Leadership and conditional cooperation in a sequential voluntary contribution mechanism: Experimental evidence

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Abstract

We show experimentally that public goods are provided more efficiently via the voluntary contribution mechanism (VCM) if players can divide their contributions into two stages. Our findings address the role of leadership in social dilemmas. Do leaders provide a "good example"? And how do they affect the behavior of potential followers? We find that Stage 1 contributions in the sequential two-stage VCM show significant leadership effect. At the same time, the followers’ Stage 2 contributions represent a negligible share of the efficiency gain. We conclude that an efficient sequencing of contributions in the VCM has to be targeted towards creating leadership incentives, and that leadership should be inclusive rather than exclusive.

**JEL Classification:** C72; C91

**Key words:** public goods, conditional cooperation, leadership, sequential VCM, experiment.

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1 Introduction

In the absence of any enforcement mechanism, standard theory predicts that the presence of positive externalities in the public goods games will result in their underprovision. Indeed, although the behavior in the Voluntary Contribution Mechanism (VCM) experiments is marked by the absence of full defection at the start of the subjects’ interaction, this partial cooperation is found to ebb away over time (Ledyard, 1995, Keser and van Winden, 2000, Croson et al., 2005). This pattern of contributions to the public good can be explained by the preference heterogeneity of the subject pool where besides strategically acting, own-payoff maximizing subjects, also conditionally cooperative (or reciprocal) subjects are present in the subject pool (Fischbacher and Gaechter, 2008, Burlando and Guala, 2005). The initial contributions can be attributed to these conditional cooperators, while the decline over time is result of their reaction to the presence of defectors (Andreoni, 1995, Brandts and Schram, 2001).

In this paper, we address whether the standard simultaneous-move VCM can be redesigned with the goal of achieving higher efficiency, when taking into account the role conditional cooperation might play. We focus on two aspects of the presence of conditional cooperators in the subject pool. First, on the fact that conditionally cooperative subjects are willing to sacrifice material payoffs in order to increase payoffs of others, provided these other subjects also manifested their willingness to sacrifice material payoffs. Second, on the fact that some subjects might recognize the role of conditional cooperation and choose to behave cooperatively due to strategic, rather than due to intrinsic motivations. We refer to the former as the followers’ effect, and to the latter as the leadership effect. To summarize briefly, we show in this paper that introducing a sequential structure into VCM results in a higher efficiency than the simultaneous VCM, and this in the absence of any enforcement mechanisms. In this way, wasteful costs of the enforcement process, whether centralized or decentralized, could be saved purely by restructuring the interaction of the players. We comment on the extent to which our design is successful in achieving this goal. We analyze the role of leadership and followers in generating the efficiency gain, and stress the crucial role of inclusive leadership in the efficient VCM design.

The experimental study we present here is related to an extensive literature on the role of conditional cooperation in social dilemmas, as well to a less extensive, but not less important, work on the role of leadership in the social dilemmas.

To start with, there is a vast experimental evidence on the human tendency for conditional cooperation. Around half of the subjects in the seminal paper by Fischbacher, Gaechter and Fehr (2001) use conditionally cooperative strategies in the VCM experiment: they contribute more to the public good the higher is the average contribution of others in their group. This observation has quite a general validity as it has been replicated across various geographic pools and experiment designs (see e.g. Bardsley 2000, Keser and van Winden, 2000, Herrmann and Thoeni, 2007, Kocher et al. 2007, Fischbacher and Gaechter, 2008). Moreover, conditional cooperation is found in the field and shown to affect the economic performance of real-world institutions. Any team production problem or charity institutional design might represent an example in point. For example, Shang and Croson (2006) find that charity donations are sensitive to the feedback on the provision of the previous donors: potential donors increase (decrease) own contribution when
they learn that another individual contributed more (less) than the past contribution of the respondent. Similarly, Frey and Meier (2004) observe that students contribute more to a students’ fund when informed that a high fraction of others contributed as well, rather than when informed that a low fraction of others contributed. In the team production set-up, Knez and Simister (2001) find that the ability to monitor other members’ behavior leads to a significant efficiency gain among luggage handling teams of an airline company, upon being exposed to a group bonus payment scheme, effectively turning the team members into public good providers. And, Ittner et al. (2006) use data on compensation schemes of medical group practices to show that they are dependent on variables determining the extent of monitoring, allowing for conditional cooperation, and hence for team-based rather than individual-performance based incentive schemes.

