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ABSTRACT

Exclusion and Reintegration in a Social Dilemma*

Using a negatively framed public good game, we study the cooperative behavior of individuals who reintegrate their group after being excluded by their peers. We manipulate the length of exclusion and whether this length is imposed exogenously or results from a vote. We show that people are willing to exclude the least cooperators although it is not an equilibrium strategy. Exclusion has a positive impact on cooperation when it is followed by a quick rather than a slow reintegration and that the length of exclusion is chosen by the group. In this environment, a quicker reintegration also limits retaliation. Post-exclusion cooperation and forgiveness depend not only on the length of exclusion but also on the perceived intentions of others when they punish.

JEL Classification: C92, H41, D23

Keywords: ostracism, exclusion, reintegration, social dilemma, cooperation, experiment

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1 Introduction

In the presence of social dilemmas, *i.e.* when private and social interests are at odds, the temptation of free-riding is strong, but cooperation can be sustained thanks to several mechanisms, including communication, rewards, sanctions, or taxation. In particular, the effectiveness of punishment mechanisms is now well established. An extreme form of punishment is the exclusion of group members who do not comply with the norm of the community. Various forms of exclusion can be found in societies. Informal and decentralized exclusion (ostracism) sanctions individuals with undesirable behavior who are isolated from the community for a certain amount of time, usually determined by customs.[1] Formal and centralized exclusion mechanisms sanction, notably by imprisonment, people who do not comply with judicial rules. In both cases, the goal is both preventive, punitive and corrective. The intention is to make wrongdoers comply ex ante with the rules of the community if the threat is sufficient, or ex-post if the threat was not sufficient, once they are rehabilitated. However, exclusion may also increase the risk of anti-social behavior and recidivism after they are reintegrated in their group.[2]

Exclusion is an effective mechanism to enforce social norms and limit free-riding in social dilemmas (*e.g.*, Bowles and Gintis, 2004).[3] But while the deterrence theory of Becker (1968) predicts that increasing a penalty should discourage misbehavior, there is still little conclusive empirical evidence of the effect of the *length* of exclusion on post-release compliance and recidivism. For example, studies on the length of prison sentences find little evidence that this length affects either recidivism (Martinson, 1974; Blumstein *et al.*, 1978), employment or income (Needels, 1996; Kling, 2006) after rehabilitation.[4] Moreover, we are not aware of any study measuring the impact of the length of informal exclusion on deterrence and compliance. The absence of conclusive evidence is partly due to the fact that the empirical analysis

[1]The word 'ostracism' comes from the pieces of pottery that were used in the Athenian democracy to vote once a year about the banishment for ten years of non-compliant citizens. The anthropological literature is full of examples of social exclusion in tribes. Ethological studies have shown that scape-goating and shunning exist in social animal species. The forms of exclusion evolve over time, with cyberostracism as a modern expression of the refusal to communicate with someone (Wesselmann and Williams, 2013).

[2]This risk may be all the more important as exclusion may affect emotionally those who are excluded. Exclusion generates anger, lowers self-esteem (Zadro *et al.* 2004; van Beest and Williams, 2006), and may even lead to depression if it lasts (Pressman and Cohen, 2005). In neurosciences, William (2002) has found that exclusion leads to the activation of the anterior cingulate cortex, an area of the brain that responds to pain, and the right ventral pre-frontal cortex, an area that is involved in coping with pain (see also Eisenberger *et al.*, 2003; Masten *et al.*, 2009; Bolling *et al.*, 2011). In contrast, forgiveness coincides with activation in regions implicated in "theory of mind" and perspective-taking (Will *et al.* 2015).

[3]Studies in psychology have shown that ostracized individuals tend to conform more when they are re-admitted in the group (*e.g.*, William *et al.*, 2000; Feinberg *et al.*, 2014), they work harder in group tasks (William and Sommer, 1997) and they become more sensitive to social cues (Gardner *et al.*, 2005).

[4]Smith, Gendreau and Goggin (2002) found that more punishment leads to at most a slight increase in recidivism. In contrast, Lott (1992) found a large effect of the prison sentence length.

based on natural data is often plagued with endogeneity and selection issues.[5]

Our objective is studying how the length of exclusion affects the behavior of wrongdoers *after* they are readmitted in their group, in the context of a social dilemma game. We also study whether the length of exclusion has a different impact when voters had a choice between different lengths, compared to when it is imposed exogenously by an external authority. We consider two dimensions of behavior after reintegration: cooperation and forgiveness *vs.* retaliation. Addressing these questions is highly policy-relevant because the recommendations will differ if a longer exclusion is shown to generate higher net benefits in terms of post-reintegration compliance or if it triggers violent antisocial behavior. By keeping the environment constant (*e.g.*, the same reference group and the same level of information before, during and after exclusion), a laboratory experiment helps identify the direct effect of the length of exclusion and its mode of determination on behavior. It can also mute two channels that play a role in real settings: the loss of human capital associated with durable exclusion and peer effects that permit social learning during exclusion in the behavior that led to exclusion.

Our experiment uses a taking game that is played for 20 periods. We formed groups of four subjects who have to decide simultaneously how many units to withdraw from a preexisting public good. After being informed about the withdrawal decision of each partner, individuals can vote to exclude some members. The decision of excluding someone requires two votes to become effective. Excluded members remain inactive, cannot communicate, receive information about the evolution of cooperation in their group, and are paid a low inactivity payoff. Since the initial value of the public good depends on the group size, excluding a member is potentially costly. In one treatment, the length of exclusion is fixed at one period; in another it is fixed at three periods, and in a third treatment, individuals vote also about the length of exclusion, up to three periods. This environment does not allow group mobility: excluded members are always reintegrated in their previous group. We compare behavior in these treatments with a baseline in which exclusion is not allowed. Thus, we can investigate the effect of exclusion followed by reintegration on excluded members' behavior once they are readmitted in their original group, depending on how long they have been excluded and on the procedure of exclusion.

Our study makes three contributions to the literature. The first contribution is comparing the impact of various lengths of exclusion on the cooperative behavior of

[5]For example, an inmate with a long prison sentence is more at risk of recidivism due to his own characteristics that led to his exclusion, to peer effects in prison and to stigma on the labor market. To address these issues, Drago *et al.*, 2009 used a natural quasi-experiment in Italy where a law implemented an immediate three-year reduction in detention, giving a random manipulation of the length of the remaining sentence at the date of the pardon. They found that longer sentences had ex ante a higher deterrent effect on recidivism, but the inmates who stayed longer in prison responded less to the variation in incentives. In contrast, Maurin and Ouss (2009) who exploited the discontinuity in the relationship between the time served in prison and the date of release created by a collective reduction of sentence in France for the Bastille Day showed a resulting increase on recidivism. Kuziemko (2007) also found that longer sentences decrease recidivism.

excluded members *after* they reintegrate their group. Earlier studies on exclusion in social dilemmas have focused more on the threat of exclusion than on reintegration and most did not manipulate the length of exclusion (*e.g.*, Masclet, 2003; Cinyabuguma *et al.*, 2005; Kerr *et al.*, 2009; Sheremeta *et al.* 2009; Maier-Rigaud *et al.*, 2010). Our second contribution is studying whether endogeneizing the length of exclusion through a voting procedure modulates the impact of exclusion on future cooperation after reintegration in the same group. In the previous literature on exclusion in social dilemmas, the length of exclusion was fixed exogenously. In contrast, we examine whether choosing a less severe sanction when a more severe one was available is perceived as a warning, signaling a willingness to forgive after reintegration, compared to when the length is fixed exogenously.

Our third contribution is studying the impact of the length of exclusion and of its mode of determination on retaliation. Previous studies have highlighted the risk of revenge (*e.g.*, Nikiforakis, 2008) and feuds (Nikiforakis and Engelmann, 2011) induced by punishment in social dilemmas. In our study punishment results from a group decision, which may signal more strongly what the norm of the group is, especially when subjects choose also the length of exclusion. Ambrus and Greiner (2015) have shown that democratic punishment decreases anti-social behavior compared to individual punishment. In our case, we can compare retaliation behavior for a given length of exclusion according to the mode of choice of this length.

Our results show that when the length of exclusion is exogenous, if a larger difference between the individual withdrawal and the group average withdrawal increases the willingness to exclude, this effect is similar regardless of the severity of punishment. In this setting, a longer exclusion has a larger effect on norm compliance after reintegration compared to a shorter exclusion. When the length of exclusion results from a vote, the difference between the individual withdrawal and the group norm also triggers exclusion but does not affect the length of exclusion. We find a (weak) effect of recidivism on the latter. In this setting, the choice of a shorter exclusion has a larger positive effect on cooperation after reintegration whereas the choice of a longer exclusion increases retaliation behavior. Choosing a shorter exclusion when a more severe sanction is available leads to more forgiveness by the reintegrated members and limits negative reciprocity. Indeed, behavior after reintegration does not only depend on the severity of the sanction but also on the intentions of group members that can be inferred from it.

The remaining sections are organized as follows. Section 2 reviews the related litarature very briefly. Section 3 details the experimental design and the procedures. In Section 4, we present behavioral conjectures. Section 5 displays our main results. Section 6 concludes.

2 Literature Review

The previous literature has considered various exclusion mechanisms in different environments, in particular in principal-agent games or gift-exchange games (*e.g.*, Brown *et al.*, 2004; Charness *et al.*, 2011; Berninghaus *et al.*, 2013; Falk *et al.*, 2015; Bernard *et al.*, 2017) and in coordination games. For example, Kopanyi-Peuker *et al.* (2017) study a weak-link game with noisy information in which a principal can replace some members of a team. They find that the fear of exclusion increases cooperation even when workers are imperfectly monitored; but to be effective, the threat of exclusion has to be maintained permanently. Croson *et al.* (2015) compare the impact of excludability in three team production settings (weak-link, voluntary contribution, and a best-shot games) when the lowest contributor in the team is automatically excluded. They find that excludability increases efficiency dramatically, but less so in the weak-link game. In contrast, we study exclusion in a public good environment without competition (between group members or between unemployed players); the decision to exclude someone is made by the group members themselves,[6] without any formal rule defining who should be excluded (also in contrast with Swope, 2002). Note that we also differ from these previous studies in that our design allows us to study whether the reintegrated players retaliate by trying to exclude their punishers.

We also differ from the previous literature in which group members can exclude each others as we manipulate the length of exclusion. In these studies, we observe three types of length of exclusion. In some studies, exclusion is irreversible (Cinyabuguma *et al.*, 2005; Maier-Rigaud *et al.*, 2010). An excluded subject remains ostracized until the end of the session. In contrast, in Charness and Yang (2014) exclusion from the group is irreversible but subjects can move immediately to another group. Finally, in other studies exclusion is only for one period (Masclet, 2003; Kerr *et al.*, 2009; Sheremeta *et al.*, 2009; Koike *et al.* 2015). None of these studies compares different lengths of exclusion. Neuhofel and Kittel (2015) show that irreversible exclusion has a stronger impact than a one-period exclusion but this comparison is based on a between-subject design. The lack of within-subject variation of the length of exclusion in the previous literature is somewhat surprising because exclusion is the only punishment mechanism that has been studied in a binary way: someone is or not excluded, and if punished, each excluded member gets the same punishment regardless of his action. Yet, in real life the severity of exclusion usually depends on the harm caused. Therefore, in our study, we manipulate the possible length of reversible exclusion.[7]

Our study is also related to the literature on endogenous group formation, as

[6] In our setting all group members have the same status; thus, we also differ from Güth *et al.* (2007) in which a leader decides whom to exclude in the group and from Fatas *et al.* (2010) where the subject excluded is selected randomly.

[7] Davis and Johnson (2015) do manipulate the length of exclusion in a game in which participants vote to exclude group members and to reintegrate them. However, excluded members are only excluded from a chat and they are still allowed to contribute to the public good. Exclusion has no monetary consequences.

excluding group members enables players to choose their partners, to a certain extent. For example, Ahn *et al.* (2008) showed that restricted entry in an endogenous group formation mechanism in a public goods game leads to the formation of mid-sized highly cooperative groups. Restricted entry also increases average contributions and earnings in a congestible public good game (Ahn *et al.*, 2009). Riedl *et al.* (2016) found that letting players form networks in a weak-link game leads to fully efficient coordination, demonstrating that the possibility of choosing interaction partners is fundamental to achieve efficiency. Sääksvuori (2014) shows that competitive pressure between groups decreases the likelihood of social exclusion. In our game players can choose their partners, but only if they are able to coordinate to exclude some of them. Once individuals have chosen the length of exclusion, they do not have to vote about the reintegration of the excluded members. Moreover, players in our game reintegrate the same group after being excluded. This allows us to study to which extent reintegrated individuals are willing to cooperate with those who have previously excluded them.

3 Experimental Design and Procedures

We first present our design before detailing the procedures.

3.1 Design

The experiment is based on a taking game, *i.e.* a negatively framed public good game, that is played for 20 periods with a fixed matching protocol. It consists of four treatments that are played between subjects. In all treatments we form groups of four subjects who receive a random identifying number that they keep throughout the 20 periods. A group account is given to the group at the beginning of each period and its value depends on the number of active (non-excluded) members in the group. In period 1, the group account always consists of 80 Experimental Currency Units (ECU), *i.e.* 20 ECU per group member[8]. Each of the four group members can withdraw $w_i \in [0, 20]$ ECU from the group account that they can put in their private account. Each ECU left in the group account yields 0.4 ECU to each member. Each ECU extracted by a member and placed in her private account pays 1 ECU to this member.

The payoff function for subject i in period t is the following:

$$\pi_{i,t} = w_{i,t} + \alpha(n * 20 - \sum_{j=1}^{n} w_{j,t}) \tag{1}$$

with $\alpha = 0.4$ the marginal per capita return of the group account and n the number of active members in the group.

[8]The exchange rate is 35 ECU = 1 Euro.

