mechanism is used differently by individuals. While ostracism increases contributions irrespective of the game is played with a alliances of individuals or teams as the decision makers, the earnings do not statistically significant increase in alliances of individuals. This result can be explained with different voting patterns. Compared to individuals, teams vote and in turn exclude significantly less in early periods but more in later periods of the game. Thus, negative earnings effects of ostracism, i.e., excluded players can neither contribute to the collective good nor receive from the collective good, are found to be less severe in alliances of teams.

JEL Classification: C91, C92, H41
Keywords: alliances, team decision; public good; collective good; ostracism; exclusion; experiment

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1 Introduction

In the fifth century, the Athenians introduced ostracism as a democratic procedure to expel citizens from Athens for 10 years. This was an institutional innovation that stabilized democracy and increased the risk of political leadership by enabling people to wield political power over individuals that act, or are expected to act, excessive or undemocratic.[1] Although the ancient form of ostracism cannot be considered as a legitimate democratic tool anymore, many communities nowadays rely upon various ostracism mechanisms to enforce cooperation. In particular, in alliances where people, groups, or states join together to achieve some mutual benefit, it is often necessary to identify and punish allies that do not fulfill the commitments of the alliance with a non-monetary punishment mechanism such as ostracism. We define ostracism as a non-monetary punishment mechanism because the exclusion itself implies no direct costs. Nevertheless, it should be clear that an exclusion can have costly consequences, for excluded member and the alliance. One example of a powerful alliance that misses an efficient mechanism to discipline their allies is the NATO (Ringsmose, 2016). The collective good of the NATO is a system of collective defense to mutual defend each other in response to an attack by any external party. The amount each member state spends on military and defense expenditures, however, is not obligatory and hence some countries may have incentives to free-ride on others' expenses.[2] In particular, because a monetary punishment mechanism is hard to implement and enforce.

Non-cooperative behavior in alliances is well documented (see Pryor, 1968; Russet, 1970; Starr, 1974; Hansen et al., 1990), and the tactical calculation, the interactions, and the behavior of cooperators and non-cooperators when ostracism is possible is a highly regarded strand of recent theoretical literature (see Ali & Miller, 2016; Tridimas, 2016; Jackson et al., 2017). Empirical evidence on the topic, however, is scarce. While we know that ostracism has positive effects on cooperative behavior of individuals (Cinyabuguma et al., 2005; Maier-Rigaud et al., 2010) and teams (Masclet, 2003) in public goods games in general, we don't really know, however, if and how the effects differ when the groups consists of individuals and teams as the decision makers. Moreover, we do not know whether individuals and teams use the ostracism mechanism differently. This article contributes here. It provides evidence on the power of ostracism to increase public goods provision and it investigates whether single persons use the ostracism mechanism differently as compared to teams that consists of two persons who must come to a mutual decision. The research design of the games is close to the workhorse model of the public good literature, i.e., a ten-period public good games with a group that consist of six players. This allows to complement and revise previous findings of the literature at best. However, we introduce two variations:

First, we play the game with (O) and without an ostracism mechanism (NO) which is designed as follows: After the players decide on how much to contribute to the public good, the contributions of all players are made public to all players. Based on this information the players can (but do not have to) vote for the exclusion of one other player. A player is excluded when she/he receives at least 50% of all possible votes. Once a player is excluded, she/he can neither vote for the exclusion of others nor receive benefits from the public good in the further course of the game. Thus, the good

[1]For deeper insight on the political practices and the role of ostracism in the fifth century, we refer to Kirshner (2016).

[2]Currently, only 5 out of 28 NATO allies fulfill the NATO guideline to spend at least a 2% share of GDP on defense expenditures (NATO, 2018).

can also be called a *collective* or *club* good rather than a *public* good, because it is only accessible for the club of non-excluded players which form a sort of alliance.

The second variation of our game is that we do play the game with both individuals (I) and teams (T) as the decision maker. A team consists of two persons that can communicate face-to-face[3] with each other before they need to make a common decision about the joint contribution to the public good. Overall, we have a 2x2 design with four treatments: INO, IO, TNO, TO. In the team treatments we find that ostracism increases the average contributions and that the positive *contribution effect* dominates the two negative contribution effects, because the earnings of teams are significantly higher with ostracism than without. Compared to individuals, teams earn significantly more than individuals when ostracism is present. The different outcomes are the result of a diverse voting behavior: Individuals tend to vote and, in turn, exclude more in the first periods of the game which transmits into lower earnings for individuals. Whereas, teams are more patient and exclude less in early periods but more in late periods. As a result, teams have on average more periods to contribute to and receive benefits from the public good.

Closest to our article is the study of Auerswald et al. (2017) who investigate the behavior of individuals and teams, but do so with a monetary punishment mechanism.[4] Auerswald et al.'s laboratory experiments show that teams choose lower levels of punishment and contribute more to the public good than individuals. They explain this result with a coordination process that solely takes place in teams which tends to eliminate destructive behavior and leads to better decisions. In contrast to our experiments, they play a public goods game with four single decision makers who jointly provide a public good, and a setting of four teams at which each team consists of three players that do not communicate directly but through proposals in the spirit of Gillet et al. (2009). We would like to argue that our proposal of allowing face-to-face communication within teams comes closer to many real-world team decision making processes. While their results are mixed, they conclude that teams in general do not behave in a manner more similar to game-theoretic predictions. Another worth mentioning study is Reuben & Riedl (2009). They analyze the efficiency of sanctions for the public goods provision in privileged groups.

Our experimental setup allows to revise and complement the study of Maier-Rigaud et al. (2010) who focus on the behavior on individuals in a standard public goods game with and without ostracism. They found that ostracism increases the contribution to the public good and conclude that average earnings are higher in the groups where ostracism is possible. While we can confirm a significant positive effect of ostracism on players' contributions on average, we do not find that these higher contributions necessarily transmit into the higher earnings. That means, the earnings cannot and should not be directly rescaled from the contribution levels. In particular, we find that

[3]For a discussion of advantages and disadvantages in experimental settings of face-to-face communication as compared to more indirect forms of communication, such as communication via computer chat, we refer to Luhan et al. (2009).

[4]Chaudhuri (2011) show that the efficiency of a mechanisms with regard to increasing contributions to the public good depends heavily on the impact-cost factor of the punishment mechanism. Moreover, a monetary punishment mechanism may cause problems in many alliances. For example, if an ally falls short in contributing to the collective good due to negative (and probably exogenous) economic turbulences, punishing the ally monetarily can hardly be an effective mechanism, because the monetary punishment will worsen the economic situation which may result in lower contributions in the medium and long run overall. In other words, a naked man has no pocket. Hence, a well designed non-monetary punishment mechanism might be more useful in practice.

the increased contributions transmit into higher earnings for teams and individuals, but the increase in earnings is lower for individuals and only statistically significant for teams. These results can be explained with three effects at work: First, the fear to be excluded increases the average contributions and hence the earnings (*contribution effect*). This effect was recently deeply investigated in a nice experimental study of Kopányi-Peuker et al. (2018). They monitor the effort of workers in team production processes and analyzed the impact of the possibility and probability of team members being excluded by a manager. In contrast to them, our setup abstracts from varying the threat of being excluded, because we are more interested in behavioral differences of individuals and teams. Second, an excluded player cannot contribute which, in turn, decreases average earnings (*contributor exclusion effect*). Third, excluded players do not receive benefits from the public good which also drives average earnings down (*receiver exclusion effect*). While Maier-Rigaud et al. (2010) consider the *contributor exclusion effect* by accounting for excluded subjects with zero contributions, they abstract from considering the *receiver exclusion effect*. Our setup allows to consider both negative earning effects. We find that individuals and teams have higher average earnings when ostracism is allowed. That indicates that the *contributor exclusion effect* is not dominated by the two negative effects. However, the increase in earnings is smaller for individuals as compared to teams and the increase is not significant for individuals. Thus, the two negative effects can offset the positive *contribution effect* and the two negative effects are more important when the game is played with individuals.

Additionally to the mentioned literature on alliances and ostracism, our work complements two broad strands of literature. First, experimental studies on sources for a socially sub-optimal contribution to public goods. Second, studies on differences in decision making of individuals and teams. As Charness & Sutter (2012), Kugler et al. (2012), and Vollstädt & Böhm (2019) overview, three lessons seem to prevail: First, teams seem to be more cognitively sophisticated and come closer to the game theoretic prediction.[5] Second, researchers such as Falk & Ichino (2006) show that teams can help to overcome problems of self-control, leading to higher motivation and hence higher productivity. Third, while teams are found to act more selfishly and may thus decrease social welfare in games where cooperation is important[6], it is theoretically unclear whether the behavior of teams mitigates or enforces inefficiencies arising from the coordination problem in a public goods game because there are two detrimental effects: The *ingroup favoritism* effect who predicts teams to reduce cooperation in public goods games because team members want to achieve better outcomes for their teammates and hence teams behave more competitively towards other teams (the *outgroup*) (cf. Charness et al., 2007), and the *team identity* effect who predicts teams to enhance cooperation because playing in teams can create an identity which suppresses self-interest in favor of collective interest (cf. Eckel & Grossman, 2005; Akerlof & Kranton, 2005). By investigating individuals and teams in one unique experimental setup, we can help to evaluate these two effects.

Overall, theoretical literature does not give clear predictions whether acting in teams might

[5]In the beauty contest game, for example, teams state significantly lower numbers than individuals (Kocher & Sutter, 2005), and the larger the team, the lower the numbers stated (Sutter, 2005). Charness et al. (2010), and Fahr & Irlenbusch (2011) find teams to make less irrational errors in experimental games.

[6]This result was found in trust games by Kugler et al. (2007), in centipede games by Bornstein et al. (2004), or in prisoners' dilemma games by Charness et al. (2007), for example. The result of teams behaving more selfishly was also documented by Bornstein & Yaniv (1998). They find teams to offer less than individuals in an ultimatum game.

increase or decrease the barriers to voting for the exclusion of another player. While creating a team identity might enhance the barrier to expel other teams, the *ingroup favoritism* effect might decrease the barriers to expel other teams because other teams are seen as the outgroup. Our experiment allows to evaluate the dominance of these countervailing effects for teams.

To our best knowledge, our experiments are the first that allow to investigate the diverse impact of ostracism on the behavior of individuals and teams. In particular, we can analyze the voting patterns, the resulting exclusions, the contributions and, in turn, the earnings of individuals and teams. The findings of the present study offer interesting perspectives on the process, the use, and the implications of ostracism in alliances where teams and/or individuals are the decision makers. We show that ostracism can be a useful concept to suppress unacceptable forms of behavior within an alliance and hence add a new perspective on the economics of conflict and peace research. Of course, in real world scenarios, the mechanism needs to be designed with wisdom and foresight. In particular, it should be avoided that (m)any allies must leave an alliance.

The remainder of the article is structured as follows. Section 2 introduces our experimental setting, section 3 states our theoretical predictions, section 4 provides results, and section 4 concludes.

2 Experimental design

The experiment was conducted in the RESL lab at the University of Regensburg with overall 288 participants. The participants were recruited using the software ORSEE (Greiner, 2015) and the experiments were conducted with the software z-Tree (Fischbacher, 2007). 25% of the participants were students of economics or business administration. During the experiment, participants earned tokens which were converted to Euros at the end of the experiment. Participants received 2.5 Cent for each token. The average session lasted about 50 minutes and participants earned on average €13, including €4 for showing up. Earnings were paid in cash at the end of the experiment.