In the light of this evidence, conditional cooperation cannot be ignored in addressing the efficient provision of public goods. Sugden (1984) shows theoretically that in the standard VCM design, the interaction of reciprocal (conditionally cooperative) players and the expectation of conditional cooperation generates a set of equilibria larger than the point prediction obtained under the assumption of pure money-maximization incentives. Efficiency of these equilibria is generally higher than when conditional cooperators are not taken into account. Equilibrium multiplicity of this result, though, has to be taken into account when putting conditional cooperation to work in the lab - or in the field. In order to coordinate the players’ beliefs, the nature of conditional cooperation calls for some sort of sequencing in the players’ moves so that both the incentives for conditional cooperation, as well as incentives for triggering conditional cooperation by cooperating, are created in the new design as compared to the standard VCM, in which all players move simultaneously. Importantly, not only conditional cooperators, but also players with other preferences, in particular selfish players, need to be incentivized to contribute to the public good. Literature provides evidence that such incentives could be generated in "leader" positions - when players are aware that their behavior will be observed before others choose their actions in the VCM.

Starting from the original paper by Van der Heijden and Moxnes (2003) studying a public bad game, the evidence mounts suggesting that the presence of leaders increases the efficiency in the social dilemma game, but that the efficiency gain is prevalently due to the behavior of the leaders, rather than by the impact the leaders have on the behavior of the followers. Followers follow insufficiently any good example given by the leaders, and the economic gains of leadership, although of the significant in the mentioned studies, are economically rather small, leaving large possible efficiency gains aside. In the similar vein, when all players move sequentially, in a randomly assigned order, earlier ranked players are found to cooperate more than the later ranked players: it is the earlier ranked players that generate the efficiency gain as compared to the simultaneous move structure. Masclet and Willinger (2005) observe this effect in a sequential public goods game with a feedback on the actions of the earlier ranked players. Funaki and Vyrastekova (2008) find similarly that cooperation rates decrease in later ranked players in a sequential prisoner’s dilemma game.

Finally, evidence from endogenous timing of moves in public goods games also suggests that the contribution to efficiency gains due to conditional cooperation itself are limited. For example, Gueth et al. (2002) and Levati and Neugebauer (2004) show that inequali-
ties resulting from the individual public good contributions diminish, but efficiency does not rise, in an ascending/descending English clock auction mechanism, where all players observe the actions of all the players that choose to move. In a similar setup studied by Dorsey (1990) and Kurzban et al. (2001), players can adjust their contributions upwards and/or downwards at any time during the game, while continuously informed about the behavior of the others. In treatments where only increase of the contributions to the public good is possible, cooperation is more frequent than when both the revisions of contributions upwards and downwards are possible. Remarkably, several groups in the Kurzban et al. (2001) experiment achieved close to full efficiency in a treatment where only feedback on the lowest current individual contribution was available to the subjects. This finding is quite extraordinary, as the authors, simply by adding sequential structure and information restriction to the VCM, seem to have activated optimally the incentives to cooperate for all players, here endogenously choosing the role of the leader and/or follower. We find this observation remarkable as it points towards the role of inclusive leadership: by revealing only the lowest most recent contribution, all players expecting conditional cooperation have a motivation to improve upon the most recent lowest contribution, in order to avoid the downward spiral of defection. In a work related to the incremental nature of cooperation, Andreoni and Samuelson (2006) show theoretically and experimentally that the cooperation rates in a sequence of two prisoner’s dilemma games are highest when the players do not start with too large stakes in the first stage. Starting small promotes cooperation, and seems to be an important building block of design which optimally uses conditional cooperation as an incentive to contribute to a public good.

To summarize the findings discussed above, sequential moves - in whatever specific form - promote cooperation in the VCM through generating leadership incentives. The efficiency gains from follower’s behavior are less important for the overall efficiency gain than the contributions of the leader(s). We propose that this mounting evidence towards the role of leadership should be taken into account and could be used in designing a sequential VCM mechanism activating the leader’s incentives. Consequently, we suggest a design in which all players - rather than only one player - could be incentivized by the leadership effect, i.e. by the incentive to contribute to the public good in expectation that such a good example will be followed. In doing that, we address whether the lack of a focal leader position in this design with inclusive leadership removes the strategic incentives to lead. A simple design that could achieve this goal is a design in which players choose in two stages how much to contribute to the public good from their initial endowment, and they receive a feedback on contributions of others after Stage 1, and before their decision in Stage 2. We test the impact of this two-stage structure on the efficiency of the VCM experimentally, and analyze the role of the leadership as well as the followers’ contribution to the efficiency.