Baseline Treatment

In this treatment, the number of active members in the group is fixed throughout the game, as there is no possible exclusion. The value of the group account is equal to 80 ECU at the beginning of each period. In each period, each group member decides simultaneously how many ECU to withdraw from the group account, between 0 and 20 ECU. At the end of each period, subjects receive a feedback with their own withdrawal and earnings for the period, and the withdrawal and earnings of each other group member with their id. We rewrite the payoff function as follows:

$$\pi_{i,t} = w_{i,t} + 0.4 * (80 - \sum_{j=1}^{4} w_{j,t}) \tag{2}$$

The following treatments introduce voting and exclusion.

Exo1P Treatment

Each period of the Exo1P treatment (for "Exogenous one Period")[9] consists now in two stages. The first stage is similar to the Baseline: subjects decide simultaneously on the number of ECU they want to withdraw from the group account, between 0 and 20 ECU included. At the beginning of the period, they are informed about the number of active members in the group and the amount of the group account. At the end of the first stage, all group members are informed of the withdrawal decisions and earnings of each group member with their id.

At the beginning of the second stage, subjects have the opportunity to exclude one or more members of their group for one period. Each member of the group makes an exclusion decision for each of the other members of her group. All group members make their decisions simultaneously. If someone is excluded in period t, she will remain inactive in period t+1. This means that in t+1 she will not be able to participate in the taking stage, nor to vote in the punishment stage, and she will receive a fixed payoff of 10 ECU. Thus, being excluded is costly because the associated payoff is lower than when being in the group even if others free ride.[10] During the exclusion period, an excluded member receives feedback on the withdrawal decisions and earnings of her group members, and on the exclusion of other group members in t+1.

There is no direct cost for excluding a group member. Exclusion is indirectly costly since the value of the group account at the beginning of a period depends on the number of active group members and decreases with the number of excluded members. By excluding a group member, the remaining members lose the return from the ECU that the excluded members could have left in the group account if they were not excluded. Indirect costs are null only in the case where the excluded

[9]Note that in these treatments exclusion is endogenous since it results from a vote in the group. The name of the treatment refers to the fact that the length of exclusion is exogenously imposed.

[10]The exclusion payoff is only higher than the payoff of a cooperator who withdraws less than 4 ECU from the public account whereas others free-ride in full.

subject would have withdrawn 20 ECU in the next period if not excluded. Therefore, the payoff function of player i for a period t is:

$$\pi_{i,t} \begin{cases} 10 & \text{if i is excluded} \\ w_{i,t} + 0.4(n * 20 - \sum_{j=1}^{n} w_{j,t}) & \text{otherwise} \end{cases} \quad (3)$$

with n the number of active members in the group.

Excluding a member for one period requires at least two votes. Since a member cannot vote to exclude herself, this corresponds to a majority rule when N=4 and a unanimity rule when N=3. When two or less members remain in a period, the voting stage is withdrawn and it is not possible to exclude anyone.[11] If N=0, each subject receives the exclusion payoff of 10 ECU in t+1 and period t+2 starts.

After casting their votes, participants are informed on the id of each excluded member, if any. They are never informed on the number of votes cast to exclude a group member. A member who is not excluded never knows whether another member voted for her exclusion.

Exo3P Treatment

The Exo3P (for "Exogenous three Periods") treatment is similar to Exo1P except that the length of exclusion is exogenously set at three periods instead of one. If a group member is excluded in period t, she will remain inactive in periods $t+1$, $t+2$ and $t+3$. During each of these three periods, she receives the 10 ECU exclusion payoff and she is informed on the withdrawal decisions and earnings of her group members and on the exclusion of other group members. In period 18 (19, respectively), since there are only two (one, resp.) periods left before the end of the game, if a group member is excluded from the group, she will be excluded for two (one, resp.) periods only. In the last period it is not possible to exclude any group member from the group. This change in procedure for the last three periods is made common information.[12] At the end of the second stage, like in the Exo1P treatment, subjects receive a feedback on the id of each player that has been excluded, if any. They are also given the number of remaining periods of exclusion of the group members that have been excluded earlier.

Endo Treatment

In this treatment, the length of exclusion is endogenous. This has two implications. First, the number of periods of exclusion is no longer unique; it is restricted to the interval $[1, 3]$. Second, the length of exclusion results from a vote from the

[11]Imposing either the unanimity or the majority voting rule regardless of the group size would have been a concern because it would have imposed different requirements to exclude someone according to the group size.

[12]We chose this procedure to avoid having no risk of sanction in three periods whereas severe sanctions were available in the previous periods.

group members. If a group member votes to exclude another group member, she also has to decide for how many periods she wants to exclude this member.[13]

The actual length of exclusion of a subject is determined by the median of the length chosen by all the voters in the group. It is legitimate to assume that a subject who agrees to exclude someone for t periods tacitly agrees to exclude him for any shorter amount of time. In each period, when N=4 each subset of three members vote about the exclusion of the fourth one. If one voter chooses not to exclude, the underlying value of the length is 0. In this case, the median is the lowest number between the choices of the two remaining voters. If less than two voters choose to exclude another member, this group member will not be excluded, therefore no length is computed. Subjects are told that if all the voters agree on a given length, the program applies the chosen amount of time. If the voters chose different amounts of time and if three members are voting in favor of the exclusion of another member, the program implements the intermediate number. If only two members vote in favor of the exclusion of another member but disagree on the length, the program implements the shortest length. We provide examples in the instructions and subjects have to answer a quiz to show their understanding. At the end of the second stage, group members are informed about the members who have been excluded and, if any, about the number of periods of exclusion. They are reminded of the number of remaining periods of exclusion of the group members who have been excluded in earlier periods.

Individual Characteristics

Before playing this taking game, in a preliminary part we elicited the subjects' social preferences regarding cooperation.[14] We adapted the method developed by Fischbacher *et al*. (2001) to our taking game environment. This allows us to classify our subjects into five categories (free-riders, conditional cooperators, unconditional cooperators, subjects with U-shaped preferences, and others).[15]

[13]We acknowledge that it would be better to introduce a single change with the Exo treatments. A possibility would have been to add a treatment with three possible lengths of exclusion, but with a random assignment of each length of exclusion. This would have allowed us to isolate the pure effect of the diversity of lengths of exclusion on behavior after reintegration. However, this would have certainly modified the decision of group members to exclude. Therefore, comparability would have been limited. Instead of a random assignment we could have imposed thresholds for triggering each length, based on the empirical thresholds identified in our current Endo treatment. However, it would have been difficult to set a threshold in the case of retaliatory behavior.

[14]In the instructions this preliminary part is called part 1 and the main game is presented in part 2 (see Appendix 1). Subjects were informed from the beginning that the session consisted of two parts but they received the instructions for part 2 only after completing part 1.

[15]A subject is classified as an unconditional free-rider if he withdraws the maximum possible amount of ECU regardless of his group members' average withdrawal. A subject is classified as an unconditional cooperator if he withdraws 0 ECU regardless of the group average withdrawal. A subject is classified as a conditional cooperator if his withdrawal increases when the group average withdrawal also increases, and vice-versa. A subject with U-shaped preferences is a conditional cooperator above a certain average level of withdrawal by group members but who free-rides while others are on average more cooperative below this threshold. Subjects whose withdrawal profile does not fit in any of the previous categories is classified in the last category.

In this preliminary part, we formed groups of four subjects randomly. Subjects had to make first an unconditional decision and then, conditional decisions. For the unconditional decision, subjects had to indicate the number of ECU they were willing to withdraw from a group account in a one-shot taking game. For the conditional decisions, they had to make a withdrawal decision for each possible average number of ECU withdrawn by three other group members. Therefore, each subject had 21 conditional decisions to make. For payment, one member among the four was randomly selected by the program and paid according to his conditional decision while the three other members were paid according to their unconditional decisions. The payoff of the selected member is therefore determined by the conditional decision that matches the average amount of ECU withdrawn from the group account by the three other members. Earnings are calculated according to the payoff function described at the beginning of this section.

Subjects did not receive any feedback regarding their payoff in this preliminary part before the end of the session. They were also informed at the beginning of the following part that the groups were rematched and that the individual ID numbers were reassigned randomly. At the end of the session, we also collected standard information on the subjects' gender, age, student status and discipline.

3.2 Procedures

The experiment has been run at GATE-Lab, Lyon, France. A total of 208 participants were recruited via HRoot (Bock *et al.*, 2014) mainly among students from local engineering, business and medical schools. No subject participated in more than one session. We ran 12 sessions that involved an average of 20 subjects per session. We collected observations for 12 groups in both the Endo and Exo1P treatments, 13 groups in the Exo3P treatment and 15 groups in the Baseline treatment (see Table A1 in Appendix 2). The experiment was programmed using z-Tree (Fischbacher, 2007).

Upon arrival, subjects randomly drew a ticket from an opaque bag indicating their terminal number. The instructions for the preliminary part were distributed at the beginning of the session and those for the taking game were distributed after completion of the preliminary part (see Appendix 1). We avoided the terms "exclusion" and "excluded members" in favor of more neutral terms, as "remove" and "players who do not participate in the group". After the instructions were read aloud, subjects had to complete a quiz to check their understanding. Responses were checked individually.

Sessions lasted about 1.5 hour. The average earnings were 18.34 Euros (s.e. = 2.60). Subjects were paid the sum of their payoffs from all 20 periods in addition to their payoff for the first part and a €5 show-up fee. They received their payment in cash and in private in a separate payment room.

4 Behavioral Hypotheses

In the Baseline treatment the dominant strategy for a selfish and payoff-maximizing player is to withdraw the maximum from the group account in each period. On the opposite, the social optimum requires that players do not withdraw anything. In the treatments with possible exclusion, exclusion is costly if the excluded member does not free ride in full.[16] Indeed, each remaining group member will lose the marginal return of the amount left by that excluded member in the group account if not excluded. Thus, nobody should exclude.[17] To sum up, there is no cooperation under standard assumptions but if for whatever reason, there is a possibility that someone leaves a positive number of ECU in the group account, there will also be no exclusion.

Hypothesis 1.a: *Each group member withdraws the maximum amount of ECU from the group account.*

Hypothesis 2.a: *In the treatments with possible exclusion, no one is excluded.*

These predictions may not hold if players have social preferences. Previous works on Voluntary Contribution Mechanism games have shown that it is possible to reach full cooperation by using punishment mechanisms (Yamagishi, 1986 ; Fehr and Gächter, 2000 ; Gächter *et al.*, 2008), and that the severity of punishment affects cooperation (*e.g.*, Nikiforakis and Normann, 2012; Neuhofer and Kittel, 2015). These results lead to the following hypothesis that is alternative to Hypothesis 1.a.

Hypothesis 1.b: *The level of cooperation is positive and increases in the length of potential exclusion.*

Previous experiments on ostracism in public good games have shown that participants are willing to exclude even when the decision is costly and they generally exclude the least cooperator (Cinyabuguma *et al.*, 2005; Maier-Rigaud *et al.*, 2010; Davis and Johnson, 2015; Neuhofer and Kittel, 2015). This leads to the following hypothesis that is alternative to Hypothesis 2.a.

Hypothesis 2.b: *In the treatments with possible exclusion, subjects exclude the group members that withdraw the most from the group account.*

After excluded subjects have been reintegrated in their group, the length of exclusion may matter in two different ways: first, it may affect the level of withdrawal, and second, it may influence the willingness to seek revenge for past exclusion.

[16]The 'trembling hand' refinement of the Nash equilibrium (Selten, 1975) could explain such mistakes in the withdrawal decisions (see also Maier-Rigaud *et al.*, 2010).

[17]Note that Hirshleifer and Rasmusen (1989) have shown that costless ostracism can lead to a cooperative equilibrium in some contexts. Considering a n-player prisoner's dilemma game, ostracizing defectors is a sub-game-perfect equilibrium when players follow the 'banishment strategy' according to which everyone cooperates and excludes defectors until the last round where everyone defects.

These effects may depend on how the length of exclusion is determined.

Consider first the case in which the length of exclusion is determined exogenously. Subjects who have been excluded should be more willing to conform to the withdrawal norm of the group after reintegration than before being excluded. Because of the higher cost of exclusion, a more severe punishment should have a stronger impact on withdrawal after reintegration than a less severe one. However, the subjects who have been excluded longer may be more willing to seek revenge by voting for the exclusion of others, compared to those excluded for one period. This leads to the following two hypotheses.

Hypothesis 3: *When the length of exclusion is exogenous, a longer exclusion decreases more the level of withdrawal after reintegration than a shorter exclusion.*

Hypothesis 4: *When the length of exclusion is exogenous, subjects excluded for three periods are more likely to seek revenge than those excluded for one period.*

Consider now the case in which the length of exclusion is endogeneous. Choosing the length of exclusion by voting conveys a richer signal on the group's disapproval and forgiveness compared to the settings in which the length of exclusion is fixed exogenously. If a three period exclusion is interpreted as a less forgiving action, excluded members may express their anger after being reintegrated by increasing their level of withdrawal and by casting votes for excluding the other group members. In contrast, if a one-period exclusion is perceived as a fair and acceptable punishment, retaliation is less likely and subjects may comply more to the norm of the group than people who have been out for one period in the Exo1P treatment. This leads to our last hypotheses.

Hypothesis 5: *When the length of exclusion results from a vote, (a) choosing a shorter exclusion decreases more the target's withdrawal after reintegration compared to a longer exclusion; (b) this effect is greater than in the Exo1P treatment.*

Hypothesis 6: *When the length of exclusion results from a vote, (a) choosing a longer exclusion increases the risk that excluded subjects seek revenge compared to a shorter exclusion, and (b) this effect is greater than in the Exo3P treatment.*

5 Results

We start by examining the treatment effects on cooperation and efficiency. We next investigate exclusion and its determinants. Then, we analyze the effect of exclusion followed by reintegration on withdrawal behavior. Finally, we study retaliation behavior. Throughout the section we refer to Table 1 that displays summary statistics (means, standard deviations and non-parametric tests) for the main variables of interest (withdrawals, length of exclusion, and payoff), by treatment.