As explained in the introduction, we play four treatments of a public goods game which consists of 10 periods. In the treatments of individuals (IO and INO) a total of 96 participants formed 16 groups (or alliances) that consist of 6 individuals each. In the treatments of teams (TO and TNO) 192 participants were randomly assigned before the game was played to 96 teams that consist of two participants each. The 96 teams formed 16 groups (or alliances) that consist of 6 teams each.

To control for possible treatment order effects, one half of the individuals and teams played the treatment no ostracism (INO and TNO) first, followed by the treatment with ostracism (IO and TO), while the other half played the treatments in the reverse order. Once assigned to groups, individuals and teams played in the same group for the whole experiment. Before each treatment, the participants received instructions which we show in the Appendix.

Each team was placed in a separate room with one computer. Thus, the team members could communicate directly face-to-face to come to a mutual decision, which they had to type in the computer. Apart from the (random) formation of teams, the treatments for teams were the same as the treatments for individuals. Concerning the earnings, each team member got the same amount that the team had earned in the experiment. Thus, the monetary incentive structure for a team member was the same as for an individual.

In treatments without ostracism, the subjects[7], i.e., individuals or teams, played a standard linear public goods game in every period. The subjects had to decide how much of an initial per-period endowment of 10 tokens they wanted to contribute to a public good in each period. The payoff of subject j in each period was calculated according to the following function, which was common knowledge among all participants:

$$\pi_j = 10 - g_j + 0.4 \sum_{i=1}^{6} g_i, \tag{1}$$

where g_j denotes the contribution of subject j to the public good. While the social optimum would be to invest fully in the public good, subjects have incentives to free ride because their private return from contribution is smaller than the marginal costs, 0.4<1.

At the end of a period, subjects were informed about the contributions of the other members of their group and about their earnings in this period. We can abstract from any reputation effects in our setup because it was common knowledge among all subjects that each subject was assigned a randomized number (from 1 to 6) in each period. After being informed about the contributions of other subjects, the game proceeded to the next period in the treatments without ostracism, whereas in the treatments with ostracism, subjects had the possibility to cast a vote against exactly one other subject. If 50% or more of the votes were given to one subject, he/she was excluded from the game in the remaining periods of the ostracism treatment. Once excluded, a subject only received 10 tokens in each of the upcoming periods, and was not allowed (i) to contribute to the public good, (ii) to receive benefits from the public good, and (iii) to vote for the exclusion of other subjects.

As this setup comes along with varying group sizes, it is important to shed some light on the effects of varying group size on the incentives to contribute to the public good. As we hold marginal per capita return (MPCR) constant, the marginal benefit from contributing to the public good changes with group size. It is easy to see that with only two group members remaining the welfare-maximizing contribution to the public good is zero. However, as long as the group size remains greater than two, nothing changes with respect to individually optimal and welfare-maximizing contributions. Moreover, as Isaac & Walker (1988) showed, altering the group size while holding MPCR constant changes little concerning the free-riding behavior. Overall, it only happened once in our experiments that a group contains of less than three non-excluded players at the end of the game.

3 Predictions

Maier-Rigaud et al. (2010) show for individuals that ostracism leads to higher contributions to the public good. We expect an analogous outcome for teams, and state our first prediction as follows:

[7]Pleas note, we refer to a *participant* as a single person taking part in the experiments, whereas an *individual* is a participant taking part in the experiment for individuals as the decision maker. Furthermore, a *team* is defined as two participants taking part in the team experiment, and a *subject* is the generic term for both individuals and teams.

Prediction 1 *The ostracism mechanism enhances the contributions to the public good in the individual as well as the team treatment, that is, contributions in treatments with ostracism (IO and TO) are higher than in treatments without ostracism (INO and TNO).*

Concerning the comparison of individuals' and teams' behavior with regard to contributions and punishment, we first consider a theoretical analysis of the public goods game which the subjects played in our experiment. As a benchmark, we consider purely selfish, individually rational subjects. We call $g_{it} \in \{0, 1, ..., 10\}$ the contribution of subject i in period t, and $v_{it} \in \{0, 1\}$ the binary voting decision of subject i in period t, where $v_{it} = 0$ means that a subject did not give a vote, and $v_{it} = 1$ means that a subject voted for any other group member to be excluded.[8]

For the no ostracism treatments (INO and TNO), we arrive at the following proposition:

Proposition 1 *The unique subgame perfect Nash equilibrium in treatments without ostracism (INO and TNO) is* $g_{it} = 0 \; \forall i, t$.

Proof. The proof is straightforward. If the public goods game is played in only one period, the unique Nash equilibrium is $g_i = 0 \; \forall i$. It is clearly individually rational to contribute zero to the public good in period 10, because the game ends after this period. Backward induction implies that this behavior unravels to the first period and thus no contribution in any period is the unique sub-game perfect equilibrium for the no ostracism treatments. ■

From the literature we know that teams act more in line with the self-interested game theoretic prediction. We thus expect teams to contribute less in the treatments without ostracism.

Prediction 2 *Teams contribute **less** to the public good than individuals in the treatments without ostracism (INO and TNO).*

For the ostracism treatments (IO and TO), the analysis is more sophisticated. Here, we end up with the following proposition:

Proposition 2 *There are multiple subgame perfect Nash equilibria in treatments with ostracism (IO and TO). All of those equilibria involve* $g_{it} = 0 \; \forall i, t$.

Proof. We again prove this using backward induction. In period 10, $g_i = 0$ is individually rational for all group members, because there will be no consequences of being excluded. In period 9, the decision of a subject to contribute hinges on his/her expectation concerning the voting behavior of all other group members. A subject j could fear being excluded, and thus contribute a high amount. This holds true at least when subject j expects other subjects to vote against (and exclude) him/her if he/she is not contributing very much. However, the individual costs of being excluded in period 9 are zero, because of $\sum_i g_i = 0$ in period 10. Thus, subject j's payoff Π_j in period 10 will equal the period endowment of 10 tokens. Given this, it is individually rational to contribute zero to the public good in period 9 as well—irrespective of whether he/she is excluded after period 9 or not.

[8] Please note, in our experiment the voting decision is not binary, because actually a subject can decide whom to give a vote. However, for our analysis it suffices to model it as a binary variable, as we show later on.

This behavior unravels until period 1, and holds true for all subjects. Thus, $g_{it} = 0\ \forall i, t$ holds as the unique prediction.

For the voting behavior, the prediction is not unique. To see this, note that with zero contributions of all subjects over all periods—irrespective of whether they are excluded or not—each payoff of a subject will be the same in every period, namely the period endowment, that is $\Pi_{it} = 10\ \forall i, t$. Casting votes does not change payoffs. As a consequence, any voting behavior can be part of an equilibrium. This yields multiple subgame perfect Nash equilibria.[9] ■

To contrast the benchmark and to solve the problem of multiple equilibria, we drop the assumption of perfectly rational subjects. We consider irrational mistakes of the subjects, applying the concept of perfect (or trembling hand) equilibrium (Selten, 1975).

Proposition 3 *There is a unique perfect (trembling hand) equilibrium in treatments with ostracism (IO and TO), involving $g_{it} = 0\ \forall i, t$, and $v_{it} = 0\ \forall i, t$.*

Proof. The proof again involves backwards induction. In period 10, the dominant contribution strategy of each subject is $g_i = 0$. Because we assume trembling of the subjects, we can assign a positive probability $\varepsilon_c > 0$ to each possible amount of contribution $g_{it} > 0$ for each subject i. This means that excluding a group member in period 9 is potentially costly for the group, and in turn for each group member, because the excluded group member could have contributed in period 10 by trembling. From the perspective of subject j this means that $E[g_{i,t=10}] > 0\ \forall i \neq j$. Therefore, excluding any other group member comes at a cost, and no group member should be excluded, that is for every subject i it holds that $v_{i,t=9} = 0$.[10] Knowing this, it follows that no subject will have to fear exclusion in period 9 if contribute nothing, and will thus play the dominant one-shot strategy of $g_i = 0$ (of course, again with the possibility of trembling). Note that introducing a trembling probability for voting ($\varepsilon_v > 0$ for $v_{it} = 1$) does not change anything, as long as ε_v is independent of the contributions.[11] The contribution and voting behavior of periods 10 and 9 unravels back to the first period, leading to the unique perfect (trembling hand) equilibrium of $g_{it} = 0\ \forall i, t$ and $v_{it} = 0$ $\forall i, t$ with $\varepsilon_c, \varepsilon_v \to 0$.[12] ■

Again, we refer to the literature, showing that teams act more in line with the self-interested game theoretic prediction. Taking the perfect (trembling hand) equilibrium with zero contributions and no votes (or exclusions) into account, we thus expect teams to contribute less and vote less in the treatments with ostracism.

[9] We could assume an infinitesimally small cost of voting (for example, for the decision process as such). This would make the subgame perfect Nash equilibrium unique. However, we show that there are other ways to reach a unique equilibrium prediction.

[10] Please note, there is no need to distinguish between voting and excluding, because the probability of exclusion will grow when voting against another group member, and vice versa. Nevertheless, it is not guaranteed that voting against another group member will lead to his/her exclusion.

[11] For example, if trembling were *targeted* toward low contributors, the probability of being excluded would increase with low contributions. Because subjects fear this, they would contribute more. However, we argue that trembling cannot be targeted, because it is accidental by definition.

[12] Please note, $v_i = 0$ does not necessarily hold in period 10, because voting (and excluding) in that period has no consequences, and any voting behavior in period 10 could be part of an equilibrium. However, to assure uniqueness of the perfect (trembling hand) equilibrium, we could again assume a marginal cost of voting. Alternatively, we could drop the (irrelevant) voting stage in period 10 to assure a unique equilibrium.

Prediction 3 *Teams contribute **less** to the public good than individuals in the treatments with ostracism (IO and TO).*

Prediction 4 *Teams vote **less** than individuals.*

In our experimental design, voting is a necessary, but not a sufficient condition for exclusions. We expect votes and exclusions to be highly correlated. Thus, we expect teams to exclude less.

Prediction 5 *Teams exclude **less** than individuals.*

If teams act more in line with self-interested game theoretic predictions and thus contribute less to the public good, we expect higher earnings for individuals than for teams in the no ostracism treatments:

Prediction 6 *Teams earn **less** than individuals in the treatments without ostracism (INO and TNO).*

In the ostracism treatments, however, some countervailing effects can have an impact on the earnings. One can be called the *contribution effec*, because average earnings depend positively on contributions. Another effect is about exclusions and how they impact the earnings. Overall, average earnings depend negatively on exclusions. This stems from two effects: the *contributors' exclusion effect*, and the *receivers' exclusion effect*. The first refers to the reduction of possible contributors through exclusion, while the latter refers to the reduction of receivers that benefit from the public good. Another effect on earnings can be called the *incentive effect*, because subjects may have an incentive to contribute a great deal in order to reduce the danger of being excluded because of contributing too little. This effect can be enhanced by casting votes even if no exclusion actually takes place, because all members of a group see how many votes were cast against whom in the respective period.

All these effects can be present simultaneously. The question is which of these effects dominate, and if there are differences between teams and individuals. Some of these effects are interdependent with what happens in the course of a game. For example, if predictions 2 and 3 hold true and teams contribute less, the contribution effect assures that the average earnings of teams are smaller than those of individuals. At least if all else is equal.