The remainder of the paper is organized as follow. We present our experimental design in Section 2, and data analysis can be found in Section 3. Section 4 concludes.
2 The game and experiment design

We consider a symmetric linear public goods game where player $i$'s payoff function, $i = 1, \ldots, N$, is given by

$$\pi_i = E - z_i + \alpha Z$$  \hspace{1cm} (1)

where $E > 0$ is the initial endowment, $z_i$ is player $i$'s contribution to the public good, $Z = \sum_{i=1}^{N} z_i$ is the group's total contribution to the public good, and $\alpha \in (1/N, 1)$ is the marginal per capita return from the public good. When each player maximizes own monetary payoff, the unique best response for player $i$ is to set $z_i = 0$; resulting in a unique Nash equilibrium in which no public good is provided, while the joint payoff of all players is maximized when each player $i = 1, \ldots, N$ sets $z_i = E$.

We will distinguish two protocols by which players choose their total contribution to the public good. In the one-stage VCM, each player $i = 1, \ldots, N$, chooses own contribution to the public good $z_i \in \{0, 1, \ldots, E\}$ individually and simultaneously with all remaining players, and then observes the vector of contributions $(z_i)_{i=1}^{N}$. In the two-stage VCM, each player $i = 1, \ldots, N$ first chooses individually and simultaneously with all remaining players own contribution in Stage 1, $x_i \in \{0, 1, \ldots, E\}$, then observes the contributions vector $(x_i)_{i=1}^{N}$, and then, in Stage 2, chooses own contribution to the public good, $y_i \in \{0, 1, \ldots, E - x_i\}$, again individually and simultaneously with all remaining players. Thereafter, all players obtain feedback on the contributions vector chosen in the group in Stage 2, $(y_i)_{i=1}^{N}$. Player $i$'s total contribution to the public good in the two stages equals to $z_i = x_i + y_i$. Note that Stage 2 contribution $y_i$ of player $i$ is constrained by the endowment remaining after Stage 1 contribution, $y_i \leq E - x_i$, so that the individual contribution to the public good has the same range in both protocols, $z_i \in \{0, 1, \ldots, E\}$.

As already noted by Sugden (1984), the Nash equilibrium prediction for both protocols might differ from the Nash equilibrium with zero contributions if (some) subjects are conditionally cooperative rather than pure payoff-maximizing individuals. We now, further propose, that in order to coordinate the subjects’ beliefs, it is actually important whether the interaction takes place in the one-stage or in the two-stage protocol. The two-stage protocol allows for leadership effect: it generates strategic incentives to contribute in Stage 1 in order to motivate conditionally cooperative subjects to contribute in Stage 2. Such incentives are absent in the one-stage protocol. In other words, we suggest that more cooperation will be found in the two-stage than in the one-stage protocol because conditionally cooperative individuals but also strategically acting individuals obtain incentives to contribute a part of their endowment in Stage 1 (leadership effect), so that conditional cooperation is triggered in Stage 2 (followers’ effect).

Hypothesis: (H0) Subjects form beliefs about the presence of conditional cooperators in the same way in both protocols, and coordinate on the same equilibrium, given their beliefs in one-stage and two-stage VCM. The efficiency of the public good provision is the same in both these protocols. (HA) Subjects form beliefs - and expect that other form believes - about the presence of conditional cooperators based on the behavior observed in Stage 1. Therefore, the two-stage protocol creates strategic
incentives to contribute in Stage 1 some part of the endowment even for subjects who themselves are not conditionally cooperative. Consequently, the sequential protocol of the two-stage VCM results in higher efficiency that the simultaneous protocol of the one-stage VCM.