Table 1: Summary statistics

	Baseline	Exo1P	Exo3P	Endo
Average withdrawal	16.94	7.81***	10.65***	6.43***
(All members)	(5.40)	(8.20)	(7.56)	(8.60)
Average withdrawal	16.94	8.39***	5.74***	6.50***
of non-excluded members	(5.40)	(8.01)	(7.30)	(8.28)
Average withdrawal	-	16.43	12.31***	15.86
of excluded members		(5.39)	(7.24)	(5.65)
Average number of votes	-	3.06	1.58***	1.68***
in favor of exclusion		(3.19)	(2.14)	(2.32)
(with a max. of 12)				
Average number of active group	-	0.29	0.20***	0.21***
members in favor of exclusion		(0.14)	(0.15)	(0.19)
(with a max. of 4)				
Average number of	-	0.88	0.33***	0.43***
excluded subjects		(1.30)	(1.07)	(1.25)
(with a max. of 4)				
Average length of	-	1	3***	2.08***
exclusion (nb periods)		(0.00)	(0.00)	(0.83)
Average number of exclusion votes	-	1.64	1.29***	1.35
cast by excluded members		(0.92)	(0.95)	(0.81)
after their reintegration				
Average payoff	21.93	21.58*	22.55	22.51
(in ECU)	(4.68)	(8.16)	(8.62)	(8.69)
Average payoff of non-excluded	21.93	24.82***	26.23***	26.15***
members (in ECU)	(4.68)	(6.09)	(6.02)	(6.22)
Number of observations	1200	960	1040	960

Notes: The Table reports mean values, with standard deviations in parentheses. It also reports the results of Mann-Whitney two-tailed tests comparing each treatment with the Baseline, or comparing Exo1P and Exo3P to Endo when the Baseline is omitted. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. The withdrawals per period are measured by the number of ECU taken from the group account. The average withdrawal of excluded group members is at the period of exclusion. The average number of active group members in favor of exclusion is the mean number of subjects who cast at least one vote to exclude another group member (considering only the cases where N>2). The average number of excluded members considers only the cases where a new subject has been excluded. The average length of exclusion is conditional on being excluded.

5.1 Cooperation and Efficiency

We introduce our first result:

Result 1: *The existence of an exclusion mechanism helps sustain cooperation and does not harm social welfare.* This supports Hypothesis 1.b against Hypothesis 1.a.

Support for Result 1. Figure 1 displays the evolution over time of the average withdrawal from the group account by each active group member, by treatment. Subjects take more ECU in the Baseline than in any other treatment and they do so right from the first period and then, throughout the game. As also visible in Table 1, the mean level of withdrawal by active member is lower on average in the treatments in which exclusion is possible (Exo1P: 10.65 ECU; Endo: 7.81; Exo3P: 6.43) compared to the Baseline (16.94 ECU) (Mann-Whitney tests - MW, hereafter: $p < 0.001$ for each pairwise comparison with the Baseline).[18] Considering period 1 in isolation, the mean withdrawal is also lower in the treatments with possible exclusion (Exo1P: 8.16 ECU; Endo: 7.56; Exo3P: 7.08) compared to the Baseline (12.14 ECU) (MW tests: p <0.001 in all pairwise comparisons with the Baseline). This confirms the previous literature showing that the threat of exclusion itself enhances cooperation even before getting any information about others' behavior.

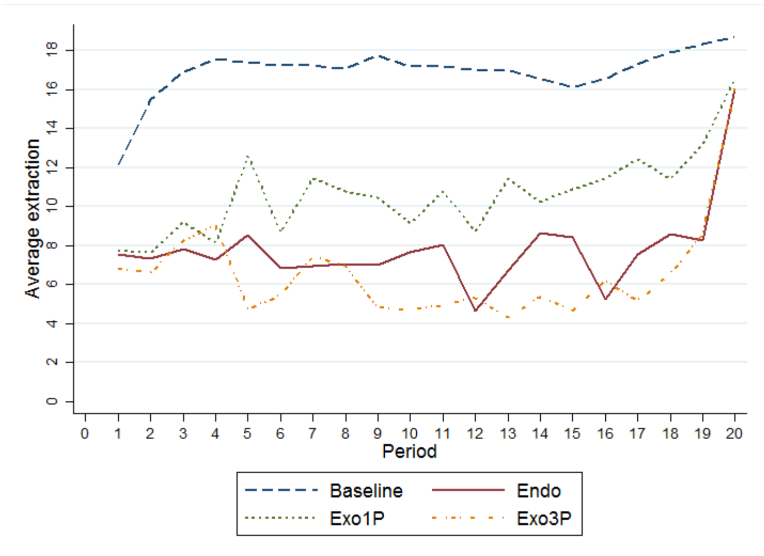


Figure 1: Evolution of average withdrawal over time, by treatment (including all the subjects).

As suggested by Figure 1, we find significant differences in the level of withdrawal depending on the length of exclusion when comparing the Exo1P and the

[18]For the Mann-Whitney tests, the mean withdrawal over all periods for each group gives one independent observation, except when we consider only the first period, in which case the mean withdrawal of each group in this period gives one independent observation. All tests are two-tailed.

Exo3P treatments (MW test: $p < 0.001$), which supports our hypothesis that the length of exclusion matters. However, we find no significant difference between the other treatments with possible exclusion (MW tests: Exo1P *vs*. Endo: p=0.100; Exo3P *vs*. Endo: p=0.320). Interestingly, in the first period there is no significant difference between Exo1P (12.27 ECU), Exo3P (13.19 ECU) and Endo (12.44 ECU) (MW tests: Exo1P *vs*. Endo: p=0.860; Exo1P *vs*. Exo3P: p=0.346; Endo *vs*. Exo 3P: p=0.439). The threat of a harsher punishment in some treatments does not affect the initial withdrawal decisions. This indicates that the effect of possible exclusion in terms of cooperation at the beginning of the game depends on whether there is a punishment mechanism available, but not on the severity of this punishment. This differs from Neuhofer and Kittel (2015), probably because the difference in the threat between a three-period and a one-period exclusion is much smaller than the difference between irreversible exclusion and a one-period exclusion. Overall, this indicates the higher cooperativeness of an environment with a more severe potential punishment when the length of exclusion is exogenous (consistent with *e.g.*, Nikiforakis and Normann, 2008).

Regarding efficiency, as indicated in Table 1, the average payoffs in Endo (22.51 ECU) and Exo3P (22.55 ECU) are higher than in the Baseline (21.93 ECU), but these differences are not statistically significant (MW tests: Endo *vs*. Baseline: p=0.276; Exo3P *vs*. Baseline: p=0.608; Exo3P *vs*. Endo: p=0.825). Interestingly, participants in the Exo1P treatment are worse off on average than in the absence of punishment mechanism (21.58 ECU) (MW test: Baseline *vs*. Exo1P: p=0.048). However, exclusion significantly increases the payoffs of the non-excluded members (21.93 ECU in the Baseline, 26.15 ECU in Endo, MW test: p <0.001; 24.82 ECU in Exo1P, p <0.001; and 26.23 ECU in Exo3P, p <0.001). Hence, exclusion does not systematically harm efficiency when it is followed by reintegration. This result is consistent with previous findings (Cinyabuguma *et al.*, 2005; Sheremeta *et al.*, 2011; Neuhofer and Kittel, 2015). Moreover, the possibility to exclude group members rebalances the distribution of earnings in favor of the more cooperative players since, as shown in the next subsection, cooperative players are less likely to be excluded.

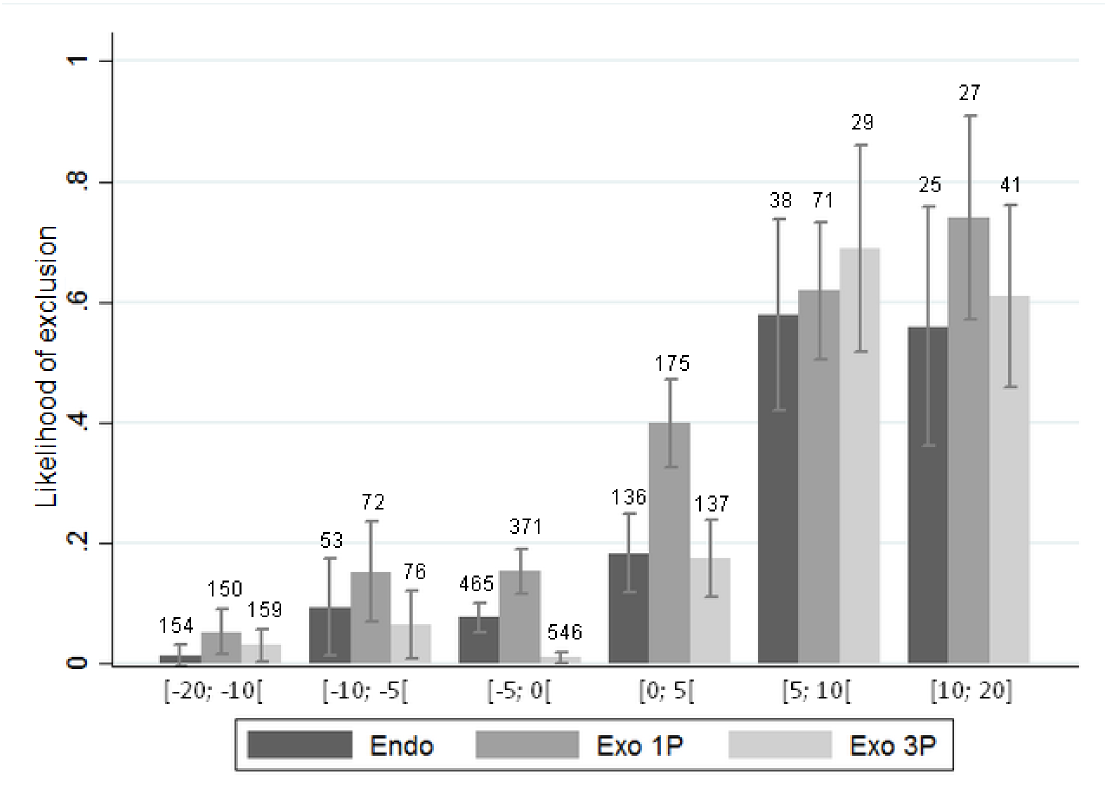
5.2 Determinants of Exclusion

We next analyze the exclusion patterns. We first consider the decision to exclude before examining the choice of the length of exclusion in Endo. Our second result is the following:

Result 2: *Individuals are willing to punish and generally they exclude the least cooperators.* This supports Hypothesis 2.b. against Hypothesis 2.a. *The choice of a length of exclusion depends less on withdrawal behavior than on past sanctioning behavior.*

Support for Result 2. Significantly more people vote for excluding others in Exo 1P (0.29) than in Endo (0.20) and Exo 3P (0.21) (MW tests: Exo1P *vs*. Endo:

p=0.007; Exo1P *vs.* Exo3P: p=0.002). The difference between Endo and Exo3P is not significant (MW test: p=0.956). The overall percentage of group members in favor of exclusion is 26.16% in Exo1P, 14.20% in Exo3P and 15.46% in Endo.[19] As a result, there are more people excluded in Exo 1P (0.88) than in Endo (0.43) and Exo 3P (0.33) (MW tests: Exo1P *vs.* Endo: p <0.001; Exo1P *vs.* Exo3P: p <0.001). The difference between Endo and Exo3P is not significant (MW test: p=0.150). This leads to an overall percentage of excluded subjects of 21.29% in Exo1P, 22.69% in Exo3P and 22.5% in Endo.[20] Thus, individuals are willing to exclude others and this willingness is not affected by the severity of sanctions when individuals cannot adjust this severity.



Note: The numbers above the bars indicate the number of observations.

Figure 2: Exclusion rate according to the difference between the individual withdrawal and the average withdrawal in the group, by treatment.

Subjects excluded for one period withdrew on average 16.43 ECU in Exo1P and 15.44 in Endo; those excluded for three periods withdrew 12.31 ECU in Exo3P and

[19]These results remain the same when excluding the last three periods where long exclusion is no longer possible in Exo3P and in Endo (MW tests: Exo1P *vs.* Endo: p =0.001; Endo *vs.* Exo3P: p=0.912; Exo1P *vs.* Exo3P: p =0.006).

[20]These results remain the same when excluding the last three periods where long exclusion is no longer possible in Exo3P and in Endo (MW tests: Exo1P *vs.* Endo: p <0.001; Endo *vs.* Exo3P: p=0.149; Exo1P *vs.* Exo3P: p <0.001).

14.9 in Endo; and those excluded for two periods in Endo withdrew 17.5 ECU. Figure 2 displays the mean rate of exclusion of individuals depending on the difference between their withdrawal and the mean withdrawal in their group (excluding themselves), taken as the group norm. Each bar represents the proportion of members who, among those subjects who extracted x to y ECU more or less than their group average, have been excluded in each treatment. We can see that group members who extract on average 10 to 20 ECU more than the group average (bars on the far right of Figure 2) are more likely to be excluded than those who extract on average less than 5 ECU more than the group average. This is observed in all treatments.

A regression analysis in which the dependent variable is the voting decision of subject i to exclude subject j in period t confirms that the willlingness to vote for exclusion increases significantly when j withdraws more than the group average (at the 5% or the 1% level of significance, depending on the model). Tables A.2 and A.3 in Appendix 2 report the estimates from random-effects logit regressions with standard errors clustered at the group level. These Tables also show that for a given difference in withdrawal between the target's withdrawal and the group average, the probability to vote to exclude a group member is the same across treatments, regardless of the severity of punishment.

