NOT JUST LIKE STARTING OVER

LEADERSHIP AND REVIVIFICATION OF COOPERATION IN GROUPS

This draft: July 25, 2014

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ABSTRACT

We conduct a laboratory experiment to study how, after a history of decay, cooperation in a repeated voluntary contribution game can be revived in an enduring way. Simply starting the repeated game over - a simple fresh start - leads to an initial increase of cooperation, but to a subsequent new decay. Motivated by cooperation decay in organizations we study the potential of three interventions of triggering higher and sustained cooperation taking place at the same time as a restart. Surprisingly, we find that the detailed explanation of the causes of the decay in cooperation from Fischbacher and Gaechter (2010) combined with an advice on how to prevent decay do not have an effect beyond that of just starting over. In contrast, a one-way free form communication message sent by the leader to the followers strongly revives cooperation. Repeated free form communication by the leader further strengthens the reviving effect on cooperation. Combining the two previous interventions does not outperform the pure effect of communication. Our content analysis reveals that leader communication is more people oriented and less formal than the expert advice.

KEYWORDS: leadership, cooperation, communication

JEL CLASSIFICATION NUMBERS: C71, C73, C92, D83, J63, L20

◊ We would like to thank Arthur Schram, Gary Charness, Orsola Garofalo, Julian Rode, Daniel Schunk and the participants in the discussion lunch at the Business Department at UAB, at the Alhambra workshop 2011, and at the IMEBE conference 2013 for constructive comments on how to improve the paper. We also gratefully acknowledge financial support from the Antoni Serra Ramoneda (UAB – Catalunya Caixa) Research Chair, the Spanish Ministry of Economics and Competitiveness (Grant: ECO2011-29847-C02-01) and the Generalitat de Catalunya (Grant: 2009 SGR 820).

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1. Introduction

A common observation in experimental studies of public goods games with voluntary contributions is that in environments with a finite horizon cooperation levels are initially rather high but then decrease steadily over time. The question we study in this paper is which instruments can be used to revive cooperation effectively after such a history of decay. In natural environments salient temporal landmarks, like the start of a new week or a new season, may create a sense of a new beginning and allow for the revivification of cooperation. Dai, Milkman and Riis (forthcoming) discuss in detail how such temporal landmarks can affect individual behavior, like eating more healthy or saving money. Our focus is on whether such salient temporal landmarks also affect the behavior of groups and whether their effects can be reinforced through some additional interventions. Our motivation for studying these issues comes from the analysis of organizations and the need to find ways to sustain organizational change.

Our experiment builds on two important results of earlier experimental work related to the effects of a fresh start in the context of a cooperation task. First, it has been shown that in fixed groups the level of cooperation can be driven up again by simply restarting the game after the initially announced horizon has been reached. In the experiments reported in Andreoni (1988) participants play the voluntary contribution game in the finitely repeated form and, after the initially announced ten rounds are over, they are informed that there will be some additional rounds of the same game. Here the re-initiation of play allows for a fresh start. Contributions go up again after the prolonged experiment is announced. In Andreoni (1988) experiment play was suspended after three additional rounds and during these rounds the cooperation level stayed up. This effect is called the “restart effect,” and it is the first of two results on which we build.

The second regularity we build on is reported in Croson (1996) who follows up on Andreoni (1988) with public goods experiments in which, after the initial ten rounds, ten additional rounds are announced. The results confirm that the restart leads to an initial increase of cooperation in fixed groups. However, after the initial increase in cooperation, the decline in cooperation begins again and play ends up at an even lower level than at the end of

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the first ten rounds. That is, cooperation can be revived by starting over, but the effect is short-lived.²

In this paper we use experiments to study how, after a history of decay in cooperation levels, cooperation in groups can be revived in an enduring way by using various managerial strategies that come along with a fresh start. That is, are there ways to avoid that the positive short-run restart effect vanishes over time? As discussed above, a positive reaction to a fresh start seems to be a widespread behavioral regularity. Our focus is on studying whether humans’ spontaneous tendency to react to a fresh start can be reinforced by some additional intervention. Identifying such effective interventions may be crucial, since without them fresh start effects may just peter out over time.

We study this issue in the context of a public good game involving a leader. We choose a structure involving a leader, because we are mostly motivated by issues of successful teamwork in organizations.³ Almost all types of institutions, firms, departments and (sport) teams are organized in some kind of hierarchical structure and guided by a leader. Societies are lead by politicians or ideological leaders, companies by managers, departments by directors and sports teams by coaches. When cooperation failure has occurred it is one of leaders’ natural roles to take action to reinforce a new beginning. Companies, organizations and other human groups with leaders have access to instruments that can facilitate a turnaround.

In our set-up, leadership takes the form of leading-by-example used in the studies by Güth et al. (2007), Rivas and Sutter (2009), Gächter et al. (2010) and Potters et al. (2007) among others. The game is sequential and each group is composed by one leader and three followers. Interaction is repeated and the group composition is constant over time, i.e. the group members are the same over the entire experiments. First, the leader decides on his contribution to the public good. The followers are informed about their leader’s decision and simultaneously choose their contribution levels. Both, leaders and followers of a group influence the group outcome through their contribution to the public good. Leading by example can be a conscious or subconscious form of leadership being present in a broad range of situations. The importance of leadership, and in particular of leading by example, becomes clear when thinking about outstanding business leaders like Steve Jobs or Jack Welch. But also in every-day situations, this kind of leadership is a key feature of the organization and coordination of a group of individuals.

² Dai et al. (forthcoming) discuss the issue of the persistence of fresh start effects for individual behavior.
³ Leadership can also be studied experimentally without a leading-by-example structure. See, for example, Brandts, Cooper and Weber (forthcoming).
Can leaders in a leading-by-example environment take advantage of human cooperation’s tendency to react positively to exogenously set landmarks (after cooperation has failed) by taking deliberate action precisely at the natural landmark? Here we study two interventions and a combination of the two interventions that a priori can be expected to lead to a stronger revivification of cooperation than that following a pure restart and that are interesting from a managerial point of view. Both interventions involve a restart, but add another element aimed at avoiding that the increase in cooperation is only short-lived. One of the interventions involves communication by the leader with the employees. The other involves providing information about the causes of cooperation decay. A third treatment combines the two elements and compares the joint effect with the separate effects.

We have four treatments. The first is the restart treatment, a control treatment in which the restart is pure, that is not accompanied by any other change in the environment and which is meant to establish a baseline. Our second treatment is the comprehension/advice treatment, a restart with the provision of a detailed explanation of the causes of the decrease in cooperation and of advice for future contributions. Our third treatment is the communication treatment, a restart with a one-way free form message sent by the group leader to the followers. In the fourth treatment, the comprehension/advice/communication treatment, we combine the second and third treatment. After participants have received the detailed explanation of the causes of the decrease and the advice for future contributions, the group leader can send a one-way free form message to the followers. All three interventions involve a restart in the sense that, after a number of experimental rounds, additional rounds are played, but they all also involve one or two element that go beyond the pure restart. We think that the two interventions and their combination are central in the context of organizational change.

Our comprehension/advice treatment is inspired by the common practice in every-day business of obtaining expert analysis and advice from a consulting company for instance. McDonald and Westphal (2003) find that CEOs tend to seek advice when performance deteriorates, which in our context corresponds to decreasing cooperation. The effect of external consultancy and advice on performance is however rather inconclusive as a number of field experiments with micro-, small and large organizations in developing countries obtain different results.\(^4\) Compared to the advice provided in Chaudhuri et al. (2006), where common knowledge advice from a previous generation of participants increases cooperation

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\(^4\) See, e.g., Drexler et al. (2010), Karlan and Valdivia (2011), Bruhn and Zia (2011), Bruhn et al. (2012), Karlan et al. (2012), Bloom et al. (2013).
significantly, our advice has the nature of an exogenous expert advice. In our context, participants first receive an expert explanation of the cooperation decay followed by an advice on how to prevent such a decay. We give participants insights into the difficulties of cooperating over time based on the analysis of this problem contained in the influential paper by Fischbacher and Gächter (2010). This paper contains a very thorough analysis of how the decay of cooperation in public goods environments comes about.

Our design allows us to study whether a careful analysis of what goes wrong and constructive advice on how to improve team performance can cause a change in participants’ cooperation, beyond the one that comes from a pure restart. A priori, a better understanding of the causes behind the decay of cooperation appears to be a good basis for improvement. Without understanding the causes behind the decay, they cannot be eliminated. In this sense, we provide information on the nature of the problem and on how group members can contribute to an improvement (see McGuire, 1985). Our design allows us to shed light on the conjecture that receiving a rational explanation by expert advisors can lead to an improvement. We think that a dispassionate analysis of the root causes of a problem is typically considered to be an important step to achieve an improvement of the situation. To further strengthen this point, we conclude the explanation with an advice on how a decrease in cooperation can be prevented. Note that the explanation as well as the advice may affect participants’ beliefs about others’ contributions.) While the effect of the explanation on beliefs about others’ contributions can be expected to be negative, the effect of the advice can be expected to be positive leading to opposites effects on cooperation. We expect that the effects of the explanation and of the advice balance out leaving a better understanding as the main determinant of cooperation. We therefore expect the effect of the treatment on cooperation to be positive overall.