In the text below, we test our hypothesis using the data from experiments conducted at University of Liverpool, Management School, in year 2006 and 2007. The subjects were 140 students of business, economics and finance programs, who participated in cca 1,5 hour lasting experimental session. The language of the experiment was English, and it was computerized, programmed and conducted using z-Tree (Fischbacher, 2001). Upon arrival at a session, participants were randomly seated at computers. No communication other than submitting contributions in the public goods game via the programmed software was allowed. Subjects were paid for their decisions. Before making paid decisions, subjects provided answers to a few test questions on the understanding of the experiment instructions, which were distributed on paper to the participants and read aloud by the experimenter.

Subjects participated in 12 rounds of a public goods game with the payoff function given by equation 1, where we set $E = 15$, $N = 4$ and $\alpha = 0.4$. Subject’s payoffs in both treatments were presented by the formula as well as by a payoff table, see Appendix 1 and Table 5. In the experiments, we used anonymous Partner matching, and in the control treatment (T1-partner treatment), we implemented the one-stage public goods game, while in the main treatment (T2-partner treatment), we implemented the two-stage public goods game.

Additionally, we also used stranger matching in the two-stage game (T2-stranger treatment) in order to study the impact of repeated interactions on the two-stage VCM, see Table 1. In the standard simultaneous VCM, contributions usually decline faster under the strangers matching than under the partners matching (Keser and van Winden, 2005). This difference is expected to be less prominent in the two-stage VCM (treatment T2) if Stage 1 contributions are used as incentives to motivate Stage 2 contributions by conditional cooperators.

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1In all experimental sessions reported in this paper, subjects participated in two tasks. Data from Task 1 corresponds to the data we report in this paper. Task 2 was an unrelated experiment.

Note that instructions to each task were distributed only prior to the task and there were no interdependencies in payments or otherwise between the two tasks. Subjects were informed that they participate in two separate tasks, that the tasks are fully independent, and they received earnings feedbacks at the end of each task. We therefore can focus in this paper the behavior of the first task in isolation of the second task.

2We applied so called anonymous Partners matching, where the group compositions stays the same in all periods, but subjects’ randomly assigned labels (ranging from 1 to 4) change in each round. The advantage of this design is that players cannot track individual histories over time, and hence their strategies can only condition obtained on the information in the current round, and on the commonly known history of the play.

3All subjects received the same instructions differing only in a few sentences describing the treatment: i.e. contribution to the public good to be done in one stage; or in two stages, with a feedback between them.
3 Data analysis

Figure 1 shows the average group contributions to the public good in the one-stage VCM (T1) and two-stage VCM (T2) over time. Splitting the VCM contributions into two stages leads to a significant increase in the total public good provided as compared to the standard one stage VCM (unit of observation is the average group contribution over 12 rounds in T1-partner vs. T2-partner treatment, Mann-Whitney U-test, N=7+16, p=0.008). We also find that the average group contributions in the two-stage T2 treatment do not differ in the two matching protocols (unit of observation is the average group contribution in T2-partner vs. T2-stranger, Mann-Whitney U-test, N=12+16, p=0.767).

**Observation 1:** Contributions to the public good are higher when subjects choose them sequentially in two stages. The contributions in the two-stage T2 treatments are independent of the matching protocol (partners or strangers).

Based on this observation, we reject our null hypothesis in favor of the alternative hypothesis. The two-stage VCM structure does affect the efficiency of the public good provision. Similarly as in the numerous other leadership studies we surveyed in this paper, this efficiency gain is economically far from overwhelming.\(^4\) Nevertheless, the contributions are significantly higher than in the standard one-stage VCM, and this without any

\(^4\)The average group contributions are 11.7 vs. 4.0 in T2-partner and in T1-partner, respectively. Recall that the social optimum is 60, while the Nash equilibrium prediction is 0.
additional enforcement mechanism whatsoever. In that sense, it is relevant to identify the source of the efficiency gain, to be able to bank on it in mechanism design. Let us discuss where the efficiency gain obtained in T2 as compared to T1 (partner matching) comes from. Can the efficiency gain be attributed to the leadership in Stage 1, or can we mark it as due to the conditional cooperation of the followers in Stage 2?

For one, we find a significant leadership effect in Stage 1 behavior: players in Stage 1 of treatment T2 contribute more because Stage 2 is present. The most persuasive evidence on the leadership effect is that groups in Stage 1 of treatment T2 contribute twice as much as they do overall in treatment T1, and this difference is significant (7.7 vs. 4.0, MWU $p = 0.033$, $N=16+7$). In this respect, both Stranger and Partner treatment in T2 show the same role of leadership incentives, as the Stage 1 contributions in both matching designs are statistically not different from each other (MWU, $N=12+16$, $p = 0.802$).