In the Endo treatment, subjects who vote for the exclusion of a group member have also to choose the length of exclusion. 30.77% of the excluded members were excluded for one period, 30.77% for two periods and 38.46% for three periods (the average length of exclusion is 2.08 periods, see Table 1). To investigate the determinants of the length of exclusion we estimated random-effects ordered logit regressions. Our dependent variable is a categorical variable that equals 3 if individual i votes to exclude j for three periods, 2 if i votes to exclude j for two periods, and 1 if i votes to exclude j for one period. Table 2 reports the marginal effects of the independent variables on the vote to exclude for one period in columns (1) and (2), two periods in columns (3) and (4), and three periods in columns (5) and (6). The independent variables include the difference between j's withdrawal and the group average withdrawal (excluding j) in period t when j withdraws more than the group (max (0; $w_{j,t} - \sum_{-j=1,-j\neq j}^{n-1} w_{-j,t}$)) and the difference between the group average withdrawal and j's withdrawal in t when j withdraws less than his group (max (0; $\sum_{-j=1,-j\neq j}^{n-1} w_{-j,t} - w_{j,t}$)). They also include a control for whether j has already been excluded in the past. They include a reintegration dummy that equals 1 if i is reintegrated in t and 0 otherwise. In model (2) reported in columns (2), (4) and (6), we add variables detailing the length of exclusion of i. The variable "i is reintegrated in t after xP exclusion" takes value 1 if i has been reintegrated in t after x period(s) of exclusion and 0 otherwise. This allows us to test whether subjects who have been recently punished are more severe or more forgiving than non excluded members. We also control for the group size, for time, and for individual characteristics (gender, age, student status and category of social preferences).[21]

[21]We estimated alternatively a random-effects GLS model after applying a 2-step Heckman correction, in order to control for a possible selection bias and for unobserved heterogeneity between group members who vote for exclusion and those who do not vote for exclusion. Since the inverse

Table 2: Determinants of the length of exclusion in the Endo treatment

Dep. variable: Choice of i regarding the length of exclusion of j	Exclusion for 1 period (1)	1 period (2)	2 periods (3)	2 periods (4)	3 periods (5)	3 periods (6)
Max (0; $w_{j,t} - \sum_{-j=1,j\neq -j}^{n-1} w_{-j,t}$)	-0.005	-0.007	-0.002	-0.002	0.007	0.009
	(0.005)	(0.006)	(0.002)	(0.002)	(0.007)	(0.007)
Max (0; $\sum_{-j=1,j\neq -j}^{n-1} w_{-j,t} - w_{j,t}$)	-0.002	-0.002	-0.001	-0.001	0.002	0.003
	(0.011)	(0.012)	(0.004)	(0.004)	(0.015)	(0.016)
Exclusion of j prior to t	-0.097*	-0.087	-0.032	-0.025	0.130*	0.112
	(0.050)	(0.055)	(0.028)	(0.029)	(0.075)	(0.081)
i is reintegrated in t	-0.127*	0.110	-0.041***	0.031	0.169**	-0.142
	(0.074)	(0.099)	(0.015)	(0.037)	(0.080)	(0.131)
i is reintegrated in t after 2P exclusion (Endo)	-	-0.349**	-	-0.099	-	0.451**
		(0.178)		(0.062)		(0.194)
i is reintegrated in t after 3P exclusion (Endo)	-	-0.296**	-	-0.083*	-	0.382**
		(0.152)		(0.047)		(0.158)
Group size	-0.047	-0.042	-0.015	-0.012	0.063	0.054
	(0.088)	(0.089)	(0.030)	(0.027)	(0.118)	(0.116)
Period	-0.002	-0.001	-0.001	-0.001	0.002	0.002
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	335	335	335	335	335	335
Clusters	11	11	11	11	11	11
Log pseudo-likelihood	-267.20	-263.40	-267.20	-263.40	-267.20	-263.40

Notes: Table 2 reports the marginal effects from two random-effects ordered logit regressions with robust standard errors clustered at the group level in parentheses. The second model, corresponding to columns (2), (4), and (6), differs from the first model simply by controlling for the length of exclusion of player i. We consider only: *i*) periods from 1 to 17; *ii*) observations from the Endo treatment in which i chose to exclude j; *iii*) groups with more than two members; *iv*) cases where j and i are not excluded (as i cannot vote if she is excluded and i cannot vote to exclude j if j is already excluded). *** p <0.01, ** p <0.05, * p <0.10.

Table 2 shows that the vote for a specific length of exclusion is not directly affected by the number of ECU taken by j relative to the average withdrawal in the group. There is a marginally significant effect of the reputation of the individual who is punished. When j has already been excluded in the past, i is less likely to choose to exclude her for one period (column (1)) and more likely to choose to exclude her for three periods (column (5)). This suggests that the severity of the punishment depends partly on the adjustment of behavior after a previous exclusion. However, the significance of this variable is lost when we control for the length

of the Mills' ratio was not significant, indicating that there is no need to control for a selection bias, we do not report these estimates.

of exclusion of the punisher (columns (2) and (6)). These models also indicate that i is more likely to vote to exclude another group member for three periods and less likely to exclude for one or two periods when herself was reintegrated in period t after two or three periods of exclusion compared to a reintegration in the same period but after only one period of exclusion, expressing the willingness to retaliate severely in reaction to a non-minimal length of exclusion for oneself. We analyze this behavior in sub-section 5.4. Finally, among the individual controls, the social preferences of the subject do not influence voting behavior. [22]

To summarize, if the probability to exclude increases generally in reaction to the importance of the deviation from the norm of the group, the choice of a more severe exclusion does not depend directly on the withdrawal behavior, but rather on recidivism and on the desire to take revenge after having suffered oneself from a more severe punishment.

5.3 Reintegration

The analysis of reintegration patterns delivers two main findings.

Result 3: *Exclusion for three periods improves cooperation in the reintegration period compared to exclusion for one-period in the Exo treatments but not in the Endo treatment.* This supports Hypothesis 3 and Hypothesis 5(a).

Result 4: *The positive effect of exclusion for one period on compliance after reintegration is larger when the length of exclusion results from a vote by the group compared to when the length of exclusion cannot be modulated and is fixed exogenously.* This supports Hypothesis 5(b).

Support for Results 3 and 4. Figure 3 displays the difference between the number of ECU withdrawn by the excluded members and the average withdrawal of their group both in the period of exclusion (left bars) and in the period of reintegration (right bars), by treatment.[23] It shows that reintegrated subjects after three periods of exclusion continue to withdraw more than their group average in the reintegration period in both Endo (+1.83) and Exo3P (+2.48), whereas subjects reintegrated after one period of exclusion comply to the norm of the group in Exo1P (+0.36) and withdraw less than the group average in Endo (-0.92) but the variance is large[24].

The less-than-group-average withdrawal by reintegrated subjects after a one period exclusion in Endo is particularly striking, as in the period of exclusion the

[22] More generally, the category of social preferences of the subject is never significant in any regressions. Most of the time, the other individuals characteristics are not significant either.

[23] Although not illustrated on Figure 3 to keep the comparison symmetric, group members excluded for two periods in Endo take on average 1.56 ECU more than their group members in the period of exclusion and 0.31 ECU more than their group members in the reintegration period.

[24] Note that the difference cannot be due to less information in the case of a longer exclusion since excluded subjects receive also feedback on decisions and earnings of the group members during each period of exclusion.

difference with the group average was higher compared to Exo1P, Exo3P and long exclusion in Endo. Precisely, in the period when they are reintegrated, the members excluded for one period in Endo withdraw 8.73 ECU while the group average withdrawal is 9.65 ECU, whereas in Exo1P they withdraw 15.07 ECU while their group average withdrawal is 14.71 ECU. Conversely, group members excluded for three periods in Endo withdraw on average 14.53 ECU when they are reintegrated while the group average is 12.70 ECU, and in Exo3P they withdraw 9.20 ECU while their group average is 6.72 ECU. Finally, when reintegrated, group members excluded for one period in Endo seem to withdraw on average less ECU than group members excluded for three periods in the same treatment, while group members excluded in Exo1P take on average more ECU than group members excluded in Exo3P; the difference is marginally significant (MW test: p=0.097). The differences between Endo and the other treatments are not significant (MW test: Endo *vs.* Exo1P: p=0.179; Endo *vs.* Exo3P: p=0.447).[25]

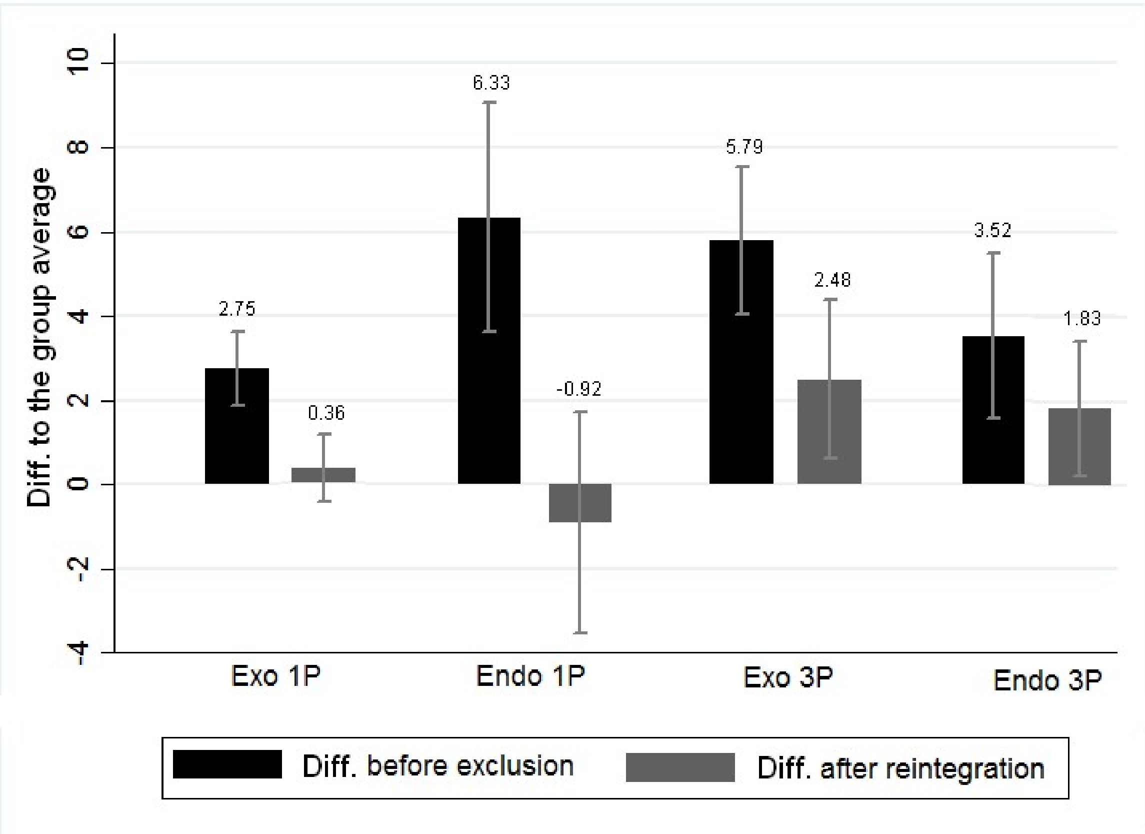


Figure 3: Difference between the number of ECU withdrawn by excluded subjects and by their group members in the exclusion period (left bars) and in the reintegration period (right bars), by treatment.

Using regressions allows us to compare the effect of exclusion on behavior after

[25]We cannot test the significance of the differences between members excluded for one period and members excluded for three periods in Endo because observations are not independent.

reintegration, controlling for the average withdrawal in the group in the period prior to reintegration and for the time of the decision. A regression analysis in which the dependent variable is the number of ECU withdrawn from the group account by an excluded subject in period t when he reintegrates his group is reported in Table A.4 in Appendix 2. It is based on the estimates of random-effects GLS with robust standard errors clustered at the group level. This analysis reveals a significant difference, at the 5% level, between Exo3P and Exo1P: reintegrated subjects withdraw less after three periods of exclusion than after one, controlling for the group average in the period preceding immediately the reintegration (model (1)). In contrast, choosing one-period exclusion in Endo as the reference category instead of Exo1P in model (2) indicates that being excluded for two or three periods instead of one in Endo increases significantly, at the 5% level, the level of withdrawal during the reintegration period. This supports Result 3.

To control for the subject's withdrawal behavior before exclusion, we estimate also random-effects GLS regressions with robust standard errors clustered at the group level in which the dependent variable is the difference in the withdrawal level between t and t-2 in model (1) or between t and t-4 in model (2), for both reintegrated and non-excluded members. These regressions exclude subjects that cannot be observed in both t and t-2 or t-4. If a subject has been excluded for one period (for three periods, respectively) and reintegrated in t, this indicates the difference in withdrawal levels between t, the period of reintegration, and t-2 (t-4, resp.), the period of exclusion. The independent variables include a dummy variable equal to 1 if the subject has been reintegrated in t after being excluded in t-2 in Endo and Exo1P or in $t-4$ in Endo and Exo3P, and 0 if not excluded. We add an interaction term between being reintegrated and the Endo treatment to measure whether the impact of exclusion differs when the length of exclusion results from a vote. We also include the group average withdrawal (excluding the individual) in t-1 and the evolution of the group average withdrawal between t-1 and t-2 or t-4, according to the model. We add a time trend and controls for individual characteristics. Table 3 reports these estimates. The data include the observations from subjects reintegrated in periods 3 to 20, excluding subjects who were excluded after period 17.

Model (1) shows that controlling for the level and the evolution of the group average withdrawals, being reintegrated after being excluded for one period decreases the extraction level between t and $t-2$. The effect is even significantly stronger in the Endo treatment. Model (2) shows also a significant decrease in the evolution of withdrawal between t and t-4 for the individuals reintegrated after being excluded for three periods compared to those who have not been excluded. Here, there is no significant difference between Exo3P and Endo. Being excluded for one period has a positive impact on compliance to the group norm of withdrawal when it is possible to modulate the length of exclusion, which supports Result 4. In contrast, being excluded for three periods has the same impact on cooperation independently of how this length of exclusion has been determined.