Communication between manager and co-workers has been shown to be a crucial element of the successful performance of a firm. One reason could be that information from in-group sources will have more impact than information from external sources (Olson and Zanna 1993). In the context of coordination games, Brandts and Cooper (2007) show that communication between manager and employees is quite effective in improving performance of groups. In the experimental public goods literature, there is wide evidence that communication from the very start enhances cooperation. Brandts, Cooper, Weber (forthcoming) find that leaders who are elected by followers are significantly better at improving their group’s outcome than randomly selected ones and that the improved effectiveness of elected leaders results from sending more performance-relevant messages.
Koukoumelis, Levati, and Weisser (2012) show that one-way communication by one group member increases cooperation significantly in the simultaneously played game, where communication is possible from the outset and not just after cooperation has broken down. The crucial difference to our communication treatment is that in their case individuals do not have any (negative) cooperation experience with their group members before communication takes place. Our case is one in which cooperation levels end up at a low level and we ask whether communication at this point makes it possible to escape from such a situation. It is not clear whether cheap-talk communication works after the group has experienced cooperation failure with the same group members. To our knowledge, this has not been studied in previous experiments. Given the positive results of communication in the existing literature, we expect that communication will have a positive effect on contributions to the public good even after having experienced decay in cooperation with the same group members.

In the third treatment, the combination of an outsider expert explanation and advice and the leader’s communication with the followers is expected to yield the highest contribution levels with the effect of comprehension and advice being two-fold. In the first place, the direct effect of comprehension and advice is expected to be positive as pointed out above. The indirect effect of comprehension and advice is expected to work through the leader’s communication with the followers. We expect that leaders (and followers) understand the game better after having read the explanation and that they have a good idea about what would be the best thing to do after having received the advice. The quality of the leaders’ communication should thus improve and have a stronger effect on cooperation than in the communication only treatment.

Among other contributions to the existing literature on cooperation, our design involves two restarts that allow us to study to what extent the effect of the different interventions becomes stronger over time. In the first part of the experiment, we let participants play the game without any intervention. The purpose of the first part is to create the experience of decreasing cooperation in the group and to provide an interesting situation for a restart. Our contribution to the existing literature on cooperation is fourfold: First, we analyze the pure restart in a sequential form of the voluntary contribution game. Second, we study the effect of communication after having possibly experienced cooperation failure. Third, “expert” advice in the context of a voluntary contribution game has not been studied previously to our knowledge. Previous experiments have shown that communication from the start (Koukoumelis et al. 2012) and commonly known advice from another experienced (non-
expert) person outside the group (Chaudhuri et al. 2006) increase cooperation significantly. It is not clear whether the same is true for communication and expert advice after participants have experienced decreasing cooperation. Fourth, the repeated restart allows us to study whether, if the first effect is positive, repeated interventions can further strengthen and lead to sustained cooperation levels. It is likely that the repeated intervention can strengthen a positive experience after a negative cooperation experience.

We find that the effects of the pure restart and comprehension/advice do not differ significantly in the long-run, suggesting that exogenous expert consultancy revives cooperation to the extent of a pure restart, but not beyond. Using the thorough analysis of cooperation decay from Fischbacher and Gaechter (2010), the informational content and therefore the understanding of the game are supposed to be highest in the comprehension/advice treatment and, in addition, participants receive advice on how to act. However, the message sent by the leader to the followers in the communication treatment revives cooperation significantly more compared to the pure restart and also compared to the comprehension/advice treatment. Furthermore, the combination of comprehension/advice and communication does not outperform the effect of pure communication. There is evidence that the repeated communication by the leader without the expert’s explanation and advice further reinforces the reviving effect on cooperation by eliminating the decline in contributions over time almost completely. Communication (of the leader) is the most effective managerial instrument in our experiment. It is rather person oriented compared to the expert explanation and advice, which is rather production oriented. When communication is preceded by expert explanation and advice it becomes more production oriented, which is not good for cooperation. The positive effect of repeated communication with limited frequency is in consonance with other research in the psychological literature (McGuire, 1985). In summary, comprehension and advice has the same effect as a pure restart. In contrast, leader communication leads to an effect which is beyond that of just starting over.

2. EXPERIMENTAL DESIGN

In section 2.1., we present the sequential voluntary contribution game used in our experiment. In section 2.2 we provide some general information on the procedures of the experimental sessions. In section 2.3., the control treatment and the intervention treatments are discussed in detail.
2.1 The game

In the leading-by-example setting we study, a voluntary contribution game is played repeatedly by fixed groups of four participants. Group members are matched randomly at the beginning of the experiment. There are two roles: one leader and three followers. The role of the leader is assigned to one of the group members and the remaining group members are followers. The roles are assigned randomly at the beginning of the experiment and are the same throughout the entire experimental session.

The payoff function is the same for leaders and followers. The individual endowment is $E = 40$, the return rate of the private good is $r_p = 1$, and the return rate of the public good is $r_v = 0.5$ yielding the following payoff function of individual $i$ in round $t$:

$$\pi_i, t = \left(40 - h_i, t\right) + 0.5 \cdot \sum_{j=1}^{4} h_j, t$$

An individual $i$’s contribution in round $t$ to the public good is denoted by $h_{i,t}$, the contributions by all group members are denoted by $h_{j,t}$ with $j=1,...,4$. The game is played sequentially by the four players over a total of 36 rounds and the group composition does not change over time. All rounds have three stages. In the first stage of the game, the leader of each group decides how much of the endowment to contribute to the public good. In the second stage, followers are informed about their leader’s decision and decide each of them independently how much of their individual endowment to contribute to the public good. In the third stage, all players are informed about the average contribution by the other group members, the sum of contributions by all group members and the individual payoff.\(^5\)

The equilibrium contribution of leaders and followers in the sequential structure of the game is the same as in the simultaneous game, i.e. zero. This holds for the stage game as well as for the finitely repeated game, which can be shown by backward induction. Therefore, the equilibrium contribution in the finitely repeated sequential voluntary contribution game is zero, too. The socially optimal solution is just the same as in the finitely repeated simultaneous game: Each group member $j=1,...,4$ contributes in each round the entire individual endowment $E$ to the public good leading to an individual round payoff of $r_v \cdot 4 \cdot E = 80$.

\(^5\) We inform participants only about the average contribution by the other group members instead of the individual contributions to create slightly imprecise information which we thought would facilitate a decrease in contributions over time.
2.2. Procedures

The general instructions are handed out to the participants on paper. They are then read aloud by one of the experimenters at the beginning of an experimental session. In the general instructions shown in part A.1 of the appendix, the chronological order of an experimental session and the three stages of each round are represented. They are the same for the control treatment and the three intervention treatments. Also, participants get the information about the total number of rounds before the experiment starts and they are informed that the 36 rounds of the repeatedly played voluntary contribution game are divided into three parts with 12 rounds each and that they will get part-specific instructions at the beginning of each part.

Additional part-specific instructions (see appendix) including the reminder that the group composition would remain the same over the 12 rounds of the subsequent part are shown on the computer screen just before the corresponding part starts and also announced aloud by one of the experimenters. The restart and the interventions take place at the beginning of part 2 (before round 13) and part 3 (before round 25). Thus, the part-specific instructions differ for the control treatment and the three intervention treatments. Having three parts of twelve rounds allows us to investigate the effects of the two restarts instead of just one. We discuss this in more detail in the results section. A twelve-round part can be seen as a work-period (week, month, quarter, year), a season, the time a particular project lasts or any other length of time after which there is a natural break in the interaction. After the experiment finishes, participants are required to fill out a questionnaire and are paid the earnings in private.

The experimental sessions were conducted at the Universitat Autònoma de Barcelona (UAB, Spain) and programmed with the experimental software z-Tree, Fischbacher (2007). Participants were mainly undergraduate students from the UAB and were recruited using the online recruitment system ORSEE, Greiner (2004). A total of 208 participants took part in twelve experimental sessions composed by 123 women and 85 men. The average earnings per person were 19.70 Euro (including a show-up fee of 5.00 Euro). The average duration of a session was 2 hours 30 minutes.

2.3. Treatments

In the control treatment with the pure restart, the participants do not get any additional information and do not have to take any new type of action in the second or third part. At the beginning of both rounds 13 and 25, participants are informed in the part-specific instructions
that they will continue playing in the same group composition as before during the subsequent twelve rounds. Note that the effects of a pure restart were studied by Andreoni (1988) and Croson (1996) in a simultaneous voluntary contribution game and the restart was a surprise for participants. Hence, our control treatment is an extension and not a pure replication of previous work. To our knowledge, the restart effect as such has not yet been studied in a sequential form of the game and without it being a surprise.

In the comprehension/advice treatment, we explain to participants, before the start of part 2, how contributions usually evolve in related experiments and give an explanation of why they typically decline, following the findings of Fischbacher and Gächter (2010). Then we provide some advice on what to do to avoid the decline and to reach and maintain high earnings from the public good. The idea of this treatment is that of a working group receiving external expert analysis, explanation and advice. Following psychological research on attitude change and persuasion (McGuire, 1985) we provide participants with a rational analysis of the causes of cooperation decay and with an evidence-based advice on how the process of decay can be prevented.

The better understanding of the problem at hand (McGuire, 1985), i.e. the better understanding of the (possibly experienced) decay in cooperation, and increased beliefs about others’ contributions caused by the advice lead us to expect that contributions would be higher in the comprehension/advice treatment than in the control restart treatment.

The content of the explanation given to subjects is the following: We first inform participants that we observed a decline in average contributions over part 1 in previous sessions driven by followers undercutting previous contributions on average. We then explain to them that a study showed that the decline in contributions in the repeated simultaneous game occurs because participants are on average imperfect conditional contributors (Fischbacher and Gächter, 2010). Finally, we state that it is recommendable that followers contribute at least as much as the leader of their group to reach and maintain high earnings from the public good. Note that we use in the advice part the Spanish plural form of you (“vosotros”) referring to the total group earnings from the public good. In the comprehension text as well as in the remaining instructions, we use the singular form of you (“tu”). Before part 3, we give a short reminder of the explanation and the recommendation. The full text of the comprehension/advice instructions for part 2 and part 3 can be found in the appendix. We wanted to make sure that participants understood well what was going on in the game and we wanted to give a clear comprehensive recommendation of what to do to avoid the decline. We thought carefully about the information we put in the explanation and advice and let non-
economists proofread it for understandability. Also, we gave participants enough time to read the information again after we had read it out aloud and asked if anyone had a question before proceeding.