The effect of predictions 4 and 5 holding true is more sophisticated. If teams vote and exclude less, the exclusion effects would predict higher earnings, because there are more subjects in the game that can contribute. However, the incentive effect for teams would be weaker, because the teams would have less fear of exclusion. Finally, we formulate the following two hypotheses:

Prediction 7a *Teams earn **less** than individuals in the treatments with ostracism (IO and TO).*

Prediction 7b *Teams earn **more** than individuals in the treatments with ostracism (IO and TO).*

Table I: Descriptive statistics: contributions

Treatment	Share of contributions with... 0 token	1 to 9 token	10 token	Contributions Median	Mean	Std. Dev.	Obs.
INO + TNO	0.27	0.45	0.28	5	4.976	4.090	1920
IO + TO	0.15	0.33	0.51	10	7.384	3.683	1920
INO	0.28	0.43	0.29	5	5.053	4.155	960
TNO	0.26	0.47	0.26	5	4.898	4.024	960
IO	0.19	0.23	0.58	10	7.214	4.004	960
TO	0.12	0.44	0.44	9	7.554	3.325	960
IOnet	0.05	0.27	0.69	10	8.487	2.837	816
TOnet	0.05	0.47	0.47	9	8.112	2.711	894

4 Results

4.1 Does ostracism increase the contributions to the public good? (Prediction 1)

Table I shows the share of contributions chosen by the subjects as well as the median, the mean, and the standard deviation of the subjects' contributions for different treatments. Additionally to the four treatments INO, TNO, IO, and TO, the aggregated results in games without ostracism (INO+TNO) and without ostracism (IO+TO) for all 1920 decisions taken by the 192 subjects. The numbers indicate that the fear of being excluded works: Compared to treatments without ostracism, the overall average contribution with ostracism is 48 % higher. In 51 % of all decisions to contribute, subjects decided to contribute fully with ostracism, while this was only the case in 28 % without ostracism. Nothing was contributed in 15% of all cases with ostracism and in 27 % of all cases without ostracism.

Figure I presents the average contributions over the course of the game for individuals and teams. Panel (a) shows the treatments without ostracism. Panels (b) and (c) show the treatments with ostracism where we omit excluded subjects in the calculation of the average contributions in panel (c). The figure reveals the same insights for individuals as reported by Maier-Rigaud et al. (2010). Especially, we do not see zero contributions prevailing over all periods in either treatment. Thus, individuals do not behave purely selfishly as game theory would predict. Our findings for teams show no big difference, as the level and the shape of the three lines are similar for teams and individuals. The theoretical prediction of zero contributions cannot be found for individuals or teams. The average contribution of the subjects declines quite sharply in the course of the game without ostracism, whereas with ostracism the contributions are more stable and at a higher level with a sharp decline in the last two periods.

Figure I(a) confirms the findings of Maier-Rigaud et al. (2010). It shows the mean of the group

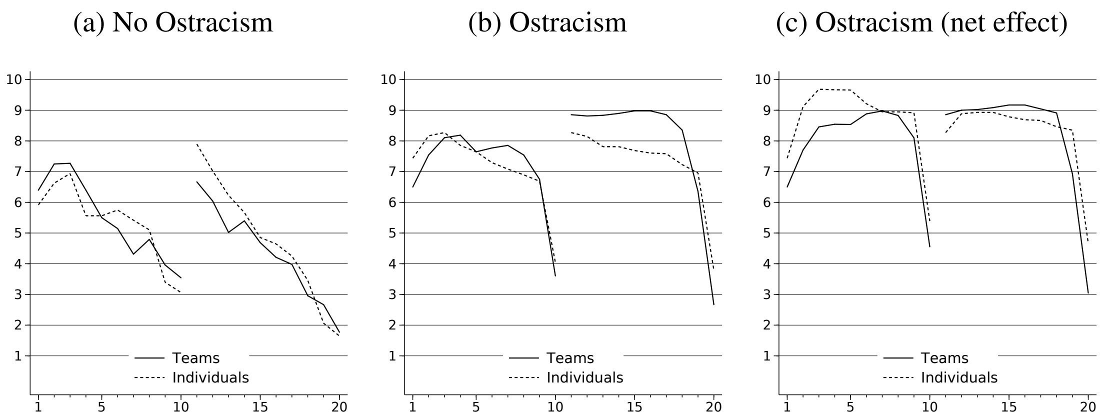

Figure I: Average contributions of teams and individuals by treatment per period.

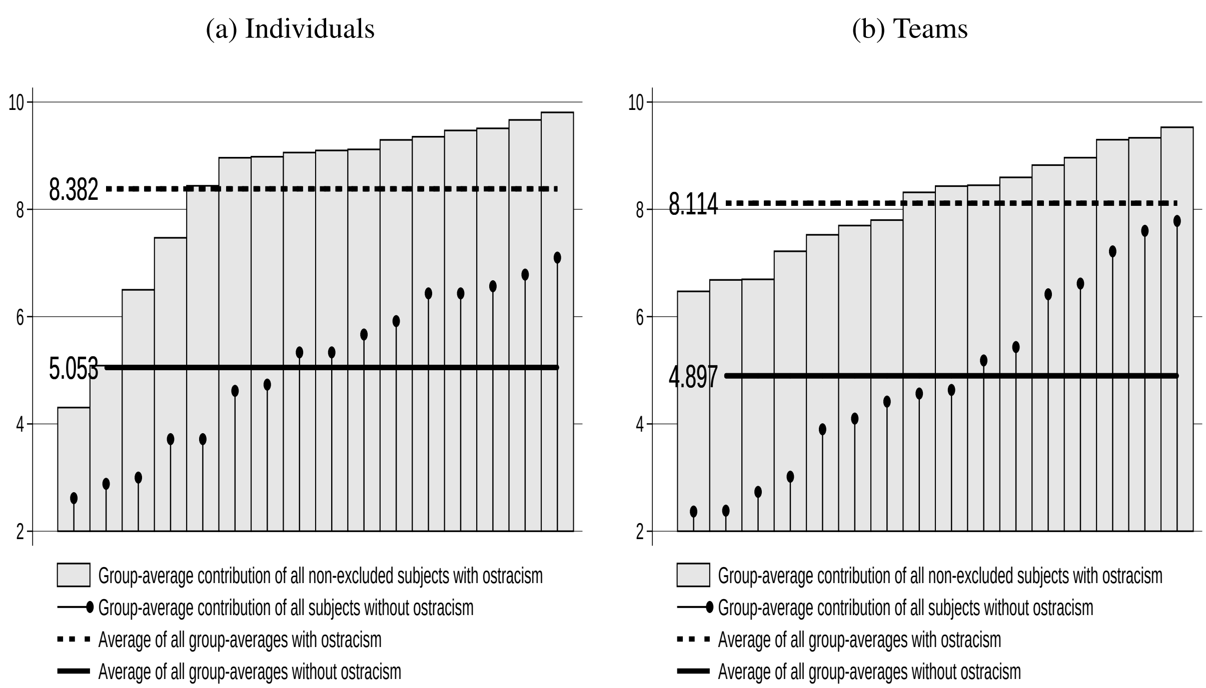

Figure I: Group-average net contributions over all periods by treatment

Note: The two figures show the average net contributions of all subjects for the 16 groups of individuals and teams, respectively. The average of all group-averages are different to the mean statistics shown in Table I because here we calculate the average of the 16 group averages, whereas in Table I, we show the average contributions of all subjects.

average contributions over all periods for individuals[13]. The group averages in the ostracism treatments are *net effect* contributions, that is, only non-excluded subjects count. The average of all group-averages of individuals is larger with ostracism than without ostracism which is statistically significant according to a Wilcoxon signed ranks test for paired replicates (see Siegel & Castellan Jr., 1988, p. 87ff) ($p < 0.001$, two-tailed). Figure I(b) shows the same pattern for teams: average contributions are significantly higher with than without ostracism ($p < 0.001$, two-tailed).

⇒ Ostracism enhances the contributions to the public good for individuals and teams. Thus, we fail to reject prediction 1.

4.2 Do teams contribute less? (Predictions 2 and 3)

Coming back to Table I, we see that the contribution differences between teams and individuals are rather small without ostracism and are sizable in treatments with ostracism, at least when you it comes to the share of contributions with 10 tokens. Individuals contribute in 58 % of all cases fully with in IO, whereas teams decide only in 44 % of all cases so. It seems to be surprising that such a behavior can yield a smaller average contribution for individuals than for teams (7.214 to 7.554). As we will discuss later in detail, this is the result of exclusions and the timing of exclusions. Once we consider only contributions of non-excluded subjects (see IOnet and TOnet), individuals contribute on average more than teams (8.487 to 8.112). The lines IOnet and TOnet indicate that the *contributor exclusion effect* may be larger for individuals than for teams because only 66 times a subject in a team group was forced to contribute zero due to its exclusion from the game, whereas for individuals we count 144 of these cases. Obviously, this can have two sources: individuals exclude more often or they exclude earlier in the course of the game. Additionally we can state that the variance in the decision to contribute is smaller for teams than individuals, because they tend to choose less often the extreme values of 0 or 10 tokens.

To address differences in the contribution behavior of individuals and teams (predictions 2 and 3) in more detail, we compare the group-average net contributions of individuals and teams in treatments with and without ostracism. Figure I shows that the average contribution of all group-averages is larger for individuals than for teams in treatments without ostracism (5.053 vs. 4.897), but it is not statistically significant as a median test reveals (continuity corrected Pearson $\chi^2 = 0.125$, $p = 0.724$)). Please note, dealing with contributions in our setup, the median test is the proper test for statistical analysis, because the data are strongly truncated to the maximum contribution of 10 token. For a further discussion on the usage of the median test we refer to Siegel & Castellan Jr. (1988, p. 124)[14] In treatments with ostracism, the average contribution of all group-averages is also larger for individuals than for teams (8.382 vs. 8.114). However, a median test shows no statistical significance of this difference (continuity corrected Pearson $\chi^2 = 0.125$, $p = 0.724$)[15]

[13] Please note, the subjects' contributions are interdependent because they have a common history in the game (apart from those in period 1). The average contributions of groups, however, are independent and thus are the proper unit of observation for statistical tests (see Falkinger et al., 2000, p. 254).

[14] A Wilcoxon rank-sum test (z-statistics = 0.339, $p = 0.734$, two-tailed) and a Fisher-Pitman Permutation test ($p = 0.795$, two-tailed) also confirm our findings. Both tests are in line with our results.

[15] A Wilcoxon rank-sum test (z-statistics = -0.377, $p = 0.706$, two-tailed) and a Fisher-Pitman Permutation test ($p = 0.555$,

Table II: Descriptive statistics: Votes and exclusions

Treatment	Sum of votes cast	Share of possible votes cast	Sum of excluded subjects… …in the first 5 periods	…in the last 5 periods	…overall	Average period of exclusion
IO + TO	444	0.260	23	23	46	5.435
IO	224	0.275	16	11	27	4.667
TO	220	0.246	7	12	19	6.526

The table contains descriptive statistics for the treatments with ostracism. The Share of possible votes cast is defined by the fraction of the sum of votes cast relative to the sum of all possible votes, with being 816, 894, and 1710 for IO, TO, and IO+TO, respectively. That means, overall 210 votes could not have been cast, because 46 subjects were excluded about 4.565 periods before the game ends.