Table 3: Determinants of the evolution of the level of withdrawal over time

Dep. variable: Evolution of number of ECU withdrawn	$(wi_t - wi_{t-2})$ All 1P (1)	$(wi_t - wi_{t-4})$ All 3P (2)
Reintegrated after exclusion	-5.214***	-4.314***
	(1.107)	(1.092)
Reintegrated after exclusion *Endo	-3.723**	-0.954
	(1.530)	(1.424)
Group average in t-1	0.003	0.028
	(0.070)	(0.059)
$GA_{t-1} - GA_{t-2}$	0.119**	-
	(0.047)	
$GA_{t-1} - GA_{t-4}$	-	0.204*
		(0.105)
Group size in t	1.660***	2.142***
	(0.307)	(0.640)
Period	0.078	0.221***
	(0.055)	(0.059)
Individual controls	Yes	Yes
Constant	-6.198***	-8.841***
	(0.920)	(2.852)
Observations	1339	1217
Clusters	24	25
R-squared	0.03	0.07

Notes: Table 5 reports random-effect GLS regressions with robust standard errors clustered at the group level in parentheses. GA for group average. The data include the observations from subjects reintegrated in periods 3 to 20, excluding subjects who were excluded after period 17.Individual controls include gender, age, student status, and category of social preferences. *** p <0.01, ** p <0.05, * p <0.10.

5.4 Retaliation

In this section we focus on retaliation behavior by examining the voting behavior of the excluded members after their reintegration, conditional on how long they have been excluded and by which procedure.[26] Our last results are the following.

Result 5: *When the length of exclusion is endogenous, subjects who have been excluded for a shorter duration are less likely to seek revenge when they reintegrate*

[26]In a post-experimental questionnaire we asked subjects to comment on their motivation if they voted at least once to exclude a fellow group member. Most responded that they voted for exclusion to punish free-riders. However, 25% of them reported that they were willing to retaliate from previous exclusion.

their group than subjects excluded for a longer duration; no such effect is found when the length of exclusion is imposed exogenously. This rejects Hypothesis 4 and supports Hypothesis 6(a).

Result 6: *Subjects excluded for three periods (one period) seek only marginally (significantly at the 1 percent level, resp.) more (less, resp.) revenge when the length of exclusion is endogenous rather than exogenous.* This supports only weakly Hypothesis 6(b).

Support for Results 5 and 6. Figure 4 displays the share of subjects who were previously excluded and who exert total revenge when reintegrating their group. ”Total revenge” is defined as the fact for a previously excluded subject to vote to exclude all the other active group members after reintegration. This behavior is blind when N=4 since exclusion requires two votes.

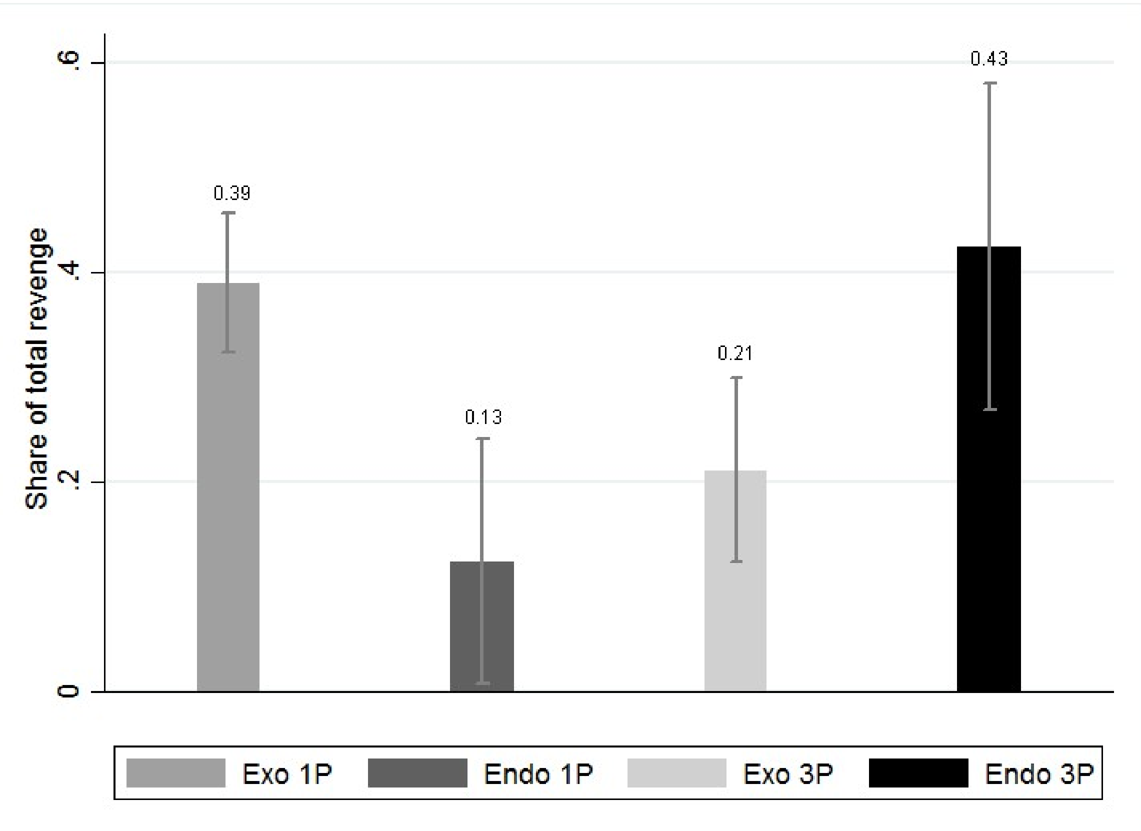


Figure 4: Share of total revenge by excluded members in the reintegration period, by treatment

In Exo1P 39.05% of the reintegrated subjects vote for excluding all the other group members. This percentage is only 12.5% for reintegrated subjects excluded for one period in Endo. In contrast, it is 21.18% in Exo 3P but it rises to 42.5% for those excluded for three periods in Endo. The percentage in Exo1P is significantly higher than in Endo (30.77%, regardless of the length of exclusion) (two-tailed two-sample test of proportions: p <0.001) and in Exo3P (p <0.001). The difference between Exo3P and Endo is also significant (p=0.022). As before, we cannot test the comparisons involving the split samples of Endo since the observations are not independent.[27] One-period exclusion limits counter-punishment in Endo, but not when the length of exclusion is imposed exogenously.

To investigate retaliation, we first examine the determinants of the reintegrated subjects' willingness to cast 0, 1, 2 or 3 exclusion votes when they reintegrate their group. Therefore, we estimage a random-effects Poisson regression with standard errors clustered at the group level. The outcomes are reported in column (1) in Table 4. The dependent variable is a categorical variable equal to the number of exclusion votes by the reintegrated subject. The independent variables include dummy variables for each possible length of exclusion of subject i interacted with each treatment, setting Exo1P as the reference category. We control for the amount withdrawn by i in t, the average amount withdrawn by the other group members in t, the group size and the usual individual characteristics. The sample pools the data from all the treatments with exclusion but includes only the excluded subjects who reintegrate their group in period t. We only consider periods 3 to 17 and groups where exclusion is possible (N > 2).

Column (1) shows that group members reintegrated after one period of exclusion in Endo cast significantly less exclusion votes than those excluded in Exo1P. They are less likely to retaliate when group members chose a short exclusion when they could have chosen a longer duration. Group members reintegrated after three periods in Endo cast more exclusion votes than those excluded in Exo1P. Since there is no significant difference between Exo1P and Exo3P, this indicates that individuals excluded for a longer time are marginally more likely to seek revenge when group members chose the length than when it was imposed to them, supporting Result 6. A longer exclusion increases significantly the number of exclusion votes cast by reintegrated members only in Endo.[28]

To explore the determinants of voting for total revenge, column (2) reports the estimates of a random-effects logit regression with standard errors clustered at the group level. The dependent variable is a dummy variable equal to 1 if the reintegrated member votes for the exclusion of all the other active group members, and 0 otherwise. The independent variables are the same as in column (1). Controlling for the individual and the group average withdrawals, column (2) shows that group members excluded for one period in Endo are significantly less likely to vote for the exclusion of all the other group members when reintegrating the group compared to similar subjects in Exo1P. Members excluded for one period are less likely to retaliate systematically when the length of exclusion has been chosen than when it

[27] While not illustrated in Figure 4 to keep the comparison symmetric, 34.38% of the subjects excluded for two periods in Endo vote for total revenge after reintegration.

[28] A similar regression conducted only on the Endo data indicates that the marginal effect of a two-period exclusion is 0.750*** (0.287) and the effect of a three-period exclusion is 1.024*** (0.267), compared to a one-period exclusion.

is fixed exogenously.

Table 4: Effect of the length of exclusion on the number of exclusion votes and on the likelihood of total revenge by reintegrated subjects

Dep. variables:	Nb of exclusion votes (1)	Total revenge (2)
1P exclusion in Exo1P	*Ref.*	*Ref.*
1P exclusion in Endo	-0.627***	-0.290***
	(0.181)	(0.075)
2P exclusion in Endo	0.003	0.166
	(0.185)	(0.193)
3P exclusion in Endo	0.264**	0.224
	(0.110)	(0.182)
3P exclusion in Exo3P	0.115	0.033
	(0.205)	(0.204)
Amount withdrawn	0.009	0.016**
by i in t	(0.007)	(0.007)
Group average withdrawal	0.029**	0.018*
in t excluding i	(0.012)	(0.009)
Number of exclusion	0.034	0.077
prior to t	(0.056)	(0.064)
Group size	0.450***	0.001
	(0.116)	(0.134)
Period	-0.017	-0.013
	(0.018)	(0.018)
Individual controls	Yes	Yes
Constant	-1.537***	
	(0.562)	
Observations	323	323
Clusters	35	35
Log pseudo-likelihood	-479.46	-169.23

Notes: Column (1) reports the marginal effects from a random-effects Poisson model where the dependent varable is the number of exclusion votes cast by excluded members when they reintegrate the group. Column (2) reports the marginal effects from a random-effects logit regression where the dependent varable is the probability of the reintegrated members to vote for total revenge (*i.e.*, for the exclusion of all the other group members). We retain only the observations for the groups that contain at least three members and the observations from periods 3 to 17. Standard errors (in parentheses) are clustered at the group level. *** p <0.01, ** p <0.05, * p <0.10.

There is no significant difference in the likelihood of total revenge between group members excluded for one period or for three periods when the length of exclusion is fixed exogenously. In contrast, subjects excluded for two or three periods are significantly more likely to use total revenge than those excluded for one period when the length of exclusion resulted from a vote, supporting Result 5.[29]

To conclude, subjects excluded for a longer time are more likely to seek revenge than those excluded for one period but only when the length of exclusion results from a vote. When it is fixed exogenously, the length of exclusion does not affect the likelihood of counter-punishment. Thus, it is not the length of exclusion that matters so much in triggering negative reciprocity, but the perceived intentions of the group.

6 Conclusion

In the context of social dilemmas, when people have to reintegrate their group after being excluded instead of joining another group, to which extent are they able to cooperate with those who previously excluded them? The answer to this question may depend on the length of exclusion and on how this length has been determined. To address this question we have conducted a controlled experiment based on a negatively framed public goods game in which group members can vote for excluding their peers for different durations and in which the severity of punishment is either imposed exogenously or chosen by the group members.

Our findings show that deviations from the group average withdrawal behavior determine the vote for exclusion but not the choice of the legnth of exclusion. Regarding the latter, we find some (weak) evidence of a second-chance strategy, as people tend to punish more severely subsequent defections that the initial ones. When the length of exclusion cannot be modulated, members excluded for three periods cooperate more when they return compared to those excluded for one period. But when the length of exclusion results from a vote and can be adjusted to the distance between the individual withdrawal behavior and the group average, a shorter length has a positive effect on the cooperativeness of the reintegrated participants. On the opposite, subjects excluded for the maximum length are less likely to comply with the group norm when they return and they are more likely to retaliate by voting for the exclusion of all the other members, including the cooperators.

Our results highlight the importance of adaptive punishment and a quick reintegration of the individuals who have been punished to sustain cooperation and limit anti-social behavior after reintegration. Short exclusion has a positive effect when it can be interpreted as forgiving, which is less the case when there is only one possible length of exclusion. This is consistent with the ‘reintegrative shaming’ theory in criminology (Braithwaite, 1989) and the results of Coricelli *et al.* (2014) showing in a tax evasion context that pardon reduces future violations whereas in

[29] A similar regression conducted only on the data of the Endo treatment indicates that the marginal effect of a two-period exclusion is 0.673*** (0.203) and the effect of a three-period exclusion is 0.685*** (0.154), compared to a one-period exclusion.

the absence of pardon, offenders have no more moral motivation to comply once their reputation is lost.

We acknowledge, however, some limitations of our study. The positive effect of short exclusion on cooperation in our Endo treatment may be driven by two effects. First, subjects have been excluded for a short duration knowing that they could have been punished more severely, which may relieve them. Second, the length of exclusion results from a vote of group fellows, and this "democratic" expression of disapproval may facilitate its acceptance. Our design does not allow us to disentangle these effects. Similarly, the counter-effects of a long exclusion may result from two dimensions. A longer exclusion may trigger negative emotions against group members who could have signaled their disapproval with a milder sanction. But the possibility to choose the length of exclusion helps also screen the free-riders. Those who are repeatedly less compliant may also be those who are more likely to behave aggressively towards others after reintegration. The fact that in our regressions we never found any effect of the type of social preferences on behavior speaks in favor of the first effect. But to weight each of these two dimensions more precisely, a random assignment of the length of exclusion and direct measures of emotions might be useful. We leave this to further investigation.

Appendices

Appendix 1. Instructions

All the instructions are translated from French.