When looking at the individual contributions in both stages, see Figure 2, zero contribution is the most frequent choice in both stages. However, this choice was made in 52% of all cases in T2-partners treatment and in 65% of all cases in T2-strangers treatment, while zero contributions to the public good in the T1-partner treatment was made in 84% of all cases. We propose that the difference between the frequency of zero contributions in treatment T1 and T2 is due to the leadership effect, i.e. due to contributions that are strategic, and boost Stage 1 contributions to the public good.. In order to identify this effect, we focus on individual choices where subject $i$ contributed strictly positive amount in Stage 1, $x_i > 0$, but chooses zero contribution in Stage 2, ($y_i = 0$), see Figure 3. About one quarter of the contribution choices (26% T2 partners treatment and 21% and T2 strangers treatment) show this pattern, and might be related to strategic leadership and a direct result of the sequential structure of the two-stage VCM. Note that by focusing on zero Stage 2 contributions, we exclude from consideration the impact of conditional cooperators "starting small ", as these would choose to contribute a strictly positive amount not only in Stage 1 ($x_i > 0$), but also in Stage 2 ($y_i > 0$). This is, how-

Figure 2: Contributions to the public good by stage: (i) Stage 1 in T2 and T1, (ii) Stage 2 in T2.
ever, only partially true, as Stage 2 zero contributions might be conditional or negative reciprocal responses to situations where a pro-socially oriented player contributes in Stage 1, but then observes Stage 1 contributions of other players that trigger negative response in Stage 2, and hence zero contribution in Stage 2. To exclude such circumstances, we can focus our attention even more, and consider only situations where a negative reciprocal motivation is absent for a subject. These would be the cases where subject \( i \) contributed a strictly positive amount in Stage 1 \( x_i > 0 \), but his/her contribution was lower than the average contribution of the remaining three members of their group, \( x_i < \frac{1}{3} \sum_{j \neq i} x_j \). A reciprocal (or conditionally cooperative) subject will not choose \( y_i = 0 \) in this case, while a subject who made his/her positive contributions in Stage 1 only due to strategic motives will choose \( y_i = 0 \). Excluding the confounding of reciprocal and strategic behavior, we observe that about half of strictly positive Stage 1 contributions followed by zero Stage 2 contributions (in the absence of negative reciprocal motives) can be identified as strategic leadership contributions (the number of observations is 27/44 in T2 strangers treatment and 60/115 in T2 partners treatment, i.e. 61% and 52%, respectively). This gives us additional, individual behavior evidence, that leadership effect impacts on the two-stage VCM. To summarize,

**Observation 2:** We find significant leadership effect in the two-stage VCM, where subjects contribute to the public good in Stage 1 because of the presence of Stage 2.
Having identified leadership behavior in our experimental design, we now proceed to quantify its impact on conditional cooperation, i.e. we focus on contributions in Stage 2 of the game. In order to identify the followers’ effect in our experiment, Figure 4 presents the share of the endowment contributed to the public good in Stage 2 by subject $i$ from the endowment remaining after Stage 1, $\frac{y(i)}{E-x_i}$, depending on the comparison of the subject $i$’s Stage 1 contribution, $x_i$, to the average Stage 1 contribution of the remaining three players, $\frac{\sum_{j \neq i} x_j}{N-1}$. If Stage 1 contributions trigger Stage 2 contributions - i.e. followers’ effect - we expect that when $i$’s contribution in Stage 1 is lower than the average of the three remaining players ($x_i - \frac{\sum_{j \neq i} x_j}{N-1} < 0$), $i$ will contribute relatively high share of its remaining endowment in Stage 2, $\frac{y(i)}{E-x_i}$; and when $i$’s contribution in Stage 1 is higher than the average of the three remaining players ($x_i - \frac{\sum_{j \neq i} x_j}{N-1} > 0$), $i$ will contribute relatively low share of its remaining endowment in Stage 2, $\frac{y(i)}{E-x_i}$. We find exactly the opposite. Rather than players contributing less than others on average, we find that players contributing more than others on average are those who contribute a higher nonzero share of own remaining endowment to the public good in Stage 2. The followers’ effect is in any case not strong enough to trigger Stage 2 contributions by the subjects at the lower range of the Stage 1 contributions in their group.