⇒ **We fail to find a statistically significant difference between the average contributions of individuals and teams in treatments without ostracism as well as in treatments with ostracism. Thus, we reject prediction 2 and 3.**

4.3 Do teams vote less? (Prediction 4)

Table II shows descriptive statistics on voting and excluding behavior of individuals and teams for the different treatments. Individuals and teams took about 25% of their chances to vote for the exclusion of other subjects. The amount of votes cast is quite similar for individuals and teams (220 vs. 224). To test prediction 4, we use the average shares of votes cast of individuals and teams for all 16 groups which are shown in Figure II.[16] The average over all groups is larger for individuals than for teams (.2856 vs. .2446). However, a Wilcoxon rank-sum test indicates that the difference is not statistically significant (z-statistics = 0.735, p = 0.462, two-tailed).

When looking on the timing of votes cast, however, we find some interesting differences. The timing of votes is of particular interest in our experiment, because it can discipline subjects to contribute or it can yield exclusions and in turn zero contributions from the excluded subject. Thus, voting can have important implications on the outcome of the game. It is clear, however, that the earlier subjects are excluded, the more severe the costs of exclusion. Figure II presents the average proportion of votes cast over the course of the game for individuals and teams. It shows, that individuals vote more often in earlier periods, whereas teams seem to vote more in period 9. To test whether this impression holds statistically, we executed a Wilcoxon rank sum test for each period. The results are shown in Table III. Indeed, individuals cast on average more votes in periods 1

two-tailed) also confirm our findings.

[16]Please note that we combine periods 1 and 11, 2 and 12 and so on here. For example, period 11 is actually period 1 with ostracism for those, who play with ostracism in the second half of the game.

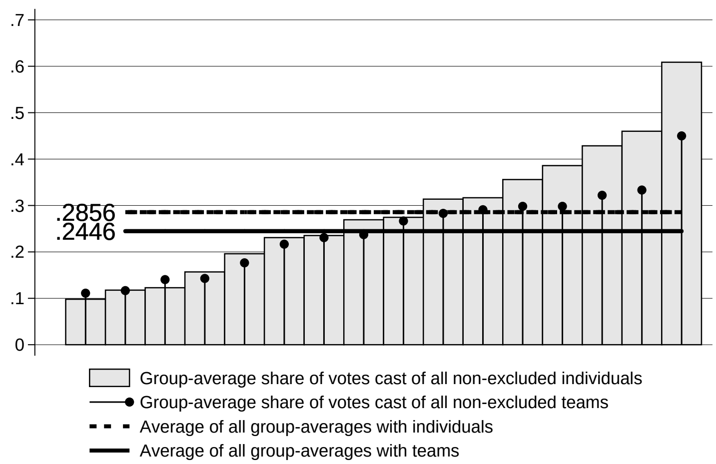

Figure II: Group-average share of votes cast over all periods for teams and individuals by groups

Note: The figure shows the average share of votes cast of all non-excluded subjects for the 16 groups of individuals and teams, respectively.

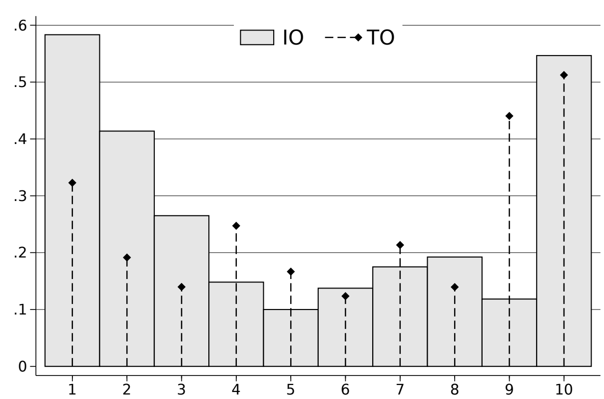

Figure II: Average share of non-excluded teams and individuals voting per period

Note: The graph shows the average share of votes cast by non-excluded subjects for both teams and individuals. Please note that the x-axis refers to the respective period played in the respective treatment. That means, we combine periods 1 and 11, 2 and 12, and so on. However, showing the picture with all 20 periods would not change the picture.

Table III: Wilcoxon rank-sum test for each period: The average share of votes cast of non-excluded of subjects in games with teams and individuals

Periods	z-statistics	p-value
1 and 11	3.462628	.0005349
2 and 12	2.428441	.0151639
3 and 13	1.536634	.1243829
4 and 14	-.9151837	.3600952
5 and 15	-.8845125	.3764196
6 and 16	-.4744603	.6351717
7 and 17	-.3820398	.7024318
8 and 18	.2386579	.8113708
9 and 19	-2.630176	.0085341
10 and 20	.3238773	.7460309

Note: The table shows the results of Wilcoxon rank-sum tests. In particular, we test the hypothesis whether the samples of group-average share of votes casted for subjects that play with and without ostracism are from populations with the same distribution (see Wilcoxon, 1945; Mann & Whitney, 1947).

and 11, and 2 and 12, whereas teams cast more votes in periods 9 and 19. Thus, individuals cast more votes in early periods and teams cast more votes in late periods. This may have implications for the exclusions and in turn the contributions of of subjects. We discuss this in the next subsections.

⇒ **Teams vote less in early periods and more in later periods. Thus, we reject prediction 4.**

4.4 Do teams exclude less? (Prediction 5)

Figure III shows the total sum of exclusions over all periods for the 16 groups for individuals and teams. While teams exclude on average less than individuals (1.187 vs. 1.687), a Wilcoxon rank-sum test fails to indicate the difference to be statistically significant (z-statistics = 1.361, $p = 0.173$). This result is not surprising, as teams and individuals cast almost the same number of votes overall. Since we know that the timing of casting votes differ between individuals and teams, we should investigate how this transmits into a different timing of exclusions. Figure III shows the average share of exclusions over all groups in the 10 periods of play for individuals and teams. We see that teams do not exclude in periods three and six. Individuals do not exclude in periods five and six. Performing a Wilcoxon rank-sum test for each period, we see no significant differences between the exclusions for teams individuals with one exception: in the first period of the game individuals exclude significantly more often, see Table IV. As we know that excluded group members cannot contribute to the public good, we suspect that this difference transmits to differences in earnings between individuals and teams.

⇒ **Teams exclude less in the first period. Thus, we fail to reject prediction 5.**

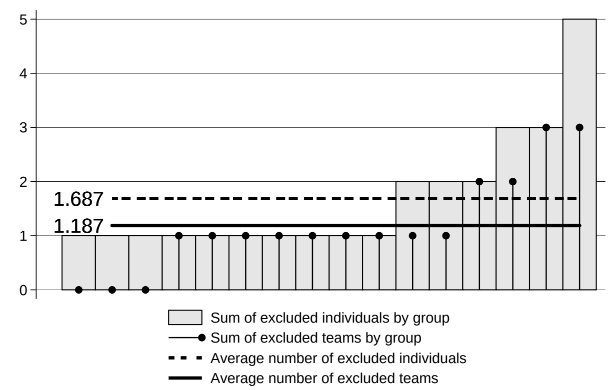

Figure III: Total sum of exclusions over all periods for teams and individuals by groups

Note: The figure shows the sum of exclusions happened over all periods for the 16 groups of individuals and teams, respectively

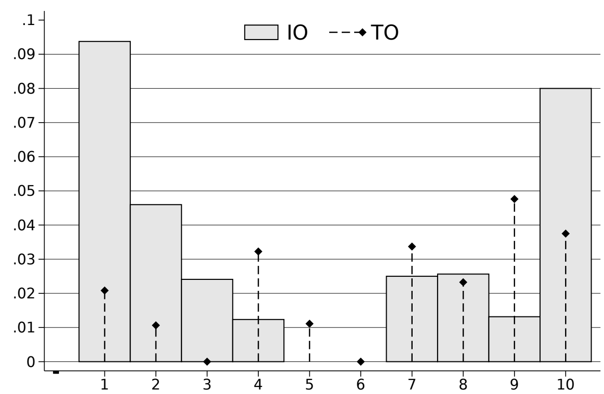

Figure III: Average share of excluded teams and individuals per period

Note: The graph shows the average share of exclusions for both teams and individuals. Please note that the x-axis refers to the respective period played in the respective treatment. That means, we combine periods 1 and 11, 2 and 12, and so on. However, showing the picture with all 20 periods would not change the picture.

The differences in voting and excluding between teams and individuals may in turn also explain the lower contributions of teams in case of ostracism. Voting for and in turn excluding low contributors can give a strong impetus for remaining subjects to contribute more. This effect is obviously lower for teams, because teams vote less and exclude later. Moreover, the lower contributions of teams may be explained by conditional cooperation. Individuals exclude earlier. If the remaining subjects are conditional cooperators and the low-contributors are excluded, this may turn contributions up for individuals. For experimental evidence on conditional cooperation, we refer to Keser & van Winden (2000).

Table IV: Wilcoxon rank-sum test for each period: The group-average share of excluded subjects in games with teams and individuals

Periods	Teststatistic: z-value	p-value
1 and 11	2.564324	.0103377
2 and 12	1.437591	.1505503
3 and 13	1	.3173105
4 and 14	-1.052209	.2927039
5 and 15	-1	.3173105
6 and 16		
7 and 17	-.4791968	.6317986
8 and 18	0	1
9 and 19	-1.437591	.1505503
10 and 20	1.160959	.2456585

Note: The table shows the results of Wilcoxon rank-sum tests. In particular, we test the hypothesis whether the samples of group-average share of excluded subjects for individuals and teams are from populations with the same distribution (see Wilcoxon, 1945; Mann & Whitney, 1947).

4.5 Earnings (Predictions 6, 7a, 7b)

While there are no direct costs of excluding other subjects, there are, as explained in the introduction, two indirect costs: the *contributor exclusion effect* and the *receiver exclusion effect*. These two effects can dominate possible positive effects on contributions that stem from the possibility of ostracism. Thus, it is unclear ex ante, whether or not enhanced average contributions transmits into higher earnings. Figure IV shows group averages of total earnings by treatment. The left histogram reveals that individuals earn on average less than teams. However, the difference is not statistically significant as a Wilcoxon rank-sum test reveals (z-statistics = -0.905, $p = 0.366$, two-tailed). The right histogram reveals that in treatments without ostracism, the average earnings for individuals and teams are similar. The confidence intervals and a Wilcoxon rank-sum test using group-average earnings underpin this statistically (z-statistics = 0.339, $p = 0.734$, two-tailed).

⇒ **Teams do not earn less than individuals in the treatments without ostracism. Thus, we reject prediction 6.**

In treatments with ostracism, however, teams earn on average more than individuals. This difference is significant at 5% which is represented by the confidence intervals shown in the figure and at a 10% significance level when using the group-average earnings in a Wilcoxon rank-sum test (z-statistics = -1.696, $p = 0.089$, two-tailed). Thus, we see that ostracism drives differences in earnings between individuals and teams.