In the communication treatment, the leader of a group sends a one-way free form text message to the followers before part 2 and part 3 begin, respectively. Except for standard rules for free form communication in experiments, leaders are free to write whatever they want. Koukoumelis et al. (2012) show that one-way free form communication by one group member increases contributions in the simultaneous voluntary contributions game significantly. We are interested in studying behavior in the sequentially played voluntary contribution game and after a decrease in contributions; our emphasis is on reviving cooperation after it has died down, which is a crucial difference to previous experiments on communication and cooperation. We think that it is an interesting context since after a negative cooperation experience it is particularly crucial that leaders find the right words to get out of the trap. Still we expect that communication will increase cooperation by more than the pure restart. Note that the informational content and understanding contained in the message participants get in the comprehension/advice treatment can be considered to be at least as precise and deep as in the communication treatment. The advice in the comprehension/advice treatment (although transmitted in a soft way to not be perceived as an order) is supposed to be clear and comprehensive.

In the comprehension/advice/communication treatment, all participants receive the exactly same explanation and advice as in the comprehension/advice treatment before part 2 and part 3 begin, respectively. On the subsequent screen, leaders can then send a one-way free form message to the followers, respectively. The instructions and the procedure are identical to the communication treatment. We expect cooperation to be highest because participants are supposed to understand the game and receive advice and additionally, the externally provided expert information can help improve the communication content of leaders’ messages.

[Table 1 approx. here]

We have one control treatment and three intervention treatments. In the following, we will denote the restart control treatment by “treatment R,” the comprehension/advice intervention by “treatment CA,” the communication intervention by “treatment C,” and the comprehension/advice intervention in combination with the communication by “treatment CAC.” Table 1 provides a summary of the characteristics and the number of observations for
each treatment. We have a total of 15 (independent) group observations for treatment R, 13 group observations for treatment CA, 12 group observations for treatment C, and 12 group observations for treatment CAC.

3. RESULTS

Sections 3.1, 3.2 and 3.3 deal with the results of parts 1, 2 and 3 respectively. In section 3.4 we study more in detail some aspects of the process by which communication affects behavior differentially. In particular, we study whether the impact of the group leaders’ contributions on followers’ contributions depends on the treatment and we analyze the content of leader communication.

3.1. Part 1

The average contributions and corresponding standard deviations of all participants, leaders and followers, are shown in Table 2. Figures 1, 2 and 3 show average contributions, average contributions of leaders and average contributions of followers over the 36 rounds of the experiment. In this section we focus on part 1, the first twelve rounds of the experimental sessions.

3.1.1. Average and leaders’ and followers’ contributions in part 1

Consider the information shown in Table 2. Average contributions of a part are the average over the group contributions in the twelve corresponding rounds resulting in 15 (control treatment R), 13 (treatment CA), 12 (treatment C), and 12 (treatment CAC) independent observations. Average contributions (standard deviations) in part 1 are 19.28 (7.442) in treatment R, 17.86 (7.086) in treatment CA, 19.62 (6.068) in treatment C, and 21.93 (6.714) in treatment CAC. As expected, the null hypothesis “no treatment differences in contributions in part 1” cannot be rejected (chi2(3df) = 1.906, p = 0.592, Kruskal-Wallis test). Also the pair-wise comparison of the part 1 contribution distributions does not reveal differences between treatments R, CA, C, and CAC (p > 0.210, pair-wise two-sided Mann-Whitney U test).

Contributions in part 1 are also the same when analyzing leaders and followers separately. For leaders, the part contributions are calculated taking the average over the
contributions in the twelve rounds of a part on the individual level. For followers, the average part contributions are calculated over the average of the three group followers in the twelve rounds of a part leading to 15 (control treatment R), 13 (treatment CA), 12 (treatment C), and 12 (treatment CAC) independent observations. Neither for leaders (chi2(3df) = 1.390, p = 0.708, Kruskal-Wallis test; p > 0.255, pair-wise two-sided Mann-Whitney U test) nor for followers (chi2(3df) = 2.000, p = 0.573, Kruskal-Wallis test; p > 0.191, pair-wise two-sided Mann-Whitney U test), are there significant treatment differences in contributions in the first part of the experiment.

Comparing leaders’ and followers’ contributions, we find that leaders contribute significantly more than the followers of the corresponding group in each treatment and part (p < 0.084 for each treatment and part separately, two-sided Wilcoxon signed-rank tests, N = 15 for control treatment R, N = 13 for treatment CA, N = 12 for treatment C, N = 12 for treatment CAC) with two (slight) exceptions: in part 2, the difference between the leaders’ and the followers’ contribution is not significant in treatment C (p = 0.170, two-sided Wilcoxon signed-rank test), and in part 3, the difference is not significant in treatment CAC (p=0.182, two-sided Wilcoxon signed-rank test). For the statistical tests, we compare a leader’s average contribution with the average contribution of all followers of the same group in a part. We will get back to the exceptions in the next sections. The larger contributions of leaders are confirmed in all regression models in table 3. On average, leaders contribute between 4.5 and 5.1 EMU more than followers with the coefficient estimate being statistically significantly different from zero at the one percent level. This replicates an earlier finding by Güth et al. (2007) among others.

3.1.2. Decline in contributions in all treatments

The decline in cooperation in part 1 is observable in figures 1, 2, and 3, where average contributions per treatments are depicted for all 36 rounds for all participants, leaders only, and followers only, respectively. The decay is also confirmed in pooled OLS regressions clustering for groups, see table 3. The observations are those of all 208 participants of control treatment R, and treatments CA, C, and CAC. We cluster by group to control for the correlation of contributions within a group. In regression models (1a), (1b), (2a), (2b), (3a), and (3b), observations are those from part 1 (round 1 through 12), part 2 (round 13 through 24), and part 3 (round 25 through 36), respectively. In models (1a), (2a), and (3a), the individual contributions are regressed on a round variable taking values between 1 and 12 corresponding to parts 1, 2 and 3 respectively, a dummy variable for each of the three
interventional treatments CA, C, and CAC and a dummy variable, which takes the value one if the individual is leader and zero if the individual is follower. The reference treatment is thus treatment R. In models (1b), (2b), and (3b), an interaction term between the round variable and each of the three treatments CA, C, and CAC is added to the corresponding model.

[Figures 1, 2, 3 approx. here]

Focusing on the regressions for part 1, the results for model (1a) show that the coefficient estimate for the round variable is negative and highly significant at the one percent level (just as in the other regression models) indicating that contributions in control treatment R decrease over the rounds of part 1 by 0.88 EMU per round on average. The coefficient estimates of the treatment dummy variables are all insignificant indicating that there are no treatment differences in part 1. In model (1b) – which is shown for comparability with models (2b) and (3b) - the dummy variables for the three treatments CA, C, and CAC are positive and not significant, though the coefficient estimate of the treatment C-dummy (4.4) has a p-value of 0.114. All three interaction terms of the treatment and the round variable are negative. For treatment C, the interaction term is significant at the five percent level in part 1. Compared to control treatment R, contributions start somewhat higher in treatment C in round 1 and the contribution decrease is steeper by 0.63 EMU per round in part 1. This seems to be a random effect because there are no treatment differences in part 1.

[Table 3 approx. here]

The contribution decline over rounds is also confirmed in regression models (4a) and (4b), where observations are those from round 1 through 36. In model (4a), the individual contributions are regressed on a round variable taking values between 1 and 36, a dummy variable for part 2 and part 3, respectively, a dummy variable for each of the three interventional treatments CA, C, and CAC, and a dummy variable for the role “leader.” In model (4b), interaction terms between each part dummy and each interventional treatment dummy are added to model (4a). For the moment, note only that the round variable in both models is negative and highly significant meaning that contributions decrease on average over

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6 We don’t have an explanation for the difference in the slope, since there are no treatment differences in part 1.
all four treatments by 0.8 EMU per round. We will get back to the remaining results of table 3 later.

3.2. Part 2

Having confirmed the decline in contributions over the rounds of part 1, we now move to the short-run restart effect for the sequential voluntary contributions game (no surprise), which was found in previous studies with the simultaneous voluntary contribution game (surprise), see Andreoni (1988) and Croson (1996). Therefore, we compare contributions in round 13 with contributions in round 12 (first restart). We will analyze the contributions on the group level, for leaders only, and for followers only. For comparisons on the group level, we calculate the average over the contributions of the leader and the three followers of a group resulting in 15 (control treatment R), 13 (treatment CA), 12 (treatment C), and 12 (treatment CAC) independent observations. For followers, one independent observation is given by the average over the contributions of the three followers of a group. The increase from round 12 to 13 is very clear for all four treatments and the increase is confirmed by non-parametric tests ($p < 0.061$ separately for each treatment and for average contributions, leaders’ contributions, and average followers’ contributions, two-sided Wilcoxon signed-rank test, $N = 15$ for control treatment R, $N = 13$ for treatment CA, $N = 12$ for treatment C, $N = 12$ for treatment CAC). Also the highly significant positive coefficient estimate of the part 2-dummy in regression model (4a) in table 3 confirms an average increase of 11.57 EMU from round 12 to round 13 (part 2-coefficient estimate: 12.37 EMU; marginal round change: -0.80 EMU).