Instructions for the introduction and part 1 (common to all treatments):

We thank you for your participation in this experiment on decision making. Please be aware that you are not allowed to communicate with the other participants during the experiment. Your payoffs will depend on your own decisions as well as on the decisions of other participants during this experiment. There is no right or wrong answers.

This experiment is divided into two parts. At the beginning of each part, the software will randomly form groups of 4 participants. You will be matched with three other participants at the beginning of the first part. At the beginning of the second part, the software will form new groups. In the second part, you will be matched with three participants who will be different from the participants you were matched with in the first part. You will stay in the same group for the whole duration of each part.

You will never know the other group members' identity. In each group, each member will be identified by a number that will remain the same throughout the part.

Every decision you make and every answer you give will remain strictly anonymous.

All the transactions during the experiment are made in ECU (Experimental Currency Units). At the end of the session, your earnings in ECU in the two different parts will be added up and converted into Euros at the following exchange rate:

35 ECU = 1 Euro

Your earnings will be paid to you in cash and in private at the end of the experiment in a separate room. You will also earn 5 euros for having arrived on time for the experiment.

First, we will distribute the instructions for the first part. You will get the instructions for the second part at the end of the first part. Please press ≪ OK ≫ to move on to the next screen.

PART 1

At the beginning of this part, a total endowment of 80 ECU will be assigned to your group of 4 participants. This endowment will be deposited on a group account. The group account yields a 40% return on its total amount to each member of the group.

Each member of the group can withdraw a certain number of ECU from this group account to put on his private account. Each member decides individually how much he is willing to withdraw from the group account, between 0 and 20 ECU inclusive.

Each ECU that you withdraw from the group account pays you 1 ECU. If you decide to keep this ECU in the group account instead, your payoff from the group account is 40% of 1 ECU = 0.4 ECU. The payoff for each other group member is also 0.4 ECU. This means that keeping ECU on the group account increases the payoff of the other members. Similarly, you earn 0.4 ECU for each ECU kept on the group account by the other group members. For each ECU kept on the group account by one of your group members, you get a 40% return of 1 ECU = 0.4 ECU.

Example:

Suppose that the total amount withdrawn is 20 ECU. The total amount left on the group account is 60 ECU (80-20=60). In this example, each group member receives a revenue from the group account equal to 40% of 60 = 24 ECU. Now, suppose that the amount withdrawn is 65 ECU. The amount left on the group account is 15 ECU. Each member receives a revenue from the group account equal to 40% of 15 = 6 ECU.

Payoff calculation:

Your final payoff in this part will be:

- On the one hand, the amount you have withdrawn from the group account.
- On the other hand, the revenue from the group account: this revenue is equal to 40% of the amount left on the group account after each group member has made his decision (the amount left on the account is 80 minus the sum withdrawn by each member). Each ECU kept on the group account yields a return of 0.4 ECU.

As a consequence, your total payoff is computed as follows:

The amount you have withdrawn from the group account
+ 40% (80 ECU – total amount withdrawn by the group members)

Example:

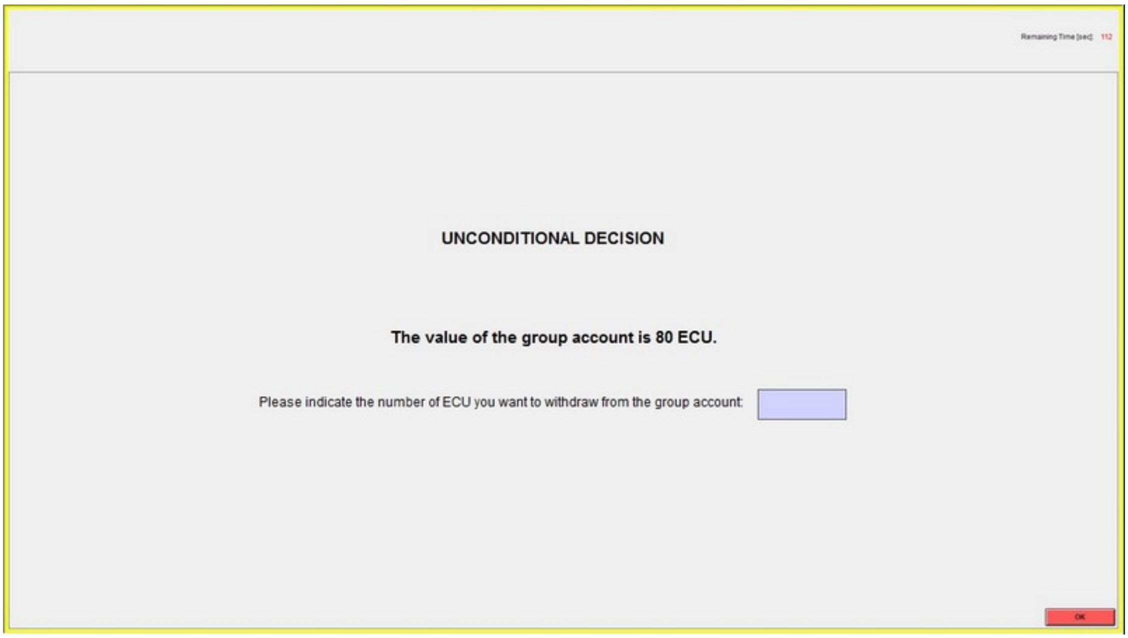
Suppose that you withdraw 10 ECU from the group account and each of the other 3 group members withdraws 1 ECU from the group account. The total amount left on the group account is 80 ECU minus the 10 ECU that you have withdrawn, minus 3 ECU withdrawn by the other group members, *i.e.* 67 ECU. In this case, you get from the group account 40% of 67 ECU = 27 ECU. You also need to add the 10 ECU that you withdrew from the group account. In this example, your final payoff is 37 ECU (10+27).

***

Before moving on to the rest of the instructions, please read these instructions again and fill out the comprehension questionnaire that was handed out to you. We will check your answers individually. If you have any question, please raise your hand or press the red button on the side of your desk and we will answer your question in private.

In this part, you are going to make two types of decisions. In the rest of these instructions, the first kind of decision will be called « unconditional decision », and the second one « conditional decision ».

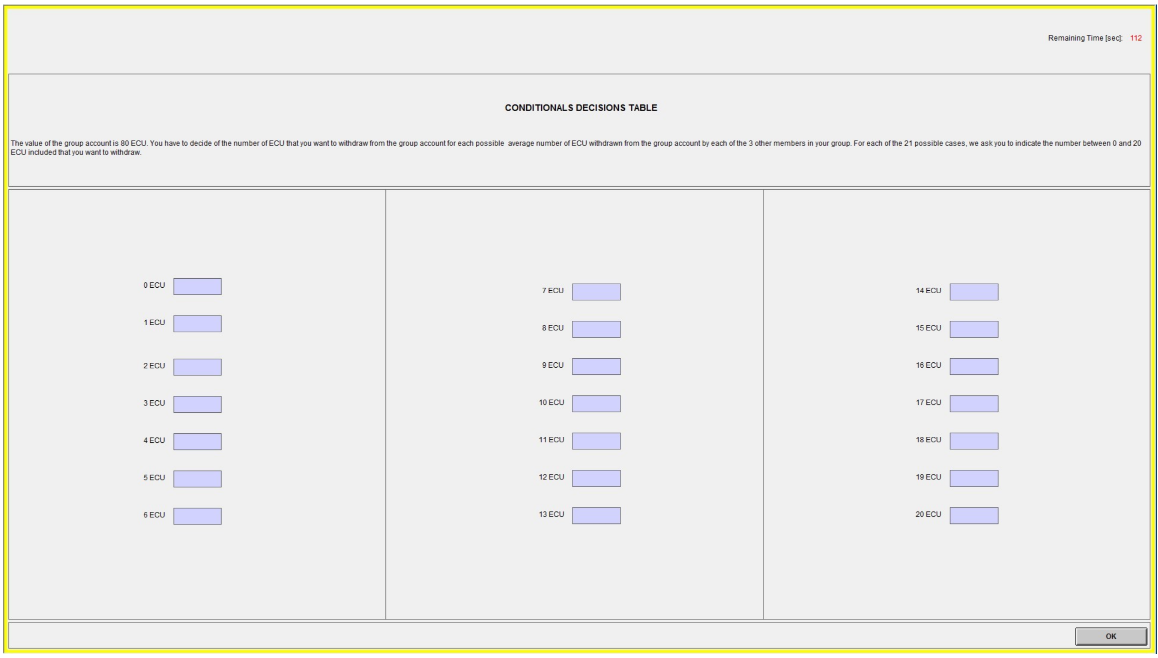
Unconditional decision: Here is an example of the screen you will get for an unconditional decision:



For this particular decision, you must chose the amount of ECU you wish to withdraw from the group account between 0 and 20 ECU. Once you have made your decision, press « OK ». Then, once each participant has made his decision, you will be redirected to the conditional decision screen.

Conditional decision:

Here is a screenshot of the conditional decision table you will get:



Here you will have to make 21 decisions. You will have to decide the amount of your withdrawal from the group account for each possible average withdrawal from each of the three other group members. For every 21 possible situations, please indicate the amount you wish to withdraw, between 0 and 20 ECU.

The number right next to each box is the average amount of ECU withdrawn by each of the three other members of your group. The task consists in indicating in each box the amount of ECU you wish to withdraw, depending on the average amount withdrawn by the three other members of the group. For example, you have to indicate how many ECU you want to withdraw if each of the three other members withdraw on average 1 ECU, 2 ECU, 3 ECU . . . You will have to fill each box with an integer between 0 and 20. Once you have made your decision for each of the 21 possibilities, please press ≪ OK ≫ to submit your decisions.

Payoff computation:

Once each participant has made his decision, the program will randomly select one of the four group members. For this specific participant, only the conditional decision table will be taken into account for payment. For the three other members, only the unconditional decision will be used. At the time of the decision, you do not know if you have been randomly selected or not. As a consequence, make your decisions carefully, as each of them can be the one taken into account for the payoff computation. You will know your payoff for this part at the end of the experiment only.

Example 1:

Suppose you have been randomly selected by the software. You will then be paid based on the conditional decision table. The three other members of your group will be paid according to their unconditional decision. Suppose their unconditional decision are 0, 2 and 4 ECU. The average withdrawal from the members of your group is 2 ECU in this case.

- If you have submitted in your conditional decision table that you wish to withdraw 1 ECU if the average amount withdrawn by the others is 2 ECU, the total amount withdrawn from the group account is 0+2+4+1= 7 ECU. Each member of the group will get a payoff of 0.4*(80-7) = 29.2 ECU from the group account. Each member will get a payoff of 29.2 ECU from the group account for this part, plus the number of ECU that they have put on their private account.

- If instead you submitted that you wish to withdraw 19 ECU if the average amount withdrawn by the others is 2 ECU, the total amount withdrawn from the group account is 0+2+4+19= 25 ECU. Each member of the group will get a payoff of 0.4*(80-25) = 22 ECU from the group account. Each member will get a payoff of 22 ECU from the group account for this part, plus the number of ECU that they have put on their private account.

Example 2:

Suppose that you have not been selected by the program. This means that you and two other members of your group will be paid according to your unconditional decision. Suppose your unconditional decision is 16 ECU, and the others have an unconditional decision of 18 and 20 ECU. The average amount withdrawn by you and the two other members is 18 ECU in this case.

- If the selected member of your group submitted that he wanted to withdraw 1 ECU if the three other members average withdrawal was 18 ECU, the total amount withdrawn from the group account is 16+18+20+1= 55 ECU. Each member of the group will get a payoff of 0.4*(80-55) = 10 ECU from the group account. Each member will get a payoff of 10 ECU from the group account for this part, plus the number of ECU that they have put on their private account.

- If instead the selected member of your group submitted that he wanted to withdraw 19 ECU if the three other members average withdrawal was 18 ECU, the total amount withdrawn from the group account is 18+16+20+19 = 73 ECU. Each member of the group will get a payoff of 0.4*(80-73) = 2.8 ECU from the group account. Each member will get a payoff of 2.8 ECU from the group account for this part, plus the number of ECU that they have put on their private account.

***

If you have any question, please raise your hand or press the red button on the side of your desk and we will come to assist you in private.

Instructions Part 2 - Baseline treatment

At the beginning of this part, the software will randomly form new groups of four members that will remain fixed throughout this part. These groups are different than those in the first part. As a consequence, you will be interacting with three other participants. This part consists of 20 periods.

Description of each period :

At the beginning of each period, a total amount of 80 ECU is assigned to your group and deposited on a group account.

Each group member chooses the amount of ECU he is willing to withdraw from the group account, between 0 and 20 ECU, to put on his private account. Once all decisions have been made, the number of ECU left on the group account is computed. The group account yields a 40% return to each group member.

Each ECU that you withdraw from the group account pays you 1 ECU. If instead you are willing to keep this ECU in the group account, your payoff from the group account will be 40% of 1 ECU = 0.4 ECU. This ECU will also pay 0.4 ECU to each other group member. This means that keeping ECU on the group account increases the payoff of the other members. Similarly, you earn 0.4 ECU for each ECU kept on the group account by the other members of your group.

Once you have made your decision, please submit it by pressing the ≪ OK ≫ button. At the end of this period, you will be informed on the total amount left on the group account, the number of ECU withdrawn by each group member, and the payoff of each group member.

Next periods:

Each new period will start automatically. At the beginning of a period, the group is given a new group account. You are matched with the same 3 group members for the 20 periods.

To sum up, in each period:

- At the beginning, the group is given a new group account.
- Each member decides on the amount he is willing to withdraw from the group account.
- You are informed on the amount withdrawn by each group member, and on his payoff.

Payoff calculation:

Your final payoff in each period will be:

- On the one hand, the amount you have withdrawn from the group account.
- On the other hand, the revenue from the group account: this revenue is equal to 40% of the amount left on the group account. The amount left is the difference between the initial amount (80) and the sum of group members' withdrawals. Every ECU kept on the group account yields a return of 0.4 ECU.