⇒ **Teams earn more than individuals in the treatments with ostracism. Thus, we reject pre-**

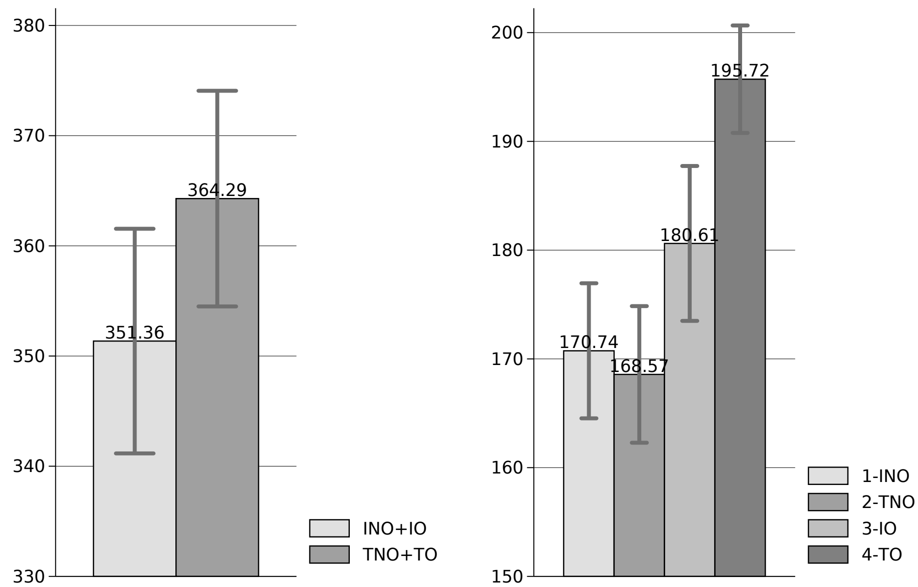

Figure IV: Average earnings of participants in different treatments

Note: The barplots are labeled with the actual value and additionally show the 95% confidence interval.

diction 7a and fail to reject prediction 7b.

Ostracism increases the contributions of individuals significantly, but this does not transmit into higher earnings. The confidence intervals of Figure IV and a Wilcoxon signed-ranks test fail to find significant different earnings. In particular, the test shows no significant difference in earnings of individuals between the treatments without and with ostracism (z-statistics -1.344, $p = 0.179$, two-tailed). For teams, however, the higher contributions indeed transmit into higher earnings as the confidence intervals of Figure IV and a Wilcoxon signed-ranks test show (z-statistics = -3.516, $p < 0.001$, two-tailed). In a public good game, aggregate earning represent social welfare. Thus, the ostracism mechanism works for teams, but fails to improve welfare for individuals.

⇒ **The increase in earnings due to ostracism is statistically significant for teams, but not significant for individuals.**

To sum up, the *contribution effect* is positive for teams and individuals: ostracism enhances the net contributions, that are, contributions of non-excluded subjects. This has positive effects on earnings. The 'contributor exclusion effect' is negative for earnings, as can be seen as gross contributions, where also excluded subjects count, are lower than net contributions. The 'receiver exclusion effect' also negatively impacts subjects' earnings. We find that this effect is much more severe for individuals because they exclude on average earlier. Overall, it holds that for individuals the two negative exclusion effects compensate the positive contribution effect, whereas for teams the *contribution effect* still dominates.

5 Conclusion

In this article, we show that individuals and teams behave differently in alliances when an ostracism mechanism is at work. We offer clear evidence that ostracism enhanced the contributions of individuals and teams but that the increase of contributions does not necessarily have to transmit into higher earning and hence welfare as proposed by the experiments of Maier-Rigaud et al. (2010). In particular, we showed that individuals cast votes earlier and exclude more in earlier periods, which has bad implications for earnings. Thus, the *receiver exclusion effect* is larger for individuals. Overall, teams seem to act more patiently and follow the game theoretic prediction more strongly, because voting and excluding other group members is rather costly.

With respect to the literature, our results indicate that whether the *ingroup favoritism* effect or the *team identity* effect dominates hinges on the form of the public goods problem. In the pure public goods game without ostracism, we don't find teams to behave more selfishly or more pro-socially than individuals. Thus, from an efficiency perspective, teams neither mitigate the inefficiencies arising in the standard public goods game, nor reduce social welfare. However, when introducing a mechanism aiming at increasing contributions and hence overcome inefficiencies, teams do better in terms of earnings and hence welfare. In a broader context, this indicates that, whenever a coordination problem comes in its pure form, teams do not reduce or increase welfare as compared to individuals, but the welfare improvement is larger for teams than for individuals when a non-monetary punishment mechanism, such as ostracism, is at work.

From a policy perspective, we argue that ostracism can be a powerful negative referendum on political leaders to discipline the contributions to a collective good. In particular, we showed that for the outcome of the ostracism mechanism it matters whether the decision to vote and hence ostracize is taken by a single person or a group of people. This should be considered when designing an ostracism mechanism. An efficient design should include the positive contribution effects without the need to actually exclude someone from an alliance. In the ancient Athen, for example, ostracism worked well, especially because only about 10 to 15 people were expelled over the course of almost 200 years (Tridimas, 2016).

We see several promising avenues for future research. One might be to investigate the effects of team composition. This might bring insights into the way participants within a team come to a mutual decision. In particular, we would like to discover which motives and behaviors dominate within teams. Another interesting issue is the role of the design of ostracism. For example, do things change, if it becomes more or less easy to exclude others. What would happen, for example, if all possible votes would be necessary to be excluded? Moreover, it would be interesting to take a closer look on what teams discuss in order to come to a common decision.

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Appendix A.
Experimental Instructions for Individuals (English)

GENERAL INSTRUCTIONS

Today you will participate in two different experiments. Decisions in experiment I don't have an influence on experiment II. The instructions for experiment I follow on this page. The instructions for experiment II will be distributed at the end of experiment I. Every participant receives exactly the same instructions.

If you read the instructions for both experiments carefully, you will be able to earn a considerable amount of money. The amount you earn today will be paid out in cash at the end of experiment II. You receive the profit out of the two experiments and additionally a show up fee of €4.

In both experiments earnings are denominated in Taler. Taler are converted into € at the following exchange rate: 100 Taler = €2.50. Your decisions in the experiments as well as the amount you earn will remain **anonymous.**

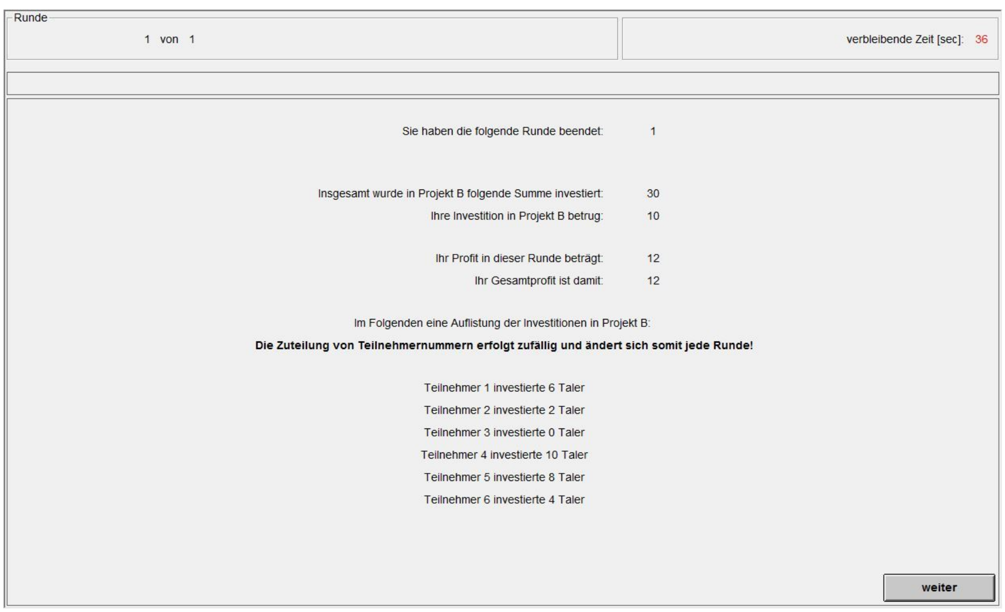
During the experiment all communication with other participants is strongly prohibited. If there are any questions, please raise your hand. We will answer all questions individually. It is very important that you follow that rule because otherwise you will be excluded from both experiments and receive no payment.

EXPERIMENT I

In this experiment you will be randomly paired into groups of 6 people. Your group therefore consists of you and 5 other participants. You play 10 rounds in that group composition.
At the beginning of each of the 10 rounds all participants receive 10 Taler each. It is your task to divide these 10 Taler between two projects (project A and project B). You only can choose integer numbers between 0 and 10.
The income from project A corresponds exactly to the amount of Taler that you invest in that project.
The income from project B corresponds to 40 % of the amount of Taler that are invested in your group **on aggregate** into project B.
Your income in each round is therefore calculated as follows:

Your income in round t
=
Your investment in project A in round t
+
0.4 ∗ (sum of all investments by group members in project B in round t)

Your total income corresponds to the sum of all income received in all rounds. This sum will be paid out to you in € at the end of experiment II together with the total income earned in experiment II and the show up fee of €4.
Afterwards you receive information about the individual investments of the other group members in **project B**.



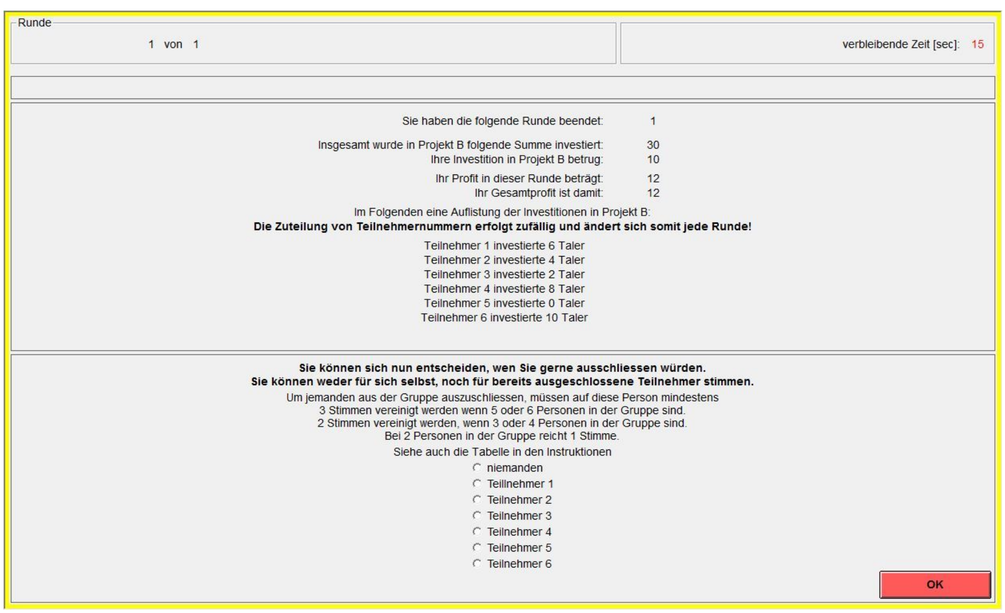
Please note that the participant numbers are remixed each round, so that a participant will not be listed under the same number each round.
Please raise your hand if you have any remaining questions.

EXPERIMENT II

Experiment II is a variation of Experiment I. You will remain in the same group of 6 people in which you participated in experiment I, so your 5 group members are identical to those in experiment I. Again you play 10 rounds in the same group composition.
At the beginning of each of the 10 rounds all participants receive 10 Taler each. It is your task to divide these 10 Taler between two projects (project A and project B). You only can choose integer numbers between 0 and 10.
The income from project A corresponds exactly to the amount of Taler that you invest in that project. The income from project B corresponds to 40 % of the amount of Taler that are invested in your group **on aggregate** into project B
Your income in each round is therefore calculated as follows:

Your income in round t
=
Your investment in project A in round t
+
0.4 $*$ (sum of all investments by group members in project B in round t)

Afterwards you receive information about the individual investments of the other group members in **project B**.
Now you have the option to vote for a participant in your group in order to expel him. You can vote by clicking on the respective field next to the participant. **Please note that the participant numbers are remixed each round, so that a participant will not be listed under the same number each round.**
Please note as well that you can neither vote for yourself nor for someone that already was expelled (the program will ask you to choose again).