**Observation 3:** The followers’ effect, if any, is too weak in order to result in Stage 2 contributions responding conditionally cooperatively to the Stage 1 contributions.

So, while we find evidence of significant leadership effect even in our inclusive leadership design without focal leader position, we, similar to other leadership papers, fail to find significant followers’ effect. Note that this discrepancy between beliefs likely to be
held by the players in the leadership positions, and the actual lack of conditional cooperation in the followers positions, results in unfulfilled expectations by the strategic leaders, and might call, over time, for adjustment of the beliefs of the subjects taking upon the strategic leadership. Consequently, one can expect the declining pattern of cooperation due to the leadership effect, as seems to be taking place in our experiments as well (see Figure 1, and Clark and Sefton, 2001, for a discussion of this question in the context of two-player prisoner’s dilemma game). One has to, therefore, further investigate how the leadership incentives could be preserved over time. Our future research will therefore address this question by studying information structures under which the behavior of conditional cooperators is steered away from the unravelling of cooperation, while at the same time, the incentives for the strategic leaders are supported. Recalling the work by Kurzban et al. (2001), there is some evidence that the type of information feedback the subjects receive affects importantly the evolution of the contributions in the VCM with sequential structure. In particular, when the feedback is such that subjects are informed after Stage 1 only about the lowest Stage 1 contribution, the incentives for the strategic leadership are strengthened, as every pure-payoff maximizing subject in the presence of conditional cooperators could have an incentive to increase the contribution level feedbacked to the conditional cooperators. At the same time, when the feedback after Stage 1 announces only the highest Stage 1 contribution, the incentives to lead could result in a coordination game among the strategic leaders, which would want to "hide" their low contributions behind a high contribution of another leader player. In this way, restricting the information feedback is either in favor of strengthening the cooperation incentives by the followers, or by the leaders, and it is open to an experimental test which of these two information designs leads to a higher efficiency. Note also, that these complementary information feedback designs might have natural counterparts in the real-world social dilemma situations, and hence serve as an explanatory variable for the performance of the leadership structures in various social dilemmas.5

4 Conclusions

Introducing sequential moves into the voluntary contribution mechanism increases efficiency of the public good provision. As we surveyed in the introduction, several authors showed this effect in various experimental designs either with one focal leader, or with all players moving in a sequence, and found that it can be attributed to the "leading positions in the game. Contributions of the followers contribute to the efficiency gains only marginally. Moreover, although leadership increases significantly the public good provision, the actual economic gain from pure leadership, absent enforcement or other

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5To give an example, a situation in which one volunteer is sufficient to take upon organizing a charity would be case of the "highest contribution" feedback. In this case, even if every individual contribution to the charity improves the public good provided, the individual with the highest contribution is the one organizing the charity, and thus visible to the others. On the other hand, an example of the lowest contribution feedback could be a group task that involves each group member cleaning up a part of the communal space from fallen leaves. As the leaves can easily spread from one place to another, the person leaving the highest amount of the leaves behind, i.e. contributing least to the public good, would determine the overall perception of how clean the communal spaces are left after the cleaning.
incentives, is not overwhelming. Nevertheless, it arises systematically, and across various experimental designs, and hence merits attention. Can we design a voluntary contribution mechanism with a higher efficiency simply by creating leadership position in the game? This question is relevant, as restructuring the players' interaction does not carry any costs, unlike invasive enforcement mechanisms, like sanctioning.

Given that subjects often choose to lead in experiments with one explicitly assigned (or self-selected) leader player, we propose and run an experiment where no player is excluded from adopting "leadership" incentives. In the interest of capturing as many efficiency gains from leadership as possible, we sequence the contribution to the public good in the VCM into two stages, and in each stage, all players move simultaneously. In Stage 1, any player can then consider his/her position to be that of "a leader", i.e. of a player who might be followed. Note that a player does not have to hold other-regarding preferences him/herself in order to contribute in the "leader" position: it is sufficient if he/she believes that others will follow the good example set by him/herself. Additionally, the two-stage design also decreases risk for those conditionally cooperative players who are rather pessimistic about the cooperation of others in their group: by moving in two stages, they can "start small" their cooperative behavior. The question remains whether in this type of design, without any focal selected/self-selected or assigned "leader", players would perceive the situation as one where strategic incentives to lead arise. Does inclusive leadership take place?