Your total payoff is computed as follows:

The amount you have withdrawn from the group account
+ 40% (80 ECU – total amount withdrawn by the group members)

The payoff is computed in the same way for each group member. This means that each member gets the same payoff from the group account.

***

Please read these instructions again. If you have any question, raise your hand or press the red button on the side of your desk. We will answer to your questions in private.

Instruction Part 2 - Exo1P treatment (*The only differences with the Exo3P treatment are indicated in italics)*

At the beginning of this part, the software will randomly form new groups of four members that will remain fixed throughout this part. These groups are different from those in the first part. As a consequence, you will be interacting with three other participants. This part consists of 20 periods. From one period to the other, your group size may vary. As it will be explained right after, you cannot be assigned to another group.

Description of each period :

At the beginning of each period, a total amount is assigned to your group. This amount of ECU is deposited on a group account and it depends on the number of members in the group.

If there are 4 members in the group, the value of the group account is 80 ECU. If there are 3 members in the group, the value of the group account is 60 ECU.

If there are 2 members in the group, the value of the group account is 40 ECU.
If there is only 1 member in the group, the value of the group account is 20 ECU.

Each period is divided in two stages:

Stage 1:

First, each member of the group decides how many ECU he is willing to withdraw from the group account, between 0 and 20, to put on his private account. Once all decisions have been made, the number of ECU left on the group account is computed. The group account yields a 40% return to each group member.

Each ECU that you withdraw from the group account pays you 1 ECU. If instead you are willing to keep this ECU in the group account, your payoff from the group account will be 40% of 1 ECU = 0.4 ECU. This ECU will also pay 0.4 ECU to each other group member. This means that keeping ECU on the group account increases the payoff of the other members. Similarly, you earn 0.4 ECU for each ECU kept on the group account by the other members of your group.

Once you have made your decision, please submit it by pressing the « OK » button. At the end of the period, you will be informed on the total amount left on the group account, the number of ECU withdrawn by each group member, and the payoff of each group member.

Stage 2:

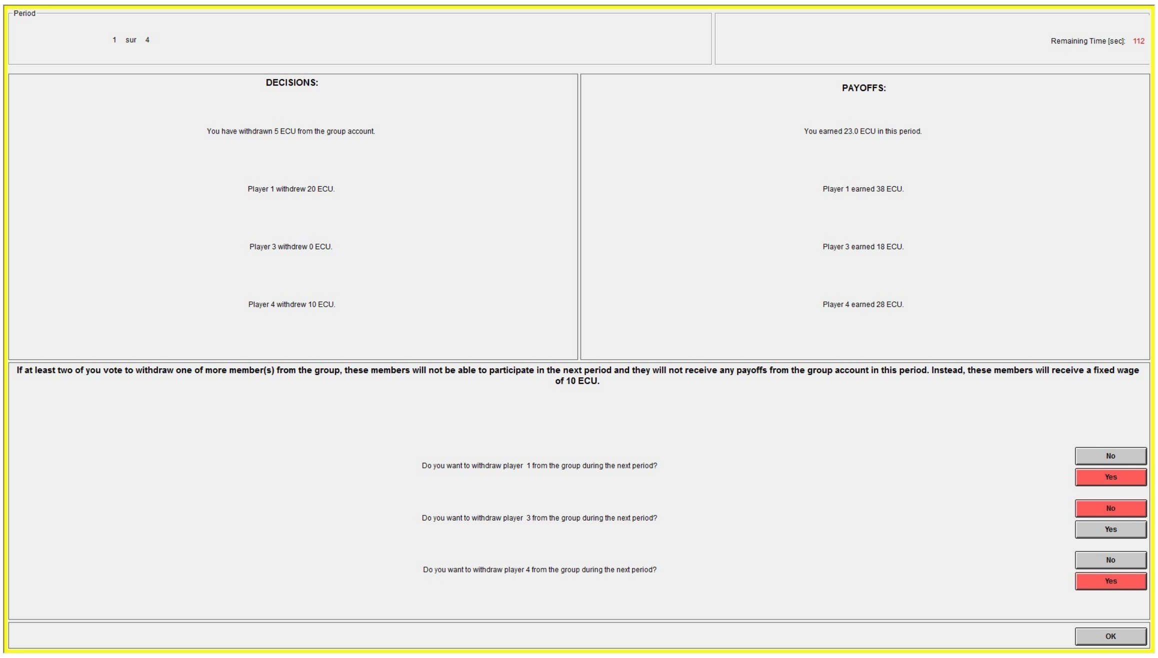
Decision rule

In this stage, the group members have the opportunity to remove one or several other group members for the following period (*for the three following periods*). Removing a member from the group means that he will not be able to participate in any of the two stages in the following period (*of the three following periods*): he will not be able to withdraw ECU from the group account or decide to remove other members. Instead, he will get a fixed payoff of 10 ECU. If one or several members of the group are removed, the total amount of the group account will be adjusted in the next period (*the three following periods*)as explained previously (60 ECU if the group is composed of 3 members, 40 ECU if the group is composed of 2 members, 20 ECU if the group is composed of only 1 member).

Several members of the group can be removed during a period. If all the group members are removed during a period, each removed member will get a fixed payoff of 10 ECU and the next period will start.

Removing one or several members of the group for the next period (*the three following periods*) is a group decision based on a vote within the group. During this stage, each member of the group has to vote for deciding to remove or not each of the other members of the group.

Here is an example of the vote decision screen:



In the top left corner, you can see how many ECU you and each member of the group have withdrawn from the group account. On the right, you can see your payoff for this period, as well as the payoff of each other group member.

In the bottom of the screen, you will be asked to make a decision for each of the member of the group (you excepted). You vote by pressing ≪ Yes ≫ if you are willing to remove this member from the group for the next period (*the three following periods*), or ≪ No ≫ if you want him to remain part of the group in the next period.

You cannot remove a member of the group during the last period. (*At the 18th period, you can only remove someone for a maximum of two periods, and at the 19th period, only for one period.*) The last period only consists in choosing how many ECU you are willing to withdraw from the group account.

Consequences of the vote

A member will only be removed **if at least two group members have pressed ≪ Yes ≫ to remove him.**

The removed participants will not be able to participate in any of the stages of the next period (*the next three periods.*). They will get a fixed payoff of 10 ECU but they will not get any return from the group account.

Information

Once each participant has made his decision for each other member of his group and submitted his choice by pressing ≪ OK ≫ at the bottom of the screen, everyone will be informed of the result of the votes.

The results only indicate for each group member if he will participate in the next period or if he will be removed from the group for one period (*for three periods*).

The number of votes for or against the removal of a participant will never be displayed.

Next periods:

Each new period will start automatically. At the beginning of a period, the group is given a new group account. The total amount deposited on this group account varies depending on the number of members in the group.

You will be reminded of the number of participants left in your group for this period on your screen. You are matched with the same participants for these 20 periods, even if some of them may not participate in each period.

To sum up, in each period:

- At the beginning, the group is given a new group account, which amount depends on the number of members in the group.
- Each member decides on the amount he is willing to withdraw from the group account.
- You are informed on the amount withdrawn by each group member and on his earnings.
- You vote to remove or not one or several members of your group for the next period (*the next three periods*).
- You are informed about the removal of other group members, if any.

Payoff calculation:

If you are part of the group, your final payoff in each period will be:

- On the one hand, the amount you have withdrawn from the group account.
- On the other hand, the revenue from the group account: this revenue is equal to 40% of the amount left on the group account. The amount left

is the difference between the initial amount (80, 60, 40 or 20 depending on the number of group members for the current period) and the sum of group members' withdrawals. Every ECU kept on the group account yields a return of 0.4 ECU.

Your total payoff is computed in the following way:

The amount you have withdrawn from the group account
+ 40% (value of the group account at the beginning of the period
– total amount withdrawn by the group members)

The payoff is computed in the same way for each group member. This means that each member gets the same payoff from the group account.

If you are not part of the group, your payoff is 10 ECU for each period you have been removed from the group.

***

Please read these instructions again and fill out the comprehension questionnaire that was handed out to you. We will check your answers individually. If you have any question, please raise your hand or press the red button on the side of your desk. We will answer to your questions in private.

Instruction Part 2 - Endo treatment

At the beginning of this part, the software will randomly form new groups of four members that will remain fixed throughout this part. These groups are different from those in the first part. As a consequence, you will be interacting with three other participants. This part consists of 20 periods. From one period to the other, your group size may vary. As it will be explained right after, you cannot be assigned to another group.

Description of each period :

At the beginning of each period, a total amount is assigned to your group. This amount of ECU is deposited on a group account and it depends on the number of members in the group.

If there are 4 members in the group, the value of the group account is 80 ECU.
If there are 3 members in the group, the value of the group account is 60 ECU.
If there are 2 members in the group, the value of the group account is 40 ECU.

If there is only 1 member in the group, the value of the group account is 20 ECU.

Each period is divided in two stages:

Stage 1:

First, each member of the group decides how many ECU he is willing to withdraw from the group account, between 0 and 20, to put on his private account. Once all decisions have been made, the number of ECU left on the group account is computed. The group account yields a 40% return to each group member.

Each ECU that you withdraw from the group account pays you 1 ECU. If instead you are willing to keep this ECU in the group account, your payoff from the group account will be 40% of 1 ECU = 0.4 ECU. This ECU will also pay 0.4 ECU to each other group member. This means that keeping ECU on the group account increases the payoff of the other members. Similarly, you earn 0.4 ECU for each ECU kept on the group account by the other members of your group.

Once you have made your decision, please submit it by pressing the ≪ OK ≫ button. At the end of the period, you will be informed on the total amount left on the group account, the number of ECU withdrawn by each group member, and the payoff of each group member.

Stage 2:

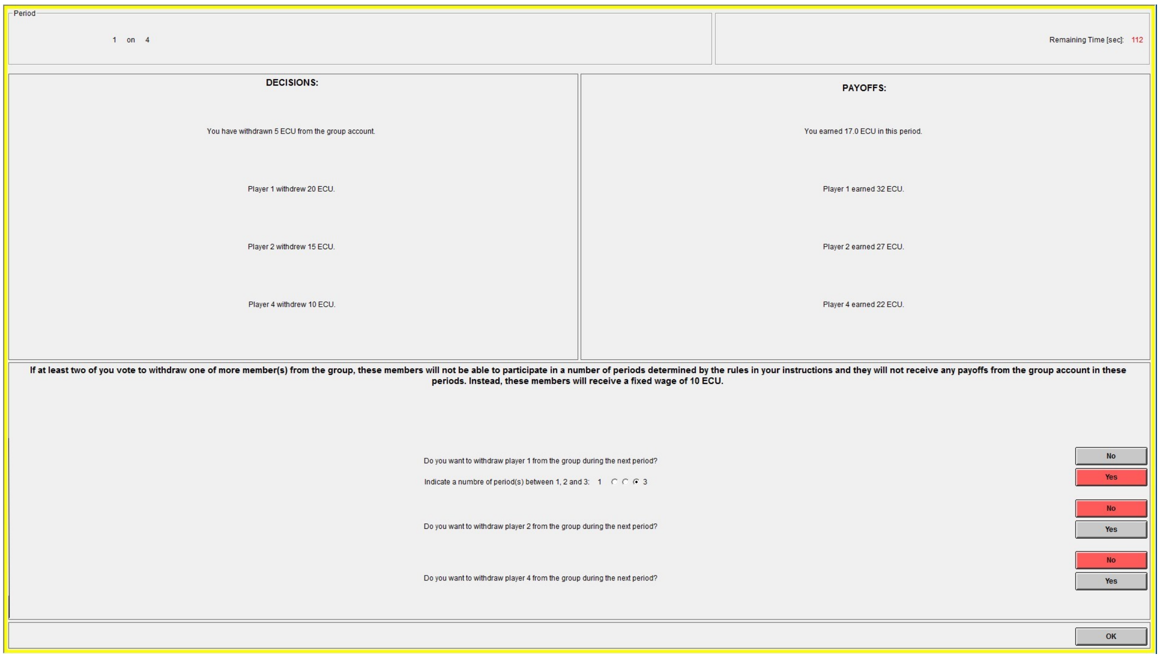
Decision rule

In this stage, the group members have the opportunity to remove one or several other group members for one, two or three following periods. Removing a member from the group means that he will not be able to participate in any of the two stages for the number of periods he has been removed: he will not be able to withdraw ECU from the group account or decide to remove other members. Instead, he will get a fixed payoff of 10 ECU. If one or several members of the group are removed, the total amount of the group account will be adjusted in the next period as explained previously (60 ECU if the group is composed of 3 members, 40 ECU if the group is composed of 2 members, 20 ECU if the group is composed of only 1 member).

Several members of the group can be removed during a period. If all the group members are removed during a period, each removed member will get a fixed payoff of 10 ECU and the next period will start.

Removing one or several members of the group for a certain number of periods is a group decision based on a vote within the group. During this stage, each member of the group has to vote for deciding to remove or not each of the other members of the group. If you vote to remove one group member, you will then have to decide for how long you want this member to be removed: from 1 period to a maximum of 3 periods.

Here is an example of the vote decision screen:



In the top left corner, you can see how many ECU you and each member of the group have withdrawn from the group account. On the right, you can see your payoff for this period, as well as the payoff of each other group member.

In the bottom of the screen, you will be asked to make a decision for each of the member of the group (you excepted). You vote by pressing ≪ Yes ≫ if you are willing to remove this member from the group, or ≪ No ≫ if you want him to remain part of the group in the next period.

If you press ≪ Yes ≫, an additional line will appear, allowing you to choose the length of the removal for this group member. You can exclude a member for 1, 2, or 3 periods.

At the 18th period, you can only remove someone for a maximum of two periods, and at the 19th period, only for one period. The last period only consists in choosing how many ECU you are willing to withdraw from the group account.