Now we ask whether there are treatment differences in the short-run reviving effect as such. The increase in group contributions from round 12 to round 13 is on average (with the corresponding standard deviation) 7.02 EMU (10.8), 18.13 EMU (9.8), 18.81 EMU (15.0), and 12.60 EMU (11.1) in treatments R, CA, C, and CAC, respectively. The differences in average contributions in round 13 can be observed in figures 1 to 3. The increase is significantly larger in the treatments CA and C than in the control treatment R ($p = 0.015$ and $p = 0.038$, respectively, two-sided Mann-Whitney U test). For leaders, this is only the case

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The increase is not significant for the CAC treatment, although the average contribution level in round 13 for CAC is as high as for the C treatment. The lack of significance can be attributed to the fact that the contribution level for CAC (randomly) remained relatively high in round 12.

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Note that, with „restart effect,” we refer to the change in contribution in the last round of a part to the contribution in the first round of the subsequent part within a treatment. With „reviving effect” we refer to the comparison of cooperation change at the beginning of a new part between treatments.
when we compare the contribution increase in treatment CA (19.15 EMU) with the rise in control treatment R (8.73 EMU) \( (p = 0.074, \text{ two-sided Mann-Whitney U test}) \). For followers only, contributions in treatments CA (17.79 EMU) and C (18.92 EMU) rise more than in control treatment R (6.44 EMU) \( (p = 0.020 \text{ and } p = 0.043, \text{ respectively, two-sided Mann-Whitney U test}) \).

What happens in the rest of part 2 (rounds 14 through 24)? Overall, contributions decline over the twelve rounds of part 2 in all four treatments, see regression models (2a) and (2b) in table 3. In what follows we present three distinct comparisons. First, we compare the contribution levels within part 2. Second, we compare – for each treatment separately - the change in contribution levels between parts 1 and 2. Finally, we take a diff-in-diff look and see whether the changes in contribution levels between parts 1 and 2 are different between treatments.

We find that contributions in part 2 are highest when the leader communicates with the followers irrespective of the additional comprehension/advice text, whereas they are similar between the pure restart and the comprehension/advice intervention, see figure 1 and table 2. In part 2, there are no significant differences in the distribution of group contributions between control treatment R (18.20 EMU) and treatment CA (18.51 EMU) \( (p = 0.695, \text{ Mann-Whitney U test}) \), nor are there between treatment C (26.56 EMU) and treatment CAC (27.50 EMU) \( (p = 0.773, \text{ Mann-Whitney U test}) \). However, contributions in part 2 are significantly higher than in treatment R and CA if the leader communicates with the followers in either treatment with communication \( (p<0.045, \text{ pair-wise two-sided Mann-Whitney U test}) \).

Separate analyses for leaders and followers draw a similar picture; see also figure 2, figure 3, and table 2. There are no differences between control treatment R and treatment CA/treatment C and treatment CAC for leaders only \( (p = 0.982/p = 0.339, \text{ pair-wise two-sided Mann-Whitney U test}) \) and for followers only \( (p = 0.730/ p = 0.730, \text{ pair-wise two-sided Mann-Whitney U test}) \). For leaders, contributions in treatment CAC in part 2 are larger than in treatment R and CA \( (0.014 < p < 0.041, \text{ pair-wise two-sided Mann-Whitney U test}) \) indicating that leaders try to push contributions in treatment CAC. Leader contributions in treatment C in part 2 are somewhat larger than in treatment R and CA, but not significantly \( (0.143 < p < 0.211, \text{ pair-wise two-sided Mann-Whitney U test}) \). Followers contribute significantly more after receiving a message from their group leader at the beginning of part 2 than in treatments R and CA, independent of the comprehension/advice text \( (p < 0.039; \text{ pair-wise two-sided Mann-Whitney U test}) \).
Another way to look at the long-run effect of the restart and the three interventions on cooperation is to compare part 2 contributions with part 1 contributions within each treatment. We do the analysis again for average contributions (leaders and followers), leaders only, and followers only, see table 2 for the respective average contributions and standard deviations. The rise in cooperation from part 1 to part 2 is only significant with communication; both without (p = 0.050, two-sided Wilcoxon signed-ranks test) and with (p = 0.060, two-sided Wilcoxon signed-ranks test) comprehension/advice. In both treatments, contributions increase by around 35%. The increase in contributions from part 1 to part 2 in treatments C and CAC is also significant for leaders and followers separately (p = 0.071 and p = 0.071 for leaders, respectively; p = 0.050 and p=0.028 for followers, respectively, two-sided Wilcoxon signed-ranks test). All other contribution changes from part 1 to part 2 are not significant, neither on the group level nor for leaders and followers separately (p > 0.256 for each treatment separately, two-sided Wilcoxon signed-ranks test). This is particularly interesting because the informational content and understanding is supposed to be higher with the external explanation and advice (treatment CA) than with communication (treatment C).

Yet another way of analyzing treatment differences is the comparison of the contribution changes between treatments (Diff-in-Diff analysis). Here, the question is whether there is a long-run reaction to a particular treatment controlling for initial contribution levels in part 1. The rise in cooperation from part 1 to part 2 is significantly larger in treatment C and CAC compared to control treatment R (p=0.032 and p=0.017, respectively, two-sided Mann-Whitney U test). The boosting effect of communication compared to the pure comprehension/advice intervention is (slightly) insignificant (p = 0.135 and p = 0.115, respectively, two-sided Mann-Whitney U test). Looking at leaders only, there are no significant differences in the long-run contribution reaction to any of the three interventions or to the pure restart (p > 0.231, pair-wise two-sided Mann-Whitney U test). Leaders’ contributions increase however slightly more in treatment CAC than in control treatment R (p=0.107, two-sided Mann-Whitney U test). The change in cooperation is significantly larger among followers who receive a message from the leader compared to the pure restart and compared to the pure comprehension/advice intervention (p = 0.015 for treatment R, p = 0.082 for treatment CA; two-sided Mann-Whitney U test). Adding communication to the comprehension/advice text does not increase the followers’ contribution significantly (p=0.157, two-sided Mann-Whitney U test) nor does adding the comprehension/advice text to the communication that followers receive from the leader (p=0.954, two-sided Mann-Whitney
There are no significant differences between treatment R and CA among followers (p = 0.461, pair-wise two-sided Mann-Whitney U test).

The regression models (2a), (2b), (4a) and (4b) in table 3 confirm the effect of communication beyond the restart effect. The dummy variables for treatment C and CAC are significant at the ten to one percent level and show that contributions in the communication treatments in part 2 are on average 8 EMU (treatment C) and 7-9 EMU (treatment CAC) larger than in the control treatment with the pure restart, see models (2a) and (4b). The coefficient estimates of the dummy variables for the other intervention treatment CA are insignificant. Note that, in model (2b), the coefficient estimates of the three interaction terms are insignificant. This means that cooperation declines over time similarly in part 2. Communication by the leader revives cooperation in part 2 effectively, but does not prevent a similar decline over time as do neither the pure restart nor the external comprehension/advice intervention. Note, however, that the interaction term of treatment CAC and the round variable is positive (though insignificant) indicating that the decline with the comprehension/advice intervention in combination with the leader’s communication somehow softens the decline in cooperation in part 2.

3.3. Part 3

We start the analysis of cooperation in part 3 by comparing contributions in round 25 with contributions in round 24 (second restart). The increase from round 24 to 25 can be seen for all four treatments in figures 2, 3, and 4 In the control treatment R, the increase is not significant for non-parametric tests (p > 0.132 separately for average group, leaders’, and followers’ contributions, two-sided Wilcoxon signed-rank test). The second non-surprise restart effect seems to be by far less strong then the first one. The augmentation is however confirmed by non-parametric tests for the three intervention treatments (p < 0.084 separately for each intervention treatment and for average contributions, leaders’ contributions, and average followers’ contributions, two-sided Wilcoxon signed-rank test). Surprisingly, leaders in treatment CAC do not contribute significantly more after the second restart (p = 0.652, two-sided Wilcoxon signed-rank test). However, the highly significant positive coefficient estimate of the part 3 dummy in the regression models (4a) and (4b) in table 3 underline an overall increase in contributions at the beginning of part 3 in all four treatments including the restart control treatment.

At the second restart, the comprehension/advice intervention leads to a new short-run reviving effect, while communication does not boost cooperation significantly, in contrast to
what happened at the first restart. The increase in group contributions from round 24 to round 25 is on average (with the corresponding standard deviation) 5.87 EMU (12.9), 13.54 EMU (12.3), 12.5 EMU (16.9), and 4.8 EMU (7.9) in treatment R, CA, C, and CAC, respectively. The increase is (not) significantly larger in treatment CA (treatments C and CAC) than in the control treatment R (p = 0.065 (p > 0.231), two-sided Mann-Whitney U test). For leaders, the short-run reaction is significantly smaller in treatment CAC than in treatment CA and C (p < 0.081, two-sided Mann-Whitney U test), which is partly due to the fact that contributions in treatment CAC decreased slightly less over part 2. Among followers, contributions in treatment CA (14.36 EMU) rise more than in control treatment R (5.67 EMU) (p = 0.029, respectively, two-sided Mann-Whitney U test).

Concerning the effects throughout part 3, the average contributions in part 3 (rounds 25 through 36) are again highest if the leader sends a communication message to the followers, whereas they are very similar with the pure restart and the comprehension/advice intervention, see figure 2. For part 3, there are no significant differences in contributions between the control treatment R (16.03 EMU) and the comprehension/advice intervention (17.12 EMU) nor are there differences between treatment C (29.31 EMU) and CAC (26.13 EMU) (p = 0.908 and p = 0.453, pair-wise Mann-Whitney U test). With communication, contributions are significantly larger than in control treatment R and treatment CA (p < 0.009; pair-wise two-sided Mann-Whitney U test). To a slightly smaller extend the same is true for communication after the comprehension/advice reminder (p < 0.107; pair-wise two-sided Mann-Whitney U test).