Based on our experiments, we find that subjects often choose to lead even in the absence of focal leadership positions: Stage 1 contributions in the two-stage VCM exceed the overall contributions of the one-stage VCM. However, like other authors, we also find that leadership is not followed sufficiently. Players in our experiments contribute very little of their remaining endowment in the second stage of the mechanism and do not match the leaders' good example. Briefly, we find the two-stage VCM with inclusive leadership structure to result in higher efficiency that the one-stage VCM, and this due to the "leadership" effect; we find no evidence for the followers' effect.

We conclude that incentives to lead others should not be underestimated when designing mechanisms for voluntary public good provision. In particular, we should be aware that a large share of the efficiency gain from leadership - is due to the leading itself - due the ability to inform others about own contribution to the public good before incremental contributions to the public good could be made - and hence, leadership should be inclusive rather than exclusive. Future research will be devoted to the question whether the information feedback affects the efficiency gains even further. In the current design, players are informed about the complete contribution vector of Stage 1 contributions before they make their decisions in Stage 2. In this way, coordination problems might lead to the unravelling of cooperation. We plan to study two modifications of our design, one in which only feedback on the lowest contribution Stage 1 is available, and one in which only information on the highest contribution in Stage 1 is available. We hypothesize that the former will further strengthen the leadership effect, while the latter might have negative impact on the overall efficiency gains due to the ability of the strategic players to "hide" their low contributions. Importantly, VCM design using sequential move structure and information feedback is absent any socially wasteful costs, and hence could be seen as an efficient counterpart to the peer sanctioning mechanisms which achieve high rates of
cooperation in the social dilemmas, albeit at a cost. Further research will show how far the efficiency gains from this non-evasive mechanism type can be pushed in direction of the full efficiency.

5 Appendix 1: Instructions for the participants

Introduction
You will now participate in an experiment on economic decision-making. The experiment will last approximately 1.5 hours. You will be paid individually after the experiment 3 pounds participation fee PLUS any additional earnings you will make in the experiment. How much you earn crucially depends on your decisions in the experiment. During the whole experiment, you are not allowed to talk to other participants. Disobeying this rule will result in your exclusion from the experiment. In the experiment, you will participate in two Tasks. You will earn points in each of them. At the end of the experiment, you will be paid for all the points you earned. The exchange rate is: 100 point = 1.5 pounds.

Task 1:
This task has 12 rounds. In each round, you will be in a group with three other participants; a group therefore consists of four participants in total. Note that you will be matched into a group with the same three participants in each round of Task 1. However, each of the three subjects in your group will be assigned a different name in each round. Information about yourself will be given to you on the computer screens under the label “Me”. Information about the other three subjects will be given to you under the labels “Other subject (1)”, “Other subject (2)” and “Other subject (3)”. Keep in mind that names change over periods (e.g. “Other subject (1)” in one round is not the same person as “Other subject (1)” in another round).

Earnings
In every round, you receive 15 tokens and can decide to use any number of them in a joint project. If you choose to put \( x \) tokens in the joint project and the sum of tokens chosen by the other three subjects in your group equals \( Y \), then your payoff is equal to Payoff = \( 15 - x + 0.4(x + Y) \). That means choosing \( x \) tokens (i.e. \( x \) is your action) decreases your payoff by \( x \), and increases your payoff by \( 0.4 \) times \( x \). At the same time, it increases the payoff of everyone else by \( 0.4 \) times \( x \). When making your decisions, you can use the above formula, but you can also make use of the Payoff Table below. This Table contains the number of points you can earn for different combinations of the number of tokens \( x \) you can choose and the sum of number of tokens \( Y \) of the other subjects that is a result of their own individual choices. Please, have a look at the Payoff Table (Figure 5) now.

In the first column (in grey), you find all possible actions ‘\( x \)’ you may choose, that is number of tokens you put into the joint project 0,1, . . . , 14,15. In the first row (in grey), you find some of the possible sums of all actions chosen by other three subjects. Your payoff in points can be found for each combination of ‘\( x \)’ and ‘\( Y \)’ in the Payoff Table.