Expulsion from the group is based on the following rules:

Current group size	Minimum number of votes
6	3
5	3
4	2
3	2
2	1

For example, if with an actual group size of 5 participants one of these participants receives 3 or more votes, he is expelled from the group. **Expulsion from the group implies that the expelled participant continues to receive his 10 Taler per round, but he neither has to make an investment decision nor will he receive any income out of project B.** After the votes are cast, the amount of votes that each individual participant received will be displayed in the following screen. The amount you are paid is the sum of the total income from experiment I and the sum of all incomes of each round of this experiment (= total income experiment II). The amount converted from Taler into € is paid out to you in addition to the show up fee of €4 without other participants knowing the amount or the decisions you made during both experiments.
Please raise your hand if you have any remaining questions.

Appendix B.
Experimental Instructions for Teams (English)

GENERAL INSTRUCTIONS

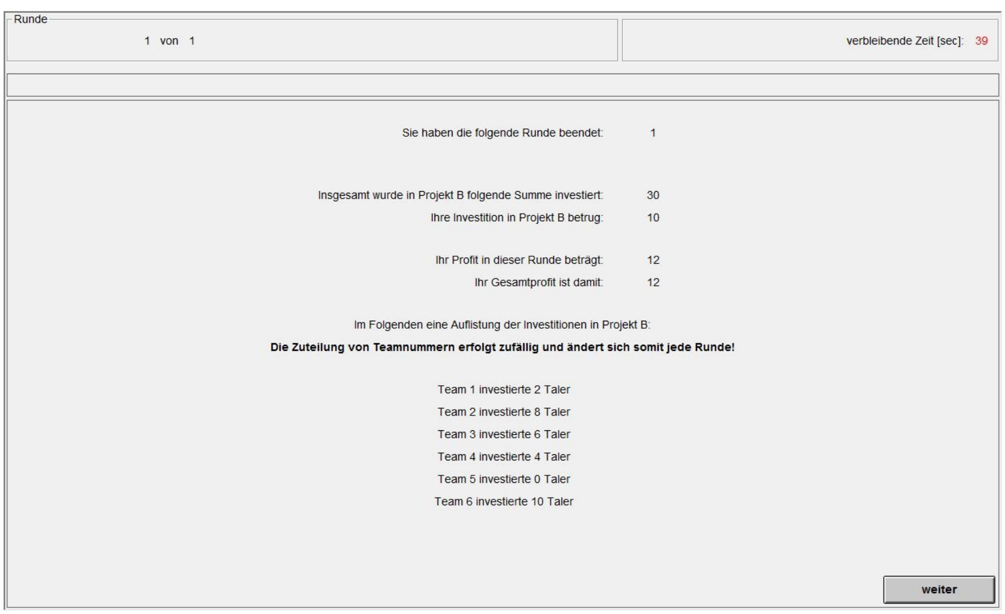
Today you will participate in two different experiments. Decisions in experiment I don't have an influence on experiment II. The instructions for experiment I follow on this page. The instructions for experiment II will be distributed at the end of experiment I. Every participant receives exactly the same instructions.
At the beginning of the experiment another participant will be randomly assigned to you. You will make decisions as a team. The composition of the teams remains unchanged for the whole experiment process.
If you read the instructions for both experiments carefully, you will be able to earn a considerable amount of money. The amount you earn today will be paid out in cash at the end of experiment II. You receive exactly the profit the team you belong to earned in the two experiments and additionally a show up fee of €4.
In both experiments earnings are denominated in Taler. Taler are converted into € at the following exchange rate: 100 Taler = €2.50. Your decisions in the experiments as well as the amount you earn will remain **anonymous**.
During the experiment only communication with your team partner is allowed. All communication with other participants is strongly prohibited. If there are any questions, please raise your hand. We will answer all questions individually. It is very important that you follow that rule because otherwise you will be excluded from both experiments and receive no payment.

EXPERIMENT I

In this experiment your team and 5 additional teams, which all consist of two participants, form a group. You play 10 rounds in that group constellation.
At the beginning of each of the 10 rounds all teams receive 10 Taler each. It is your task to make a decision jointly with the person assigned to you to divide these 10 Taler between two projects (project A and project B). You only can choose integer numbers between 0 and 10.
The income from project A corresponds exactly to the amount of Taler that you invest in that project.
The income from project B corresponds to 40 % of the amount of Taler that are invested in your group **on aggregate** into project B.
The income of your team in each round is therefore calculated as follows:

Your income in round t
=
Your investment in project A in round t
+
0.4 $*$ (sum of all investments by group members in project B in round t)

The total income of your team corresponds to the sum of all income received in all rounds. This sum will be paid out to you and the person assigned to you in € at the end of experiment II together with the total income earned in experiment II. Additionally everybody receives a show up fee of €4 .
Afterwards you receive information about the investments of the other group members in **project B**.



Please note that the numbers are remixed each round, so that a team will not be listed under the same number each round.

Please raise your hand if you have any remaining questions.

EXPERIMENT II

Experiment II is a variation of Experiment I. The composition of the group is identical to that of experiment I. Again you play 10 rounds in the same group constellation.

At the beginning of each of the 10 rounds all teams receive each 10 Taler. It is your task to make a decision jointly with the person assigned to you to divide these 10 Taler between two projects (project A and project B). You only can choose integer numbers between 0 and 10.

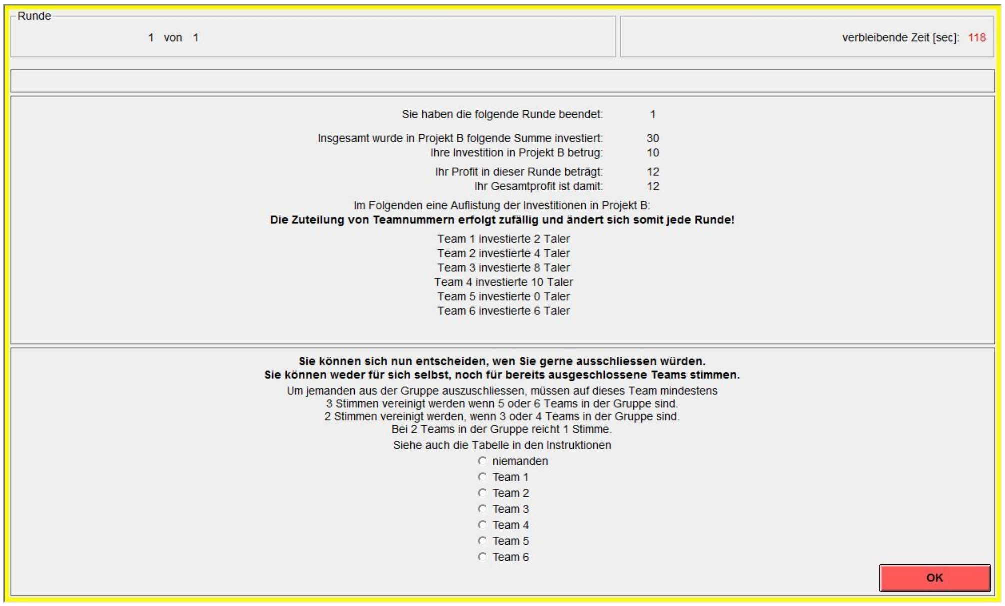
The income from project A corresponds exactly to the amount of Taler that you invest in that project.

The income from project B corresponds to 40 % of the amount of Taler that are invested in your group **on aggregate** into project B.

The income of your team in each round is therefore calculated as follows:

Your income in round t
=
Your investment in project A in round t
+
0.4 $*$ (sum of all investments by group members in project B in round t)

Afterwards you receive information about the individual investments of the other group members in **project B**.
Now you have the option to vote for a team in your group in order to expel it. You can vote by clicking on the respective field next to the team. **Please note that the team numbers are remixed each round, so that a team will not be listed under the same number each round.**
Please note as well that you can neither vote for your team nor for a team that already was expelled (the program will ask you to choose again).



Expulsion from the group is based on the following rules:

Current group size	Minimum number of votes
6	3
5	3
4	2
3	2
2	1

For example, if with an actual group size of 5 teams one of these teams receives 3 or more votes, it is expelled from the group. **Expulsion from the group implies that the expelled team continues to receive its 10 Taler per round, but it neither has to make an investment decision nor will it receive any income out of project B.** After the votes are cast, the amount of votes that each team received will be displayed in the following screen.
The amount your team earned is the sum of the total income from experiment I and the sum of all incomes of each round of this experiment (=total income experiment II). The amount converted from Taler into € is paid out to you and the person assigned to you in addition to the show up fee of €4 without other participants knowing the amount or the decisions you made during both experiments.

Please raise your hand if you have any remaining questions.

Appendix C.
Experimental Instructions for Individuals (German)

ALLGEMEINE INSTRUKTIONEN

Heute werden Sie an zwei unterschiedlichen Experimenten teilnehmen. Entscheidungen aus Experiment I haben keinen Einfluss auf Experiment II. Die Instruktionen für Experiment I folgen auf dieser Seite. Die Instruktionen für Experiment II werden am Ende des ersten Experiments verteilt. Alle Teilnehmer erhalten exakt dieselben Instruktionen.
Wenn Sie die Instruktionen für beide Experimente genau lesen, können Sie eine beträchtliche Geldsumme verdienen. Diese wird Ihnen am Ende der heutigen Sitzung, d.h. nach Experiment II in bar ausbezahlt. Sie erhalten dabei den in beiden Experimenten erspielten Betrag und zusätzlich eine Antrittsprämie i.H.v. 4 €.
Bei beiden Experimenten werden Geldbeträge mit Taler bezeichnet. Taler werden zum folgenden Wechselkurs in Euro umgerechnet: 100 Taler = 2,50 €. Ihre Entscheidungen in den Experimenten sowie Ihre Gelderträge bleiben **anonym**.
Während des Experiments ist jegliche Kommunikation mit anderen Teilnehmern streng verboten. Wenn Sie Fragen haben oder Unklarheiten bestehen, melden Sie sich bitte per Handzeichen. Wir werden alle Fragen individuell beantworten. Es ist sehr wichtig, dass Sie diese Regel befolgen, da Sie sonst von beiden Experimenten und allen Auszahlungen ausgeschlossen werden.

EXPERIMENT I

In diesem Experiment werden Sie per Zufall in Gruppen von jeweils 6 Personen eingeteilt. Ihre Gruppe besteht also aus Ihnen und 5 weiteren Teilnehmern. Sie spielen 10 Runden in dieser Gruppenkonstellation.

Zu Beginn jeder der 10 Runden erhalten alle Teilnehmer jeweils 10 Taler. Ihre Aufgabe ist es, diese 10 Taler zwischen zwei Projekten (Projekt A und Projekt B) aufzuteilen. Es können nur ganzzahlige Beträge zwischen 0 und 10 investiert werden.

Ihr Einkommen aus Projekt A entspricht genau der Anzahl an Talern, die Sie in dieses Projekt investieren.