The regression models (3a) and (4b) in table 3 confirm the repeated effect of communication beyond the restart effect. The coefficient estimates of the dummy variable for treatment CAC (and C) are (highly) significant and show that contributions are on average 7.5-10 EMU (13 EMU) higher than in the control treatment with the pure restart. Separate analyses for leaders and followers draw a similar picture, see also figures 3 4. There are no significant contribution differences in part 3 between the control treatment R and the treatment CA for leaders (p = 0.963, two-sided Mann-Whitney U test) and for followers (p = 0.982, two-sided Mann-Whitney U test). Contributions of leaders (p < 0.074, pair-wise two-sided Mann-Whitney U test) and followers (p < 0.005, pair-wise two-sided Mann-Whitney U test) are significantly higher with communication than with pure restart and with comprehension/advice. The leaders’ and the followers’ contributions in treatment CAC move somewhere in between the contributions in treatments R and CA (p < 0.200, pair-wise two-
sided Mann-Whitney U test) and treatment C (p > 0.462, pair-wise two-sided Mann-Whitney U test).

Comparing average part 3 contributions with average part 2 contributions within each treatment, we find that contributions decrease in all treatments except for the treatment where the leader communicates with the followers without the comprehension/advice stage, see table 2. The decrease is only significant for the treatment with the pure restart for all participants (p = 0.094, two-sided Wilcoxon signed-ranks test) and for followers only (p = 0.038, two-sided Wilcoxon signed-ranks test), but not for leaders only. Note that contributions decrease stronger towards the end of the experiment in treatments R, CA, and CAC leading to lower average contributions in part 3, see figures 2, 3, and 4 and table 2. This so-called last round effect is often observed in repeatedly played voluntary contribution games towards the end of the experimental session.

On the contrary, contributions in treatment C do not decrease over the rounds of the last part except for the last two rounds. The average contributions with one-way free form communication increase from 26.56 EMU in part 2 to 29.31 EMU in part 3. This is particularly surprising because the repeated communication at the beginning of part 3 apparently improves cooperation such that it compensates for more than the last round effect. The rise in contributions from part 2 to part 3 is however not significant both for average contributions and for leaders and followers separately.

Comparing the long-run reaction to the interventions and the restart after the repeated restart and interventions (difference between contributions in part 3 and in part 2), we find significant differences only for treatment C compared to the restart (p = 0.083, two-sided Mann-Whitney U test). Leaders who communicate with the followers contribute slightly more than leaders in treatments CA (p = 0.103, two-sided Mann-Whitney U test). Followers react significantly more positively to the text message by the leader than to the pure restart (p=0.054, two-sided Mann-Whitney U test). The reaction to the repeated communication is not significantly different with the comprehension/advice message than without the external information input. Also the combined intervention CAC has no larger repeated impact on cooperation than the repeated restart or the repeated comprehension/advice message does.

The lasting effect of the leaders’ (repeated) communication with the followers on cooperation is also confirmed in regression models (3a) and (4b) where the coefficient estimates of the communication dummy and of the interaction term between communication and part 3 are significant at the one percent level, respectively. The repeated communication at the beginning of part 3 does not only maintain the previous reviving effect of the text...
message, but reinforces it: compared to the pure restart, contributions in treatment C are on average 8 EMU higher in part 2, model (2a), and 13 EMU higher in part 3, model (3a) in table 3. The combination of “expert” explanation and advice and leader communication increases cooperation also in the repeated intervention, but does not perform as well as the pure communication. Looking at the contribution evolution over time in part 3 in model (3b), we find that the interaction term between treatment CA and the round variable is significantly negative with a value of -0.646. Contributions start somewhat higher, but the decay is stronger after two “expert” explanation and advice interventions than after two pure restarts. This could be due to disappointed higher expectations about the others’ contributions.

The interesting effect of repeated communication can be seen in regression model (3b): the coefficient estimate of the interaction term of the treatment C dummy and the part round variable is positive and significant at the ten percent level. Repeated communication prevents the decrease in contributions over time in part 3 to a large extent: the coefficient estimates of the part round variable and of the interaction term are -0.673 and +0.521 in model (3b), respectively. Repeated communication (without the explanation and advice stage) seems to reinforce the reviving effect of communication on cooperation. A Wald post estimation test shows that the coefficient estimate of the interaction term \((C)*(Part\ 3)\) is slightly insignificantly larger than the coefficient estimate of the interaction term \((C)*(Part\ 2)\) in model (4b) of table 3 (\(p = 0.1254\)). While the leaders’ first text message shifts contributions upwards, the leaders’ second communication with the followers results not only in the preservation of the contribution shift, but also in a hardly decreasing cooperation slope over time.

Fixed effects regressions (robust standard errors) regressing the individual contributions on the round variable for each part and each treatment separately confirm that part 3 in treatment C is the only case where the contribution decay over rounds is not significantly different from zero (regressions not reported, available upon request). For all other cases, the decay is significantly different from zero on the 1% level (treatments R and CA separately for parts 1, 2, and 3; treatment C for parts 1 and 2; treatment CAC for part 1) and on the 6% level (treatment CAC for parts 2 and 3).

3.4. How followers follow the leader and communication content

The positive effect of communication on contributions is to a large extent related to the following behavior of followers with respect to the group leader’s contribution. The long-run cooperation reaction to communication without the comprehension/advice text is
particularly strong among followers. Remember that leaders’ contributions are in general significantly larger than followers’ contributions except for treatment C in part 2 (p = 0.170, two-sided Wilcoxon signed-rank tests), see section 3.1. The average contribution gap is cut to more than half from 4.93 EMU in part 1 to 2.06 EMU in part 2 (table 2) meaning that, with communication, leaders manage to bring followers’ contributions closer to that of leaders. Leaders in treatment CAC try equally hard to push cooperation in part 2 by increasing contributions to an average of 30.69 EMU, but they do not manage to convince followers to go after them as much as in treatment C. Unexpectedly, the comprehension/advice text seems to make it harder for leaders to convince followers.

In Table 4, the followers’ contributions are regressed on a variable for each part round (taking values between 1 and 12), the group leader’s contribution in the same round (taking values between 0 and 40) and three interaction terms of the group leader’s contribution and a dummy for the treatments CA, C, and CAC, respectively (taking the value one for the respective treatment and zero otherwise). We use fixed effects regression with robust standard errors and the omitted dummy variable is treatment R. Regression models (1), (2), and (3) use the observations of part 1, 2, and 3, respectively. As shown previously, contributions decrease significantly over the rounds of a part and the group leader’s contribution has a significant impact on the followers’ contributions (highly significant coefficient estimates for the round and for the group leader’s variable in all three models).

We want to know whether the impact of the group leaders’ contribution on the followers’ contributions increases with any of the three treatments compared to the pure restart. The coefficient estimates of the interaction terms are insignificant in part 1; see regression model (1) in table 4. In part 2, the coefficient estimates of the group leader’s contribution with the dummy for treatment C and treatment CAC goes up to 0.220 and 0.209, respectively, but it is only significant for the communication treatment. Followers follow the group leader’s contributions thus more when the leader communicates compared to the pure restart without any communication. Regression model (3) confirms this trend in part 3 for treatment C only: the coefficient estimate for the interaction term with the communication dummy is 0.387 and significantly different from zero on the 1% level.

Since the communication is free-form, we are interested in what kind of messages the leaders send and whether they differ between treatment C and treatment CAC. We therefore
coded the text message that leaders in treatment C and CAC send in rounds 13 and 25 to their followers. The mean values for some summary statistics and code categories are summarized in table 5 separately for rounds 13 and 25 and treatments C and CAC, respectively. The summary statistics refer to the time in seconds that leaders need until they enter the last part of their text message and to the average number of words per text message. For the communication content analysis, we mostly adopted the coding categories from Koukoumelis et al. (2012) and added some categories that we thought would be important for our design.\footnote{One of the co-authors did the coding of the text messages as objectively as possible.}

The code categories are described in the following. The first five coding categories capture the content of the comprehension/advice message in treatment CA (and CAC). The intention is to see whether leaders mention an observed decline in previous contributions, whether they observed followers undercutting in general, whether they mention one or more possible explanation(s) such as selfishness and consequences of such an undercutting behavior, i.e. others may follow the example. Finally, we code a request for conformity, i.e. the leader’s emphasis on the need that all group members conform to the leader’s contribution.

The next six categories enclose some payoff-related arguments. In particular, they include the leader’s suggestion (point or interval) of how much to contribute to the project; the suggestion, implicit or explicit, must be unambiguous. We code whether the suggestion is efficient, i.e. an implicit or explicit suggestion that everybody in the group (including the leader) contributes the whole endowment. Furthermore, coding categories enclose whether the leader makes explicit payoff calculations associated with the proposal, whether he argues explicitly that the suggested amount maximizes the group payoff, or conjectures that participants are interested in maximizing the group payoff, as well as whether the leader mentions explicitly that the followers benefit from following his suggestion. Finally, we code with the last category in the payoff-related group whether the leader mentions a certain reaction to defecting. In particular, code 1 stands for announcing the tit-for-tat strategy, 2 stands for two-tit-for-tat, 3 for the grim trigger strategy, and 4 for a random/reducing strategy in case of someone defecting.