Example: Suppose you choose 4 tokens. In the grey column, find the row that begins with 4. And, suppose the other three subjects choose actions that gives a sum of 12. In the grey row, find the column that begins with 12. Look in the Table for the intersection of the row starting with 4 and the column starting with 12. You find that your earnings in points for that case would be 17.4 points. Observe: the number of points you earn, depends crucially on the choices of the other three subjects. If, for example, you choose 2 tokens for the joint project and if the other group subjects’ choice gives a sum of 0, you earn 13.8 points, however, if the other group subjects’ choice gives a sum of 45 then you earn 31.8 point.
Other group subjects affect how many points you earn, and you affect how many points they earn.

Two stages of one round

Each round has two stages and these are as follows. In stage 1, you and the other three subjects in your group simultaneously choose how many of the 15 tokens (0, 1, . . . , 15) you put into the joint project. After everyone makes this choice, you and the other subjects receive information about the actions of all subjects in your group. In Stage 2, you again decide how many of the 15 tokens that you did not yet put into joint project you want to put into the same project in Stage 2. After everyone makes this choice, you and the other subjects receive information about the actions of all subjects in your group. The sum of tokens in Stage 1 and Stage 2 is your action x. The sum of other subjects’ actions in Stage 1 and Stage 2 is their sum of actions Y. Your payoff is then determined according to the Payoff function and Table discussed before. We will now explain how the computer screens look.

SCREEN 1 (see figure 6).

Here you decide your action in Stage 1, that is how many tokens you put in the joint project in Stage 1. Use the keyboard to type in one of the numbers 0, 1, . . . , 15 and confirm your choice by pressing OK. Warning: Before pressing OK, make sure your choice is correct. You cannot change your decision after you have pressed OK. After having pressed OK, you will be asked to wait until all experiment participants have done the same. The experiment continues only after all experiment participants pressed OK. We therefore ask you kindly not to delay your decision too much. For every decision, a time indication of one minute is shown in the header. After this time expires, you are repeatedly asked to submit your decision, or press the OK button. After pressing OK, a waiting screen will appear. After all experiment participants have pressed OK, Screen 2 will appear.

SCREEN 2 (see figure 7).

In the upper part of this screen you find a table with information on the number of tokens chosen for the joint project in Stage 1 of this round by each subject in your group. In the lower part of the screen, you decide how many tokens that you still have left after Stage 1 you want to put in the joint project in Stage 2. Use the keyboard to type in one of the numbers 0, 1, . . . , 14, 15 (if possible), and confirm your choice by pressing OK. Remember your actions in Stage 1 and Stage 2 together cannot exceed 15.

Figure 5: Payoff table.
Warning: Before pressing OK, make sure your choice is correct. You cannot change your decision after you have pressed OK. After having pressed OK, you will be asked to wait until all experiment participants have done the same. The experiment continues only after all participants have pressed OK. We therefore ask you kindly not to delay your decision too much. For every decision, a time indication of one minute is shown in the header. After this time expires, you are repeatedly asked to submit your decision, that is press the OK button. After pressing OK, a waiting screen will appear. After all experiment participants have pressed OK, Screen 3 will appear.

SCREEN 3.

In this screen, you learn all decisions made in stage 1 and stage 2 as well as the number of points earned in this round by each of the subjects in your group. Please, raise your hand if you have questions at this moment. The experiment now starts with a short test to make sure that everybody understands how points are earned. Use your Payoff Table to answer the following questions. After all experiment participants answered all questions correctly, we will run 2 UNPAID trial rounds which have no consequence for your earnings. Use them to learn about the computer screens.

Test Questions:

1. If you use 3 tokens for the joint project and the other three subjects use 10 tokens each, what is the number of points you earn?

2. If you use 12 tokens in total for the joint project and the other three subjects use a total of 6 tokens, what is the number of points you earn?

3. I will be in the group with the same three other participants over all 12 rounds of Task 2. YES/NO

4. In all rounds, the information under the name “Other subject (1)” on my screen is information about the same person. YES/NO
5. The information in the following figure in the fields that are circled is about the same person. YES/NO

6 Appendix 2: Group contribution data

References


Figure 8: Test question.
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Figure 9: Total group contribution per period and treatment.