Consequences of the vote

A member will only be removed **if at least two group members have pressed ≪ Yes ≫ to remove him.** In this case, the duration of the removal will be determined as follows:

- If each other member has agreed on the removal and has chosen the same number of periods, the participant will be removed for this number of periods.
- If each other member has agreed on the removal but they have chosen a different number of periods, the program will select the median number of periods (the median is the intermediate number of periods, or if two of the three members have chosen the same number of periods, then it is this number of periods.)
- If two members agreed on the removal but have chosen a different number of periods, then the program selects the smaller number of periods.

Example:

Suppose that three members vote to remove the fourth member. If the first member chooses one period and the others choose two periods, then the fourth member will be removed for two periods. Now suppose that two members vote to remove a group member, one for one period and the other for three periods. Then, the length of removal will be one period.

The removed participants will not be able to participate in any of the stages for the number of periods decided at the end of the vote. They will get a fixed payoff of 10 ECU but they will not get any return from the group account.

Information

Once each participant has made his decision for each other member of his group and submitted his choice by pressing ≪ OK ≫ at the bottom of the screen, everyone will be informed of the vote results.

The results only indicate for each group member if he will participate in the next period or if he will be removed from the group. In the latter case, they will also show for how long the member will be removed.

The number of votes for or against the removal of a participant will never be displayed.

Next periods

Each new period will start automatically. At the beginning of a period, the group is given a new group account. The total amount deposited on this group account varies depending on the number of members in the group.

You will be reminded of the number of participants left in your group for this period on your screen. You are matched with the same participants for these 20 periods, even if some of them may not participate in each period.

To sum up, in each period:

- At the beginning, the group is given a new group account, which amount depends on the number of members in the group.
- Each member decides on the amount he is willing to withdraw from the group account.
- You are informed on the amount withdrawn by each group member and on his earnings.
- You vote to remove or not one or several members of your group and you decide for how long.
- You are informed about the removal of other group members, if any, and for those removed, the length of their removal.

Payoff calculation:

If you are part of the group, your final payoff in each period will be:

- On the one hand, the amount you have withdrawn from the group account.
- On the other hand, the revenue from the group account: this revenue is equal to 40% of the amount left on the group account. The amount left is the difference between the initial amount (80, 60, 40 or 20 depending on the number of group members for the current period) and the sum of group members' withdrawals. Every ECU kept on the group account yields a return of 0.4 ECU.

Your total payoff is computed in the following way:

The amount you have withdrawn from the group account
+ 40% (value of the group account at the beginning of the period
– total amount withdrawn by the group members)

The payoff is computed in the same way for each group member. This means that each member gets the same payoff from the group account.

If you are not part of the group, your payoff is 10 ECU for each period you have been removed from the group.

***

Please read these instructions again and fill out the comprehension questionnaire that was handed out to you. We will check your answers individually. If you have any question, please raise your hand or press the red button on the side of your desk. We will answer to your questions in private.

Appendix 2. Tables

Appendix 2.1 Subject pool

Table A.1: Individual characteristics, by treatment

	Number of individuals	Number of sessions	Number of groups	Males (Percentage)	Mean age	Students (Percentage)
	(1)	(2)	(3)	(4)	(5)	(6)
Baseline	60	3	15	0.383	25.68	0.783
Exo 1P	48	3	12	0.479	24.73	0.792
Endo	48	3	12	0.50	28.60	0.667*
Exo 3P	52	3	13	0.539**	23.38	0.808

Notes: A binomial test shows that there are significantly more males in the Exo3P treatment than in the Baseline (two-sided binomial test: p=0.031), while the difference between the Baseline and each other treatment is never significant (*vs.* Exo1P: p=0.103; *vs.* Endo: p=0.183). There is no significant difference in the distribution of participants in terms of age between the Baseline and any other treatment (Kolmogorov-Smirnov tests: *vs.* Exo1P: p=1.000; *vs.* Exo3P: p=0.731; *vs.* Endo: p=0.161). The percentage of students is significantly lower in the Endo treatment compared to the Baseline (two-sided binomial test: p=0.055), while the difference between the Baseline and the other treatments is never significant (*vs.* Exo1P: p=1.000; *vs.* Exo3P: p=0.740).

Appendix 2.2 Determinants of exclusion

Table A.2 reports the marginal effects of the estimates of the vote for exclusion of a subject i, using random-effects logit regressions with standard errors clustered at the group level. We only consider the observations in which exclusion is possible: we exclude the cases in which i or j are already being excluded and the observations corresponding to groups smaller than three active members. We only consider periods 1 to 17 because long exclusion is no longer possible in Endo and Exo3P after period 17.

In addition to treatment dummies, the independent variables include the difference between of j's withdrawal and the group average withdrawal (excluding j) in period t when j withdraws more than the group (max (0; $w_{j,t} - \sum_{-j=1,-j\neq j}^{n-1} w_{-j,t}$)) and the difference between the group average withdrawal and j's withdrawal in t

when j withdraws less than his group ($\max\left(0; \sum_{-j=1,-j\neq j}^{n-1} w_{-j,t} - w_{j,t}\right)$). The independent variables also include a control for whether j has already been excluded in the past to identify possible harassment strategies, controlling for withdrawal decisions. They include a reintegration dummy that equals 1 if i is reintegrated in t and 0 otherwise. In model (2) we add interaction terms between this reintegration dummy and the treatment dummies. The variable "i is reintegrated in t after xP exclusion (Y)" takes value 1 if i has been reintegrated in t after x period(s) of exclusion, in the Y treatment, and 0 otherwise. This allows us to test whether subjects who have been recently punished are more severe or more forgiving than non excluded members. We also control for the group size, for time, and for individual characteristics (gender, age, student status and social preferences of i).

Table A.2 indicates that the more ECU j takes over her group average, the more likely subject i is to vote in favor of his exclusion. The probability to vote to exclude a group member is the same across treatments, regardless of the severity of punishment. In these models we assume that the differences in withdrawal between the individual and his group average has the same impact across treatments. We relax this assumption in Table A.3, in which the independent variables include not only the treatments and the differences in withdrawal but also interaction terms between the treatments and these differences. The only significant interaction effect is the positive difference in Endo: subjects who withdraw less than the average are less likely to be excluded in Endo than in Exo1P.

Table A.2 also shows that i is more likely to vote to exclude another group member in t when he has been himself reintegrated in t. This suggests that there is some retaliation going on. Model (2) indicates that i is less likely to vote to exclude another group member when he has been excluded for one period in Endo compared to when he has been excluded in Exo1P. Therefore, when it results from a vote, a short exclusion affects differently the willingness to exclude after reintegration.

Table A.2: Determinants of an exclusion vote

Dep. variable:	All treatments	with exclusion	
Decision to exclude j in t	(1)	(2)	
Exo1P	*Ref.*	*Ref.*	
Exo 3P	-0.052	-0.045	
	(0.061)	(0.060)	
Endo	-0.060	-0.074	
	(0.063)	(0.060)	
Max (0; $w_{j,t} - \sum_{-j=1,j\neq -j}^{n-1} w_{-j,t}$)	0.044***	0.043**	
	(0.010)	(0.010)	
Max (0; $\sum_{-j=1,j\neq -j}^{n-1} w_{-j,t} - w_{j,t}$)	0.003	0.004	
	(0.003)	(0.003)	
Exclusion of j	0.001	0.002	
prior to t	(0.020)	(0.020)	
i is reintegrated in t	0.113***	0.094**	
	(0.038)	(0.043)	
i is reintegrated in t	-	Ref.	
after 1P exclusion (Exo1P)			
i is reintegrated in t	-	-0.088***	
after 1P exclusion (Endo)		(0.030)	
i is reintegrated in t	-	0.267	
after 2P exclusion (Endo)		(0.212)	
i is reintegrated in t	-	0.301	
after 3P exclusion (Endo)		(0.236)	
i is reintegrated in t	-	-0.038	
after 3P exclusion (Exo3P)		(0.029)	
Group size	-0.016	-0.016	
	(0.019)	(0.019)	
Period	0.002	0.001	
	(0.001)	(0.002)	
Individual controls	Yes	Yes	
Observations	4198	4198	
Clusters		32	32
Log pseudo-likelihood	-1325.23	-1307.26	

Notes: The Table reports the marginal effects from random-effects logit regressions with robust standard errors clustered at the group level in parentheses. We consider only: *i*) observations from periods 1 to 17; *ii*) groups with more than two active members, as it is not possible to exclude when the group has less than three active members; *iii*) cases where i and j are not excluded (as i cannot vote if she is excluded and i cannot vote to exclude j if j is already excluded). *** p <0.01, ** p <0.05, * p <0.10.

Table A.3: Determinants of an exclusion vote in treatments with possible exclusion

Dep. variable: Decision to exclude j in t	All treatments (1)	with exclusion (2)
Exo1P	*Ref.*	0.024
		(0.091)
Exo 3P	-0.054	-0.032
	(0.067)	(0.088)
Endo	-0.022	*Ref.*
	(0.081)	
Max (0; $w_{j,t} - \sum_{-j=1,j\neq -j}^{n-1} w_{-j,t}$)	0.043***	0.040***
	(0.013)	(0.008)
Max (0; $\sum_{-j=1,j\neq -j}^{n-1} w_{-j,t} - w_{j,t}$)	0.012**	-0.008*
	(0.005)	(0.005)
Max (0; $w_{j,t} - \sum_{-j=1,j\neq -j}^{n-1} w_{-j,t}$)	*Ref.*	0.003
* Exo1P		(0.011)
Max (0; $w_{j,t} - \sum_{-j=1,j\neq -j}^{n-1} w_{-j,t}$)	0.009	0.012
* Exo3P	(0.014)	(0.015)
Max (0; $w_{j,t} - \sum_{-j=1,j\neq -j}^{n-1} w_{-j,t}$)	-0.003	*Ref.*
* Endo	(0.011)	
Max (0; $\sum_{-j=1,j\neq -j}^{n-1} w_{-j,t} - w_{j,t}$)	*Ref.*	0.020***
* Exo1P		(0.008)
Max (0; $\sum_{-j=1,j\neq -j}^{n-1} w_{-j,t} - w_{j,t}$)	-0.011	0.009
* Exo3P	(0.008)	(0.008)
Max (0; $\sum_{-j=1,j\neq -j}^{n-1} w_{-j,t} - w_{j,t}$)	-0.020***	*Ref.*
Endo	(0.008)	
Exclusion of j	-0.003	-0.003
prior to t	(0.019)	(0.019)
i is reintegrated in t	0.104***	0.104***
	(0.036)	(0.036)
Group size	-0.011	-0.011
	(0.020)	(0.020)
Period	0.002	0.002
	(0.001)	(0.001)
Individual controls	Yes	Yes
Observations	4198	4198
Log pseudo-likelihood	-1311.17	-1311.17

Notes: The Table reports marginal effects from random-effects logit regressions with robust standard errors clustered at the group level in parentheses. We consider only: *i*) observations from periods 1 to 17; *ii*) groups with more than two active members, as it is not possible to exclude when the group has less than three active members; *iii*) cases where i and j are not excluded (as i cannot vote if she is excluded and i cannot vote to exclude j if j is already excluded). *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Appendix 2.3 Reintegration

Table A.4 reports the marginal effects from random-effects GLS regressions with robust standard errors clustered at the group level. The dependent variable is the number of ECU withdrawn by the excluded members when they reintegrate their group in the treatments with possible exclusion. The independent variables include dummy variables for each possible length of exclusion interacted with the treatment. The only difference between models (1) and (2) is the reference category: one-period exclusion in Exo1P in model (1) and one-period exclusion in Endo in model (2). We control for the average withdrawal of the other group members in t-1 and for the group size in t. We consider the group average withdrawal in t-1 and not in t because when subjects make their withdrawal decision in t they are only aware of their group members' decisions in t-1. Finally, we include a time trend and the same individual characteristics as in the previous Tables. The data only include the observations of reintegrated subjects from periods 3 to 20 but we do not include the observations corresponding to subjects excluded after period 17 (since the length of exclusion is censored in Endo and this could bias the comparison).

Model (1) in Table A.4 shows the difference between the effect of any length of exclusion on withdrawal after reintegration compared to one-period exclusion in Exo1P. Reintegrated subjects withdraw less after three periods of exclusion in Exo3P than after one in Exo1P, controlling for the average withdrawal in the group in the period preceding immediately reintegration, which supports Hypothesis 3. A similar regression performed on the sub-sample of the two Exo treatments indicates that the variable is significant at the 5 percent level (N=179, marginal effect = 3.972, standard error = 2.001). Choosing one-period exclusion in Endo as the reference category instead of Exo1P in model (2) indicates that being excluded for two or three periods instead of one in Endo increases significantly the level of withdrawal during the reintegration period. There is no significant difference in the effect of being excluded for two or for three periods on withdrawal after reintegration (t-test: p=0.200). The length of exclusion does not have the same effect on withdrawal after reintegration depending on how it has been determined.

Table A.4: Effect of the length of exclusion on the withdrawal (in ECU) of excluded subjects in the reintegration period

Dep. variable: number of ECU withdrawn	All treatments (1)	with exclusion (2)
1P exclusion in Exo1P	*Ref.*	3.017
		(2.294)
1P exclusion in Endo	-3.017	*Ref.*
	(2.294)	
2P exclusion in Endo	0.492	3.509**
	(1.591)	(1.540)
3P exclusion in Endo	0.944	3.960**
	(1.734)	(1.714)
3P exclusion in Exo3P	-3.973**	-0.956
	(1.917)	(2.461)
Group average withdrawal	0.286***	0.286***
excluding i in t-1	(0.100)	(0.100)
Group size	-1.394	-1.394
	(0.944)	(0.944)
Period	0.107	0.107
	(0.091)	(0.091)
Individual controls	Yes	Yes
Constant	7.037	4.020
	(4.406)	(4.436)
Observations	244	244
Clusters	35	35
R-squared	0.30	0.30

Notes: The model estimates a random-effect GLS with robust standard errors clustered at the group level in parentheses. The data include the observations from subjects reintegrated in periods 3 to 20, excluding subjects who were excluded after period 17. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.