The third group of coding categories encompasses social preferences, emotional expression, and own contribution behavior. With fairness, we refer to an explicit or implicit
reference to fairness or just behavior, which also includes an explicit rejection of some group member contributing less than the others. Team spirit refers to a statement promoting the willingness to cooperate as part of a team or emphasizing the importance of cooperation in the group. Closely related is the notification of low contributors, implicit or explicit, of those who contributed less than suggested or who started decreasing their contributions. The difference to the category “Observation of followers undercutting” is that here the leader refers to the followers as a whole. We furthermore code whether the leader praises or complains about observed contributions. The mood of the communication is (mostly) independent from the leader’s praise or complaint and gives an overall impression of bad, neutral, or positive vibes, which includes the use of “smileys,” or other forms of creating a good or bad atmosphere. Furthermore, we code whether the leader leaves the contribution decision explicitly to the followers, promises to contribute some specific amount, or expresses the willingness to contribute more than the followers do.

The last group includes a set of different coding categories. We code whether the form of the text message is rather informal, neutral, or formal, whether the leader uses the labor notion from the instructions, e.g. “director,” “workers,” or “firm,” and whether the communication content is to some extend strange, wrong or does not make any sense. The number of analyzed text messages in round 13 in treatment CAC is 11 (due to technical problems, the message of one leader was not saved). In all other cases 12 text messages were analyzed, respectively.

The comprehension/advice categories are mentioned frequently in treatment C in round 25. Whereas each of the five categories is mentioned between 17% and 58% of the times in round 13 in treatment C, the respective frequencies go up to 33% to 67% of the times in round 25. The communication content in treatment C is thus partly quite similar to the content of the expert explanation and recommendation in treatment CAC.

Besides a request for conformity in contributions, a suggestion and in particular an efficient suggestion from the leader is an important determinant of successful cooperation. Note that in the comprehension/advice communication text, we only recommend conformity to reach high earnings. In both treatments C and CAC, 83% to 91% (67% to 83%) of the leaders make a contribution suggestion in round 13 (25), but only 36% to 42% of the leaders suggest the efficient contribution to the public good in round 13, i.e. everybody contributing the entire endowment. The monetary benefit of cooperating is however stressed by almost all leaders (group payoff maximization and satisfaction).
For some communication categories, we find considerable differences between the communication only and the comprehension/advice and communication treatments. In particular for the formulation of a “punishment” strategy, for deviations from cooperating, for the notion of fairness, and the expression of emotions, we find interesting differences between treatment C and treatment CAC. When there is no explanation and advice from outside, leaders propose more often less forgiving strategies, in particular when communicating for the first time in round 13. Three leaders announce the tit-for-tat, two leaders the grim trigger, and one leader the random strategy in treatment C compared to two tit-for-tat announcements in treatment CAC in round 13. The gap in tough strategies becomes closer in round 25 but remains (one tit-for-tat, one two-tit-for-tat, two grim trigger in treatment C; two tit-for-tat, one grim trigger and one random strategy in treatment CAC). With communication only, leaders refer more often to fairness reasons (50% and 58% of the cases in rounds 13 and 25, respectively) compared to treatment CAC (18% in round 13 and 25% in round 25).

Overall, the expression of emotions in form of complaint or praise is more frequent without the expert analysis and advice. It is notable that half of the leaders in treatment C praise the observed contributions in round 25 whereas only 17% of the leaders in treatment CAC do so even though the contributions in part 2 are similar in both treatments. This might be the result of a surprisingly positive contribution behavior in treatment C or leaders feeling more responsible for the motivation in treatment C. Even though, in round 13, leaders complain more often about the followers previous contributions with communication only (25% compared to 9% in treatment CAC), the overall mood in the text messages is more positive in both rounds. Compared to none of the leaders in treatment CAC, some leaders leave the contribution choice explicitly to the followers (17% in round 13 and 25% in round 25) or express the willingness to contribute more than the followers (25% in round 13 and 17% in round 25) when they are not influenced by the expert analysis and advice.

4. CONCLUSION

Cooperation in teams is an important component of successful performance of companies and other organizations. It is a common observation that cooperation decreases over time due to different reasons and we analyzed in this study how a group leader can revive cooperation effectively. A pure restart is found to increase cooperation, but – in line with previous evidence - only has a short-run effect. We analyzed and compared two widespread managerial strategies and a combination of both strategies that organizations may realistically have available and that could create an effect beyond that of a restart.
The results show that leader communication with the followers is by far the most effective intervention for increasing cooperation in the long-run. The effect on cooperation is significantly larger than the effect of a simple restart driven mainly by increased contribution of followers, i.e. followers pursue the leader better. The effect is also larger compared to an external expert explanation and advice based on the study by Fischbacher and Gaechter (2010) even though the informational content and understanding of the decline in cooperation and a counter-action can a priori be expected to be at least as high with the expert intervention.

A combination of the expert explanation and advice together with the leaders’ communication with the followers increases cooperation, but does not outperform the pure effect of communication on cooperation. In addition, repeated communication reinforces the reviving effect of communication on cooperation. After the leader sends a second text message to the followers, contributions go barely down over time and do so significantly less than with the pure restart. Repeated communication after the comprehension/advice intervention does not have a similar reinforcing effect, but maintains high contribution levels.

It is important to note that our results are circumscribed to the particular game we use. An important feature of our design is the sequential form of the voluntary contribution game, or in other words, the leading-by-example structure meaning that leaders choose the contribution first. Cooperation revival in our design is a combination of the leader’s communication with the followers and an exemplary contribution behavior by the leader. We cannot say whether leaders may manage to revive cooperation with communication in another kind of setting or whether communication by a follower will have the same effect.

The expert consultancy does not show an effect that goes significantly beyond that of a restart in our experiment nor does it improve the effect of the leader’s communication with the followers. What our results show is that the effect is short-lived and that even the short-run effect does not go beyond that of a pure restart. We believe that these negative results are as important as the positive one mentioned above. It is perhaps most surprising that the comprehension/advice treatment has no additional effect, since it would seem that an analysis of the causes of cooperation decline and a clearly formulated advice are the best starting point for not running into the same problem as before.

One explanation for our finding may be that what matters for cooperation is not production oriented communication, as contained in the comprehension/advice intervention and mostly in the communication following the expert explanation and advice, but people oriented communication as in the communication only intervention. Another explanation could be that the communication by the leader is less formal than the written communication.
in the comprehension/advice treatment. Pinto and Pinto (1990) show that high cooperating hospital project teams use informal communication more frequent than low cooperating teams, but there are no differences concerning formal communication. In a similar vein, one could think about the formal, production oriented expert analysis and advice from an external human resource consulting firm as a way to create a short-run restart in the firm. Whether the external expert advice has an effect beyond the restart may depend on the content of the analysis and the advice and the communication form.

As to the content of the communication from leader to followers, we do not have enough observations to do a thorough analysis (nor is it the purpose in this study). However, the most commonly mentioned categories are the monetary benefit from cooperation and requesting conditional contribution. Some leaders also threaten to decrease contribution if the followers do not cooperate at the same level, create a feeling of relationship closeness and mention the previous decrease in cooperation and possible reasons thereof. The communication content is thus partly quite similar to the external “expert” explanation and advice we give to the participants adding a personal nuance. It could make a big difference whether the information is transmitted from within the group or from outside the group. Also, the content of the “expert” explanation and advice is purely informative (production oriented) while the leaders can evoke feelings and emotions such as identity, solidarity, or guilt for letting others down (people oriented), which they do more often when they are not influenced by the expert explanation and advice. Another possibility could be that too much information is not good for changing individuals’ behavior. Also the leader can target the previous cooperation in the own group with the free form communication, while the comprehension/advice text is a general statement. It would be interesting to analyze in future work what kind of communication leaders can use to restore cooperation in organizations.
REFERENCES


FIGURES

Figure 1: Average contributions in control treatment R and treatment CA, C, and CAC (round 1 through 36).

Figure 2: Average contributions of leaders in control treatment R and treatment CA, C, and CAC (round 1 through 36).
Figure 3: Average contributions of followers in control treatment R and treatment CA, C, and CAC (round 1 through 36).
TABLES

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<th>Observations</th>
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<td>Comprehension and advice text</td>
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Table 1: Overview over treatments

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<td>12</td>
<td>29.31</td>
<td>(10.32)</td>
<td>30.56</td>
<td>(11.01)</td>
<td>28.89</td>
</tr>
<tr>
<td>Treatment CAC</td>
<td>Part 1 (round 1-12)</td>
<td>12</td>
<td>21.93</td>
<td>(6.714)</td>
<td>25.73</td>
<td>(7.316)</td>
<td>20.67</td>
</tr>
<tr>
<td></td>
<td>Part 2 (round 13-24)</td>
<td>12</td>
<td>27.50</td>
<td>(9.725)</td>
<td>30.69</td>
<td>(9.814)</td>
<td>26.44</td>
</tr>
<tr>
<td></td>
<td>Part 3 (round 25-36)</td>
<td>12</td>
<td>26.13</td>
<td>(12.16)</td>
<td>28.18</td>
<td>(11.40)</td>
<td>25.44</td>
</tr>
</tbody>
</table>