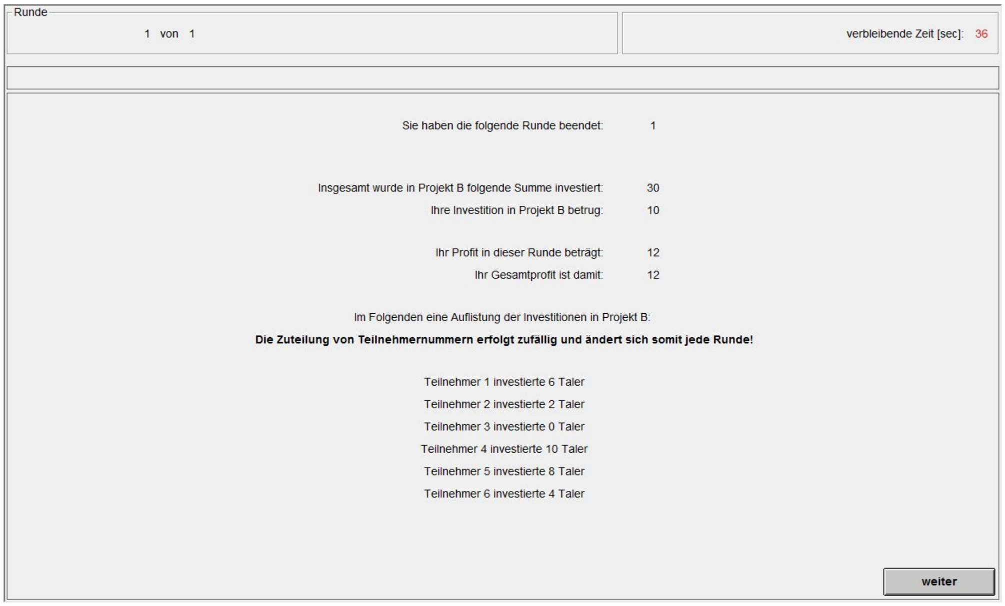
Ihr Einkommen aus Projekt B entspricht 40 % der Anzahl an Talern, die in Ihrer Gruppe **insgesamt** von allen Teilnehmern in das Projekt B investiert wurden.

Ihr Einkommen pro Runde berechnet sich also wie folgt:

Ihr Einkommen in Runde t
=
Ihre Investition in Projekt A in Runde t
+
0.4 ∗ (Summe aller Investitionen von allen Gruppenmitgliedern in Projekt B in Runde t)

Ihr Gesamteinkommen ergibt sich aus der Summe aller Einkommen jeder Runde. Diese Summe wird Ihnen in € umgerechnet am Ende zusammen mit dem Gesamteinkommen aus Experiment II und der Antrittsprämie in Höhe von 4 € ausgezahlt.

Anschließend erhalten Sie Informationen über die Investitionssummen der anderen Gruppenmitglieder in **Projekt B**.



Bitte beachten Sie hierbei, dass die Nummern in jeder Runde per Zufall zugewiesen werden, so dass ein Teilnehmer nicht in jeder Runde unter der gleichen Nummer erscheint.

Bitte melden Sie sich jetzt, wenn Sie noch Fragen haben.

EXPERIMENT II

Experiment II stellt eine Variation von Experiment I dar. Sie bleiben weiterhin in der gleichen Gruppe von insgesamt 6 Personen, in der Sie auch während Experiment I waren, d.h. Ihre 5 Gruppenmitglieder sind identisch zu denen in Experiment I. Sie spielen wiederum 10 Runden in derselben Gruppenkonstellation.

Zu Beginn jeder der 10 Runden erhalten alle Teilnehmer jeweils 10 Taler. Ihre Aufgabe ist es, diese 10 Taler zwischen zwei Projekten (Projekt A und Projekt B) aufzuteilen. Es können nur ganzzahlige Beträge zwischen 0 und 10 investiert werden.

Ihr Einkommen aus Projekt A entspricht genau der Anzahl an Talern, die Sie in dieses Projekt investieren.

Ihr Einkommen aus Projekt B entspricht 40 % der Anzahl an Talern, die in Ihrer Gruppe **insgesamt** von allen Teilnehmern in das Projekt B investiert wurden.

Ihr Einkommen pro Runde berechnet sich also wie folgt:

Ihr Einkommen in Runde t
=
Ihre Investition in Projekt A in Runde t
+
0.4 $*$ (Summe aller Investitionen von allen Gruppenmitgliedern in Projekt B in Runde t)

Anschließend erhalten Sie Informationen über die Investitionssummen der anderen Gruppenmitglieder in **Projekt B**.

Sie werden dann die Gelegenheit für ein Votum darüber haben, wer aus der Gruppe ausgeschlossen werden soll, indem Sie eine Stimme vergeben. Ihre Stimme können Sie durch einen Klick auf das entsprechende Feld des jeweiligen Teilnehmers abgeben. **Bitte beachten Sie hierbei, dass die Nummern in jeder Runde per Zufall zugewiesen werden, so dass ein Teilnehmer nicht in jeder Runde unter der gleichen Nummer erscheint**. Bitte beachten Sie auch, dass Sie weder gegen sich selbst, noch gegen jemanden, der bereits ausgeschlossen wurde, stimmen können (Der Computer gibt in solchen Fällen eine Rückmeldung und fordert Sie zu einer anderen Wahl auf).

Der Ausschluss aus der Gruppe erfolgt nach folgenden Regeln:

Aktuelle Gruppengröße	Mindestanzahl von Stimmen
6	3
5	3
4	2
3	2
2	1

Wenn beispielsweise bei einer Gruppengröße von 5 ein Teilnehmer 3 oder mehr Stimmen auf sich vereint, wird er aus der Gruppe ausgeschlossen. **Der Ausschluss aus der Gruppe bedeutet, dass der jeweilige Teilnehmer für die restlichen Runden ein Einkommen von 10 Talern pro Runde erhält, ohne dass er eine Investitionswahl hat und Einkommen aus Projekt B erzielt.** Nach der Wahl wird die Anzahl an Stimmen, die jedes Gruppenmitglied erhalten hat, im darauf folgenden Bildschirm angezeigt.

Ihr Auszahlungseinkommen ergibt sich aus dem Gesamteinkommen aus Experiment I sowie der Summe aller Einkommen jeder Runde in diesem Experiment (= Gesamteinkommen aus Experiment II). Die von Talern in € umgerechnete Summe wird Ihnen am Ende zusammen mit der Antrittsprämie in Höhe von 4 € ausgezahlt, ohne dass andere Teilnehmer von der Höhe des Betrags oder Ihren Entscheidungen während des Experimentes erfahren.

Bitte melden Sie sich jetzt, wenn Sie noch Fragen haben.

Appendix D.
Experimental Instructions for Teams (German)

ALLGEMEINE INSTRUKTIONEN

Heute werden Sie an zwei unterschiedlichen Experimenten teilnehmen. Entscheidungen aus Experiment I haben keinen Einfluss auf Experiment II. Die Instruktionen für Experiment I folgen direkt im Anschluss. Die Instruktionen für Experiment II werden am Ende des ersten Experiments verteilt. Alle Teilnehmer erhalten exakt dieselben Instruktionen.
Zu Beginn der beiden Experimente wird Ihnen per Zufall eine weitere Person zugelost. Sie bilden zusammen mit dieser Person ein Team und treffen gemeinsam Entscheidungen. Die Zusammensetzung der Teams bleibt über den gesamten Experimentverlauf unverändert.
Wenn Sie die Instruktionen für beide Experimente genau lesen, können Sie eine beträchtliche Geldsumme verdienen. Diese wird Ihnen am Ende der heutigen Sitzung, d.h. nach Experiment II in bar ausbezahlt. Sie erhalten jeweils genau den Geldbetrag, den das Team, dem Sie angehören, in den beiden Experimenten erspielt hat und zusätzlich eine Antrittsprämie i.H.v. 4 €.
Bei beiden Experimenten werden Geldbeträge mit Taler bezeichnet. Taler werden zum folgenden Wechselkurs in Euro umgerechnet: 100 Taler = 2,50 €. Ihre Entscheidungen in den Experimenten sowie Ihre Gelderträge bleiben **anonym**.
Während des Experiments ist nur Kommunikation mit der Ihnen zugelosten Person erlaubt. Jegliche Kommunikation mit anderen Teilnehmern ist streng verboten. Wenn Sie Fragen haben oder Unklarheiten bestehen, melden Sie sich bitte. Wir werden alle Fragen individuell beantworten. Es ist sehr wichtig, dass Sie diese Regel befolgen, da Sie sonst von beiden Experimenten und allen Auszahlungen ausgeschlossen werden.

EXPERIMENT I

In diesem Experiment bildet Ihr Team zusammen mit 5 weiteren Teams, die alle aus 2 Personen bestehen, eine Gruppe. Sie spielen 10 Runden in dieser Gruppenkonstellation.

Zu Beginn jeder der 10 Runden erhalten alle Teams jeweils 10 Taler. Ihre Aufgabe ist es, zusammen mit der Ihnen zugelosten Person, diese 10 Taler zwischen zwei Projekten (Projekt A und Projekt B) aufzuteilen. Es können nur ganzzahlige Beträge zwischen 0 und 10 investiert werden.

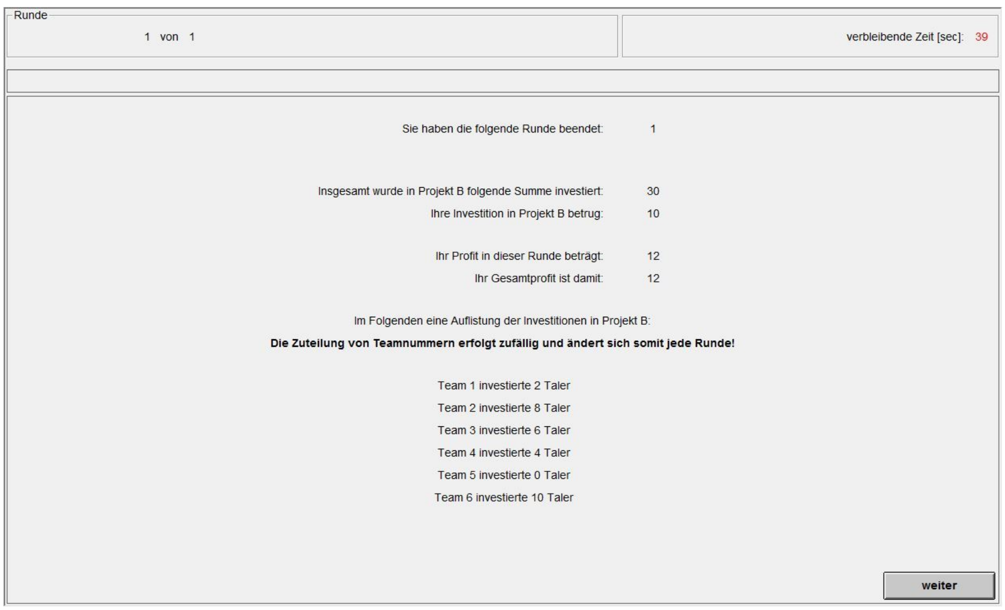
Das Einkommen aus <u>Projekt A</u> entspricht genau der Anzahl an Talern, die Sie in dieses Projekt investieren.

Das Einkommen aus <u>Projekt B</u> entspricht 40 % der Anzahl an Talern, die in ihrer Gruppe **insgesamt** von allen Teilnehmern in das Projekt B investiert wurden.