Table 2: Descriptive statistics of contributions by treatment and on the group, leader and follower level.
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1a)</th>
<th>(1b)</th>
<th>(2a)</th>
<th>(2b)</th>
<th>(3a)</th>
<th>(3b)</th>
<th>(4a)</th>
<th>(4b)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Part round (1-12)</strong></td>
<td>-0.882***</td>
<td>-0.594***</td>
<td>-0.848***</td>
<td>-0.754***</td>
<td>-0.679***</td>
<td>-0.673**</td>
<td>-0.803***</td>
<td>-0.803***</td>
</tr>
<tr>
<td></td>
<td>(0.137)</td>
<td>(0.220)</td>
<td>(0.167)</td>
<td>(0.251)</td>
<td>(0.148)</td>
<td>(0.261)</td>
<td>(0.101)</td>
<td>(0.101)</td>
</tr>
<tr>
<td><strong>Round (1-36)</strong></td>
<td>12.37***</td>
<td>8.557***</td>
<td>(1.721)</td>
<td>(2.018)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Part 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21.35***</td>
<td>16.03***</td>
<td>(3.005)</td>
<td>(3.985)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comprehension/advice</td>
<td>-1.413</td>
<td>1.924</td>
<td>0.311</td>
<td>2.886</td>
<td>1.086</td>
<td>5.288</td>
<td>-0.00513</td>
<td>-1.413</td>
</tr>
<tr>
<td></td>
<td>(2.676)</td>
<td>(2.604)</td>
<td>(3.233)</td>
<td>(4.385)</td>
<td>(3.846)</td>
<td>(5.146)</td>
<td>(2.675)</td>
<td>(2.676)</td>
</tr>
<tr>
<td>Communication</td>
<td>0.345</td>
<td>4.405</td>
<td>8.358***</td>
<td>10.68**</td>
<td>13.28***</td>
<td>9.895**</td>
<td>7.328***</td>
<td>0.345</td>
</tr>
<tr>
<td></td>
<td>(2.529)</td>
<td>(2.743)</td>
<td>(3.020)</td>
<td>(4.282)</td>
<td>(3.793)</td>
<td>(4.923)</td>
<td>(2.390)</td>
<td>(2.528)</td>
</tr>
<tr>
<td></td>
<td>(2.653)</td>
<td>(2.858)</td>
<td>(3.323)</td>
<td>(3.827)</td>
<td>(4.197)</td>
<td>(4.807)</td>
<td>(2.910)</td>
<td>(2.653)</td>
</tr>
<tr>
<td>(CA)*(Part round)</td>
<td>-0.513</td>
<td>-0.396</td>
<td>-0.646*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.335)</td>
<td>(0.380)</td>
<td>(0.368)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(C)*(Part round)</td>
<td>-0.625**</td>
<td>-0.357</td>
<td>0.521*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.299)</td>
<td>(0.534)</td>
<td>(0.308)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CAC)*(Part round)</td>
<td>-0.0691</td>
<td>0.378</td>
<td>0.155</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.426)</td>
<td>(0.368)</td>
<td>(0.449)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CA)*(Part 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.723</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>(2.801)</td>
<td></td>
</tr>
<tr>
<td>(CA)*(Part 3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.499</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(4.196)</td>
<td></td>
</tr>
<tr>
<td>(C)*(Part 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.013**</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(3.007)</td>
<td></td>
</tr>
<tr>
<td>(C)*(Part 3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12.94***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(4.382)</td>
<td></td>
</tr>
<tr>
<td>(CAC)*(Part 2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.647**</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2.741)</td>
<td></td>
</tr>
<tr>
<td>(CAC)*(Part 3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.440*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(3.936)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.804)</td>
<td>(0.805)</td>
<td>(0.928)</td>
<td>(0.929)</td>
<td>(0.960)</td>
<td>(0.961)</td>
<td>(0.768)</td>
<td>(0.768)</td>
</tr>
<tr>
<td></td>
<td>(1.952)</td>
<td>(2.047)</td>
<td>(2.336)</td>
<td>(2.929)</td>
<td>(2.809)</td>
<td>(3.507)</td>
<td>(1.932)</td>
<td>(1.935)</td>
</tr>
<tr>
<td>Observations</td>
<td>2,496</td>
<td>2,496</td>
<td>2,496</td>
<td>2,496</td>
<td>2,496</td>
<td>2,496</td>
<td>7,488</td>
<td>7,488</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.073</td>
<td>0.077</td>
<td>0.129</td>
<td>0.134</td>
<td>0.157</td>
<td>0.165</td>
<td>0.110</td>
<td>0.128</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Pooled OLS (clustering for group), observations from round 1-12 (regression models 1a and 1b), round 13-24 (regression models 2a and 2b), round 25-36 (regression models 3a and 3b), round 1-36 (regression models 4a and 4b)

Dependent variable (contribution) takes values between 0 and 40.

**Table 3: Pooled OLS regression (Data: treatments R, CA, C, and CAC).**
### Table 4: Fixed effects regression with robust standard errors (Data: treatments R, CA, C, and CAC, followers only).

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Dependent variable: Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Part 1)</td>
</tr>
<tr>
<td>Part round (1-12)</td>
<td>-0.524***</td>
</tr>
<tr>
<td></td>
<td>(0.0946)</td>
</tr>
<tr>
<td>Contribution group leader (CGL)</td>
<td>0.386***</td>
</tr>
<tr>
<td></td>
<td>(0.0599)</td>
</tr>
<tr>
<td>(Comprehension/advice)*(CGL)</td>
<td>-0.0139</td>
</tr>
<tr>
<td></td>
<td>(0.0932)</td>
</tr>
<tr>
<td>(Communication)*(CGL)</td>
<td>-0.0277</td>
</tr>
<tr>
<td></td>
<td>(0.0786)</td>
</tr>
<tr>
<td>(Comp./advice/communication)*(CGL)</td>
<td>0.0920</td>
</tr>
<tr>
<td></td>
<td>(0.102)</td>
</tr>
<tr>
<td>Constant</td>
<td>12.62***</td>
</tr>
<tr>
<td></td>
<td>(1.229)</td>
</tr>
<tr>
<td>Observations</td>
<td>1,872</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.226</td>
</tr>
<tr>
<td>Number of subject</td>
<td>156</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1
### Table 5: Average of coded values for each summary statistic and communication category in treatments C and CAC in rounds 13 and 25

<table>
<thead>
<tr>
<th></th>
<th>Round 13 Treatment C</th>
<th>Round 13 Treatment CAC</th>
<th>Round 25 Treatment C</th>
<th>Round 25 Treatment CAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time for message (in sec.)</td>
<td>303.1</td>
<td>264.2</td>
<td>220.8</td>
<td>192.8</td>
</tr>
<tr>
<td>Number of words</td>
<td>72.6</td>
<td>55.1</td>
<td>79.4</td>
<td>72.5</td>
</tr>
<tr>
<td>Observation of decline (0=no, 1=yes)</td>
<td><strong>25.0%</strong></td>
<td><strong>9.1%</strong></td>
<td>41.7%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Observation of followers undercutting (0=no, 1=yes)</td>
<td>25.0%</td>
<td>18.2%</td>
<td>41.7%</td>
<td>50.0%</td>
</tr>
<tr>
<td>Undercutting reasons (e.g. selfishness) (0=no, 1=yes)</td>
<td>16.7%</td>
<td>18.2%</td>
<td><strong>50.0%</strong></td>
<td><strong>8.3%</strong></td>
</tr>
<tr>
<td>Consequences (Future repercussions of actions) (0=no, 1=yes)</td>
<td>16.7%</td>
<td>18.2%</td>
<td>33.3%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Conformity (0=no, 1=yes)</td>
<td>58.3%</td>
<td>72.7%</td>
<td>66.7%</td>
<td>75.0%</td>
</tr>
<tr>
<td>Suggestion (0=no, 1=yes)</td>
<td>83.3%</td>
<td>90.9%</td>
<td>66.7%</td>
<td>83.3%</td>
</tr>
<tr>
<td>Efficient suggestion (0=no, 1=yes)</td>
<td>41.7%</td>
<td>36.4%</td>
<td>33.3%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Payoff calculation (0=no, 1=yes)</td>
<td>41.7%</td>
<td>36.4%</td>
<td>25.0%</td>
<td>41.7%</td>
</tr>
<tr>
<td>Group payoff maximization (0=no, 1=yes)</td>
<td>66.7%</td>
<td>72.7%</td>
<td>50.0%</td>
<td>66.7%</td>
</tr>
<tr>
<td>Satisfaction (e.g. benefit for each) (0=no, 1=yes)</td>
<td>75.0%</td>
<td>81.8%</td>
<td>66.7%</td>
<td>66.7%</td>
</tr>
<tr>
<td>Strategy (0=no strategy, 1=tit-for-tat, 2=two-tit-for-tat, 3=grim trigger, 4=random/reduce a bit)</td>
<td>3 tit-for-tat, 2 grim trigger, 1 random</td>
<td>1 tit-for-tat, 2 two-tit-for-tat, 1 grim trigger, 1 random</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team spirit (0=no, 1=yes)</td>
<td>50.0%</td>
<td>18.2%</td>
<td>58.3%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Notification of low contributors (0=no, 1=yes)</td>
<td>33.3%</td>
<td>18.2%</td>
<td>50.0%</td>
<td>58.3%</td>
</tr>
<tr>
<td>Praise (0=no, 1=yes)</td>
<td>0.0%</td>
<td>0.0%</td>
<td>50.0%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Complaint (0=no, 1=yes)</td>
<td>25.0%</td>
<td>9.1%</td>
<td>33.3%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Mood (-1=bad, 0=neutral, 1=good)</td>
<td>0.33</td>
<td>0.18</td>
<td><strong>0.33</strong></td>
<td>0.17</td>
</tr>
<tr>
<td>Leave contribution decision to followers (0=no, 1=yes)</td>
<td>16.7%</td>
<td>0.0%</td>
<td>25.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Promise (0=no, 1=yes)</td>
<td>25.0%</td>
<td>18.2%</td>
<td>25.0%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Willingness to contribute more than followers (0=no, 1=yes)</td>
<td>25.0%</td>
<td>0.0%</td>
<td>16.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Form (-1=informal, 0=neutral, 1=neutral)</td>
<td>0.08</td>
<td>0.09</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>Labor notion (0=no, 1=yes)</td>
<td>33.3%</td>
<td>36.4%</td>
<td>16.7%</td>
<td>41.7%</td>
</tr>
<tr>
<td>Strange/nonsense (0=no, 1=yes)</td>
<td>25.0%</td>
<td>9.1%</td>
<td>8.3%</td>
<td>25.0%</td>
</tr>
</tbody>
</table>

Notes. The number of analyzed text messages in round 13 in treatment CAC is 11 (due to technical problems, the message of one leader was not saved). In all other cases 12 text messages were analyzed, respectively. The bold value pairs show a considerable difference in communication between the two treatments (circa 50% or more).
APPENDIX

Instructions

A.1. Instructions at the beginning of the experiment

General information

Thank you for coming to the experiment. You will receive 5 Euro for the participation in the experiment. You will be assigned to a group and depending on your and your group members’ decisions you can earn additional money during the experiment. It is important that you do not talk to any of the other participants until the experiment is over. You can ask questions at any time. If you have a question, please raise your hand and one of us will come to your place to answer.