Das Einkommen ihres Teams pro Runde berechnet sich also wie folgt:

Ihr Einkommen in Runde t
=
Ihre Investition in Projekt A in Runde t
+
0.4 $*$ (Summe aller Investitionen von allen Gruppenmitgliedern in der Gruppe in Projekt B in Runde t)

Das Gesamteinkommen ihres Teams ergibt sich aus der Summe aller Einkommen jeder Runde. Diese Summe wird Ihnen und der Ihnen zugelosten Person jeweils am Ende zusammen mit dem Gesamteinkommen aus Experiment II in € umgerechnet ausgezahlt. Zusätzlich erhalten sie jeweils eine Antrittsprämie in Höhe von 4 €.
Anschließend erhalten Sie Informationen über die Investitionssummen der anderen Gruppenmitglieder in **Projekt B**.



Bitte beachten Sie hierbei, dass die Nummern in jeder Runde per Zufall zugewiesen werden, so dass ein Team nicht in jeder Runde unter der gleichen Nummer erscheint.
Bitte melden Sie sich jetzt, wenn Sie noch Fragen haben.

EXPERIMENT II

Experiment II stellt eine Variation von Experiment I dar. Die Zusammenstellung der Gruppe aus Experiment I bleibt bestehen. Sie spielen wiederum 10 Runden in derselben Gruppenkonstellation.

Zu Beginn jeder der 10 Runden erhalten alle Teams jeweils 10 Taler. Ihre Aufgabe ist es, zusammen mit der Ihnen zugelosten Person, diese 10 Taler zwischen zwei Projekten (Projekt A und Projekt B) aufzuteilen. Es können nur ganzzahlige Beträge zwischen 0 und 10 investiert werden.

Das Einkommen aus Projekt A entspricht genau der Anzahl an Talern, die Sie in dieses Projekt investieren.

Das Einkommen aus Projekt B entspricht 40% der Anzahl an Talern, die in ihrer Gruppe **insgesamt** von allen Teilnehmern in das Projekt B investiert wurden.

Das Einkommen ihres Teams pro Runde berechnet sich also wie folgt:

Ihr Einkommen in Runde t
=
Ihre Investition in Projekt A in Runde t
+
0.4 ∗ (Summe aller Investitionen von allen Gruppenmitgliedern in Projekt B in Runde t)

Anschließend erhalten Sie Informationen über die Investitionssummen der anderen Gruppenmitglieder in **Projekt B.**

Sie werden dann die Gelegenheit für ein Votum darüber haben, wer aus der Gruppe ausgeschlossen werden soll, indem Sie eine Stimme vergeben. Ihre Stimme können Sie durch einen Klick auf das entsprechende Feld des jeweiligen Teams abgeben. **Bitte beachten Sie hierbei, dass die Nummern in jeder Runde per Zufall zugewiesen werden, so dass ein Team nicht in jeder Runde unter der gleichen Nummer erscheint**. Bitte beachten Sie auch, dass Sie weder gegen das eigene Team, noch gegen ein Team, das bereits ausgeschlossen wurde, stimmen können (Der Computer gibt in solchen Fällen eine Rückmeldung und fordert Sie zu einer anderen Wahl auf).

Der Ausschluss aus der Gruppe erfolgt nach folgenden Regeln:

Aktuelle Gruppengröße	**Mindestanzahl von Stimmen**
6	3
5	3
4	2
3	2
2	1

Wenn beispielsweise bei einer Gruppengröße von 5 ein Team 3 oder mehr Stimmen auf sich vereint, wird es aus der Gruppe ausgeschlossen. **Der Ausschluss aus der Gruppe bedeutet, dass das jeweilige Team für die restlichen Runden ein Einkommen von 10 Talern erhält, ohne dass es eine Investitionswahl hat und Einkommen aus Projekt B erzielt.** Nach der Wahl wird die Anzahl an Stimmen, die jedes Gruppenmitglied erhalten hat, im darauf folgenden Bildschirm angezeigt.
Das Auszahlungseinkommen für ihr Team ergibt sich aus dem Gesamteinkommen aus Experiment I sowie der Summe aller Einkommen in diesem Experiment (= Gesamteinkommen aus Experiment II). Die von Talern in € umgerechnete Summe wird Ihnen und der Ihnen zugelosten Person jeweils am Ende von Experiment II zusammen mit der Antrittsprämie in Höhe von jeweils 4 € ausgezahlt, ohne dass andere Teilnehmer von der Höhe des Betrags oder Ihren Entscheidungen während des Experimentes erfahren.

Bitte melden Sie sich jetzt, wenn Sie noch Fragen haben.

Appendix E.
Questionnaire (English)[17]

QUESTIONNAIRE

PC-Number: _____
Design: _____
Session: _____

Please answer the following questions. If multiple responses are allowed, this is explicitly mentioned in the question. Your answers are anonymous and will be used for this study only.

Part 1: *These questions refer to the previous experiments.*
In the experiment without voting: How much of the 10 Taler did you expect the other players would invest in project B (group investment)? [exp_no][18]
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Taler

In the experiment with voting: How much of the 10 Taler did you expect the other players would invest in project B (group investment)? [exp_o]
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Taler

As you had to choose between the different projects, how would you describe your strategies? (Multiple responses possible)

☐ Try to earn as much as possible for myself. [ego]
☐ Make sure that total income for all players in group is as high as possible. [social]
☐ Try to achieve a fair income distribution between the players in the group. [fair]
☐ Try to earn more than the other players. [rival]
☐ Miscellaneous. Please describe:
____.

What did prompt you to vote for other players? (Multiple responses possible)

☐ I was angry about the investment decision of the player. [anger]
☐ To my mind the player has infringed universal rules of conduct. [rule]
☐ I tried to influence future investment decisions of the other players. [strategic]
☐ Miscellaneous. Please describe:
____.

[17] Questionnaires for participants who took part in the individual treatments and the team treatments only differ by some linguistic adaptions. In the following we provide the questionnaire for participants of the individual treatments. Questionnaire for participants of the team treatments available on request.
[18] Codes in brackets were only for the sake of statistics and were not part of the questionnaire for the participants.

☐ I did not vote. [no]

When you had to make a decision in the experiments, how much did you follow social standards of your real life? [norm]

not at all	☐	☐	☐	☐	☐	☐	☐	very much
	1	2	3	4	5	6	7	

Part 2: *These questions do not refer to the previous experiments. Please answer in the most general sense.*

Do you think most people would try to take advantage of you if they got a chance, or would they try to be fair? [gss_fair]

☐ Would take advantage. [1]
☐ Would try to be fair. [2]
☐ Depends. [1.5]
☐ Don't know. [/]

Would you say that most of the time people try to be helpful, or that they are mostly looking out for themselves? [gss_help]

☐ Try to be helpful. [2]
☐ Just look out for themselves. [1]
☐ Depends. [1.5]
☐ Don't know. [/]

Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people? [gss_trust]

☐ Most people can be trusted. [2]
☐ Can't be too careful. [1]
☐ Depends. [1.5]
☐ Don't know. [/]

Your gender: [female]

☐ Female.
☐ Male.

What is your age? _____ [age]
How many siblings do you have? _____ [siblings]

Please check for completeness.
Thank you for your cooperation!

Appendix F.
Questionnaire (German)[19]

FRAGEBOGEN

PC-Kennzahl: _____
Design: _____
Session: _____

Bitte beantworten Sie die folgenden Fragen. Falls Mehrfachnennungen möglich sind, wird explizit bei der jeweiligen Frage darauf hingewiesen. Ihre Antworten werden anonym erfasst und nur für diese Studie verwendet.

Teil 1: *Diese Fragen beziehen sich auf die vorangegangenen Experimente.*
Im Experiment ohne Stimmabgabe: Wie viel haben sie vor Beginn erwartet, würden die anderen Spieler durchschnittlich von ihren 10 Talern in Projekt B (Gruppeninvestment) investieren? [exp_no][20]
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Taler

Im Experiment mit Stimmabgabe: Wie viel haben sie vor Beginn erwartet, würden die anderen Spieler durchschnittlich von ihren 10 Talern in Projekt B (Gruppeninvestment) investieren? [exp_o]
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 Taler

Als Sie in den Experimenten zwischen den beiden Projekten wählen mussten, wie würden Sie ihr strategisches Vorgehen beschreiben? (Mehrfachnennung möglich)

- ☐ Versuchen, möglichst viel für sich selbst zu verdienen. [ego]
- ☐ Darauf achten, dass der Verdienst aller Spieler zusammen gerechnet möglichst hoch ist. [social]
- ☐ Versuchen, eine möglichst gerechte Verteilung der Verdienste auf alle Spieler zu erreichen. [fair]
- ☐ Versuchen, mehr zu verdienen als die anderen Spieler. [rival]
- ☐ Sonstiges. Bitte beschreiben: ____.

Was hat Sie dazu bewegt, im entsprechenden Experiment Stimmen an andere Spieler zu vergeben? (Mehrfachnennung möglich)

- ☐ Mich hat die Investitionsentscheidung des Spielers verärgert. [anger]

[19] Questionnaires for participants who took part in the individual treatments and the team treatments only differ by some linguistic adaptions. In the following we provide the questionnaire for participants of the individual treatments. Questionnaire for participants of the team treatments available on request.
[20] Codes in brackets were only for the sake of statistics and were not part of the questionnaire for the participants.

☐ Der Spieler hat mit seiner Investitionsentscheidung in meinen Augen allgemein gültige Verhaltensregeln missachtet. [rule]
☐ Habe versucht, zukünftige Investitionsentscheidungen der Spieler zu beeinflussen. [strategic]
☐ Sonstiges. Bitte beschreiben:
____.
☐ Habe keine Stimme vergeben. [no]

Wie sehr haben Sie sich bei ihren Entscheidungen im Experiment an gesellschaftlichen Vorgaben aus ihrem wirklichen Leben orientiert? [norm]

gar nicht	☐	☐	☐	☐	☐	☐	☐	sehr stark
	1	2	3	4	5	6	7	

Teil 2: *Diese Fragen beziehen sich nicht mehr direkt auf die vorangegangenen Experimente. Beantworten Sie diese ganz allgemein.*

Denken Sie, die Mehrheit der Leute würde versuchen, sich einen Vorteil Ihnen gegenüber zu verschaffen, wenn die Möglichkeit dazu besteht oder denken Sie, dass die Mehrheit versuchen würde, fair zu sein? [gss_fair]

☐ Würde versuchen, sich einen Vorteil zu verschaffen. [1]
☐ Würde versuchen, fair zu sein. [2]
☐ Hängt davon ab. [1.5]
☐ Weiss nicht. [/]

Würden Sie sagen, dass die Leute überwiegend versuchen, hilfsbereit zu sein oder glauben Sie, dass die Leute meistens nur an sich selbst denken? [gss_help]

☐ Versuchen hilfsbereit zu sein. [2]
☐ Denken an sich selbst. [1]
☐ Hängt davon ab. [1.5]
☐ Weiss nicht. [/]

Allgemein betrachtet, würden Sie sagen, dass man den Mitmenschen vertrauen kann oder muss man im Umgang mit anderen Leuten Vorsicht walten lassen? [gss_trust]

☐ Man kann vertrauen. [2]
☐ Vorsicht walten lassen. [1]
☐ Hängt davon ab. [1.5]
☐ Weiss nicht. [/]

Ihr Geschlecht: [female]

- ☐ Weiblich.
- ☐ Männlich.

Wie alt sind Sie? _____ Jahre [age]
Wie viele Geschwister haben Sie? _____ [siblings]

Bitte überprüfen Sie die Fragen nochmals auf Vollständigkeit.
Vielen Dank für ihre Mitarbeit!

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