Role and group matching

You will be randomly assigned to one of two roles: (1) director or (2) employee. This role will be the same throughout the entire experiment. Participants will be randomly split in groups with 4 members, each composed by 1 director and 3 employees. At no time during the experiment you will know whom you are matched with and your decisions will be anonymous.

Task and stages of each of the 36 rounds

There will be 36 separate rounds. In each round, each group works on a joint project whose payoff will depend on the hours dedicated by all group members. In each round, every participant has an endowment of 40 hours and decides how many of the 40 hours to dedicate to the project. The remaining hours will be automatically dedicated to a private activity.

Each round is independent from the others and develops in the following way:

Stage 1:
Directors: The director of each group decides how many of the 40 hours to dedicate to the project. The rest will be automatically dedicated to the private activity. There will be a simulation area on the lower part of the screen where directors can calculate earnings choosing different hours dedicated to the project by themselves and by the other group members on average (see “Decision screen director”). The calculations are absolutely private. In the upper part of the screen, directors enter the hours that they want to dedicate to the project in the corresponding round.
Employees: The employees do not have anything to do in this stage and wait until the director of their group have taken a decision.

Stage 2:
Directors: The directors do not have anything to do in this stage and wait until the employees of their group have taken a decision.
Employees: The employees of each group are informed about the hours that the director of their group decided to dedicate to the project and decide how many of their own 40 hours to dedicate to the project. The rest will be automatically dedicated to the private activity. There will be a simulation area on the lower part of the screen where employees can calculate earnings choosing different hours dedicated to the project by themselves and by the other group members on average (see “Decision screen employee”). The calculations are absolutely private. In the upper part of the screen, employees enter the hours that they want to dedicate to the project in the corresponding round.

Stage 3:
Directors and employees: All participants are informed about the average hours dedicated to the project by the other group members, the sum of hours dedicated to the project by all group members and about their own earnings. Summaries of previous rounds will also be listed.

After stage 3, a new round starts which develops in the same way.
**Additional information**

The experiment is split in 3 parts and each part consists of 12 rounds. The specific instructions for each part will be shown on the screen before the corresponding part starts.

**Payoff**

Your earnings in Experimental Currency Units (ECU) for each round are given by the following function, which is the same for directors and employees:

\[
Earnings_{\text{Round}} = (40 - \frac{\text{Hours}}{4} + 0.5 \cdot \sum_{\text{Group}} \frac{\text{Hours}}{4})
\]

The earnings in ECU are composed by the earnings from the hours dedicated to the private activity by that person and the earnings from the sum of hours dedicated by all group members to the joint project. That means that each hour that you decide to dedicate to the project gives each of the group members (i.e. you and all other group members) an earning of 0.5 ECU. Analogously, each hour that another group member decides to dedicate to the project gives each of the group members (i.e. you and all other group members) an earning of 0.5 ECU. Each hour that you decide not to dedicate to the project (i.e. to dedicate to the private activity) gives you and only you an earning of 1 ECU.

150 ECU are worth 1.00 Euro. At the end of the session you will receive 5 Euro plus the sum of what you will have earned in all 36 rounds of the experiment. After the experiment finishes we will pay you the earnings in private.

**Example and test question**

So that everyone understands how decisions translate into earnings we provide an example and a test question. (The number of hours used for the example and test are simply for illustrative purposes. In the experiment the allocations will depend on the actual decisions of the participants.)

**Example:** Suppose that you decide to dedicate 31 hours to the project and the other group members decide to dedicate on average 33 hours to the project in one of the 36 rounds.

The sum of hours dedicated to the project by all group members is:

\[31 + 3 \times 33 = 31 + 99 = 130\] (hours)

Your earnings in that round are:

\[(40 - 31) + 0.5 \times 130 = 9 + 65 = 74\] (ECU)

**Test:** Suppose that you decide to dedicate 28 hours to the project and the other group members decide to dedicate on average 24 hours to the project in another of the 36 rounds.

The sum of hours dedicated to the project by all group members is:

Your earnings in that round are:
Graphical representation of the chronological order of the experiment

Experiment: 36 rounds

Start experiment  
Instruction for each part  
Payment and questionnaire  
End experiment

Part 1: 12 rounds  
Part 2: 12 rounds  
Part 3: 12 rounds

1 round: 3 stages

Stage 1  
Stage 2  
Stage 3
(The number of hours used for the example and test are simply for illustrative purposes. In the experiment the allocations will depend on the actual decisions of the participants.)
A.2. Instructions at the beginning of part 1 (all four treatments R, CA, C, and CAC)

A.3. Instructions at the beginning of part 2 (treatments R, CA, C, and CAC)
A.5. Additional instructions at the beginning of part 2 and part 3 (treatment CA and CAC)

Text at the beginning of part 2

Please read the following text carefully. It gives you some explanation about the game that you are playing in this experiment and some advice.

We observed in previous sessions of this experiment in which you are participating today that the hours dedicated to the common project decrease on average over rounds in this part. You also might have observed that the hours dedicated to the common project in your group decreased over the previous 12 rounds.

We were wondering why contributions decrease and realized that the director’s and the workers’ hours dedicated to the common project follow similar patterns. That means that directors react to the workers’ previous contributions and workers on their turn react to the other workers’ and the director’s previous contributions.

Workers contribute on average fewer hours to the common project than the other workers of the same group in the previous round and less hours than the director in the same round.
Even though the directors dedicate on average more hours to the common project than the workers in the previous round, they also tend to decrease their contributions compared to the previous round. Therefore, the hours of the directors also decrease over time. You might have observed this contribution behavior in your group.

A recent study of an experiment similar to ours analyzes more in detail the behavior of the workers only in the experiment (if you want, we can provide you with the reference of the study at the end of the experiment). In that study, the workers are not only asked about how much to contribute, but also about what they believe the other workers will contribute. The study concludes, that "contributions decline because, on average, people […] match others’ contributions only partly." That means that, on average, the workers are willing to contribute slightly less than what they believe the other workers will contribute. This leads to contributions being initially lower than expected. Once workers see this the beliefs about the others’ contributions will be lower than before. Since the workers contribute on average slightly less than what they believe that the others contribute, this reinforces the process by which average contributions decrease over rounds.

In other words, if the workers start with the idea of undercutting others then others will follow and the contributions to the common project will fall over time.

If you wish to reach and maintain a high earnings level from the common project it is recommendable that all workers dedicate at least the same number of hours to the common project as the director of the group does.

If you have a question, raise your hand and someone of us will come to your place to answer the question.

Text at the beginning of part 3

We do not know how hours dedicated to the common project evolved in your group over the previous part. However, we would like to remind you of the explanation for the decline of contributions to the common project over time and the advice that we gave you previously:

We observed in previous sessions of this experiment that the director’s and the workers’ hours dedicated to the common project follow similar patterns. Workers contribute on average fewer hours to the common project than the other workers of the same group in the previous round and less hours than the director in the same round. Even though the directors dedicate
on average more hours to the common project than the workers in the previous round, they also tend to decrease their contributions compared to the previous round. Therefore, the hours of the directors also decrease over time.

A recent study of an experiment similar to ours concludes that, on average, workers are willing to contribute slightly less than what they believe the other workers will contribute. If the workers start with the idea of undercutting others, this will lead to the decrease of contributions over time.

If you wish to reach and maintain a high earnings level from the common project it is recommendable that all workers dedicate at least the same number of hours to the common project as the director of the group does.

If you have a question, raise your hand and someone of us will come to your table to answer the question.

A.6. Additional instructions at the beginning of part 2 and part 3 (treatment C and CAC after having received the comprehension and advice text)
In the box on their screen, the directors have now/again the opportunity to write a message, which will be sent to the employees of their group. After entering the message, you - the director - need to press the Enter key. The written text will appear in the upper part of the box the way it will be sent to the employees and you won't be able to change the entered text once you press the Enter key (just like in chats in Skype or WhatsApp). When you have finished writing the text and are ready to send the message to the employees you may raise your hand and one of us will come to your table to give you the code to get to the next screen. The employees will receive the message of the director of their group and, after that, the second/third part of the experiment (rounds 13/25 through 24/36) will start.

You – the director - are free to send the message you like, including what you think is the best approach to the experiment, what you plan to do, and/or what you would like the others to do and/or why. However, there are two restrictions on the kind of messages that you can send:

1. First, you are not allowed to identify yourself to the others. Thus, you cannot reveal your real name, nicknames, or any other identifying feature such as gender, hair, or where you are seated.
2. Second, there must be neither threats nor promises pertaining to anything that is to occur after the experiment.

The minimum entry of characters is 10. Please, try to finish your message within seven minutes. The remaining time in seconds is shown on the upper right corner of the screen.

If you have a question, raise your hand and someone of us will come to your table to answer the question.