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Department of Economics Discussion Papers

ISSN 1473-3307

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Paper number 23/10

RePEc page: https://ideas.repec.org/s/exe/wpaper.html

Using Milestones as a Source of Feedback in Teamwork: Insights from a Dynamic Voluntary Contribution Mechanism*

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September 2023

Abstract

Many economic activities rely on teamwork where groups of individuals work together for a common goal by pooling their resources or skills. However, cooperation within teams can be challenging due to the social dilemma problem which arises when individual incentives interfere with operational effectiveness. We study teamwork in a dynamic public goods game setting where individuals make multiple contribution decisions to a team project and face strategic uncertainty about the behavior of their team members. We examine whether providing feedback about the team's progress at regular intervals (time-based feedback) or based on the achievement of milestones (milestone-based feedback) is more beneficial for increasing aggregate contributions. Our results reveal that providing milestone-based feedback leads to a significant increase in aggregate team contributions as compared to time-based feedback. This impact is largely driven by conditional cooperators. Findings from a follow-up experiment reveal evidence of a goal effect, a signaling effect, and an information effect arising from the use of milestones on the behavior of conditional cooperators.

Keywords: Teamwork; public good provision; milestones; feedback; voluntary contribution mechanism
JEL Classification: C92, D83, D91, H41

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* We are especially thankful to David Cooper and Milad Mousavian Hejazi for insightful discussions throughout this project. We also would like to thank Billur Aksoy, Alexander Coutts, seminar and conference participants at the FETS Seminar Series, University of East Anglia, 8th Annual Workshop on Behavioral Game Theory, Monash University, Hamburg University of Technology, 2022 North American Meetings of the Economic Science Association, University of Iowa, Rensselaer Polytechnic University, Lund University, Newcastle University, 2023 World Meetings of the Economic Science Association, Ludwig Maximilian University of Munich, University of Portsmouth, and the Virtual East Asia Experimental and Behavioral Economics Seminar Series for their comments and feedback. We gratefully acknowledge funding from the University of Melbourne. This study has been approved by the Business and Economics Human Ethics Advisory Group at the University of Melbourne (ID 2021-14599-23773-6). The experiments are pre-registered on the American Economic Association's registry for randomized controlled trials (AEARCTR-0009334): https://doi.org/10.1257/rct.9334-1.1.
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1 Introduction

Many economic activities take place in teams where groups of individuals work together for a common goal by pooling their resources or skills. According to the 2022 European Skills and Jobs survey, 8 out of 10 workers report working as a part of a team in their organization (Cedefop, 2022). In the United States, nearly 71% of people indicate that collaborative work accounts for 41% of their job, and workers report spending 42% of their time on average working collaboratively with others (Gensler, 2022; Mashek, 2022). As a result, teamwork is one of the skills most demanded by employers across a range of occupations (OECD, 2021; NACE, 2023). Outside of the workplace, successful teamwork is also required to solve many other challenges we face as a society, ranging from climate change to fundraising.

A fundamental challenge for achieving cooperation within teams is the social dilemma problem, where individual team members may have incentives to free ride on the contributions of others. Hence, the development of formal or informal institutions which can help teams overcome free-riding incentives can have significant welfare implications through improved workforce productivity and more efficient provision of public goods.[1]

In this paper, we investigate one specific type of institution: information provision. We interpret teams as groups of individuals who contribute to a joint project over multiple rounds over the duration of a project. Since we are interested in studying free riding by team members, we assume that team members' contributions are perfect substitutes. While making their contribution decisions, individuals face strategic uncertainty about the behavior of their team members. This strategic uncertainty gets resolved over time as individuals learn about the contributions of others. The dynamic feature of teamwork implies that as team members receive information on the contributions of others, they can make their contributions conditional on this information. In this way, rather than making one large contribution, individual members may divide their contributions into small increments to test each other's commitment at a lower cost (Schelling, 1960). Consequently, periodic feedback about the team's progress may either promote cooperation (e.g., due to reciprocal actions by other members when positive contributions are observed) or hinder cooperation (e.g., by making the presence of free riders more salient). Hence, a pertinent question for team managers is how feedback provision should be organized over the course of a project.

[1] As a result, a large literature in economics analyzes how free riding can be mitigated by considering the impact of interventions such as rewards, punishments, communication, leadership, and assortative matching (Balliet, Mulder, and Van Lange, 2011; Chaudhuri, 2011; Guido, Robbett, and Romaniuc, 2019; Aksoy and Krasteva, 2020; Villeval, 2020).

We consider and compare the impact of two different information provision mechanisms on team cooperation. An obvious way of giving feedback on progress is through regular intervals (time-based feedback). We compare this feedback structure with another one based on the achievement of pre-determined milestones (milestone-based feedback). Goals are often used by individuals to motivate themselves, or by managers to encourage employees to exert more effort (Locke and Latham, 2013). In many cases, the task of achieving the final goal can be divided into smaller steps with a milestone assigned for each step (e.g., having weekly sales targets or monthly key performance indicators that contribute to the overall success of the firm). In team settings, in addition to being a source of motivation, milestones may act as a valuable source of information. They can be used by team members as a way to monitor the team's progress and coordinate their contributions. It is this role that milestones may play in information release and sharing that we emphasize in this paper.

To capture the social dilemma problem in teams, we design a controlled laboratory experiment where individuals, in teams of three, have the opportunity to make multiple contributions to a joint project. The structure of the experiment follows that of a voluntary contribution mechanism (VCM) with multiple contribution rounds. Each team member is provided with a one-off endowment of 30 tokens, which can be interpreted as effort units, that will last them through six contribution rounds. In each contribution round, they can decide how many of their (remaining) tokens to contribute to the joint project. At the end of the sixth contribution round, in addition to keeping any tokens that they have not contributed to the joint project, each team member receives a payoff of 0.4 tokens for every token contributed by any member to the joint project. Hence, it is socially optimal for members to contribute all of their endowment to the joint project, but each member has an incentive to deviate by choosing not to contribute any of their endowment. This game therefore models the classic free-riding problem present in many social dilemma contexts.

We ask two core research questions pertaining to how information is provided about the team's progress. First, is milestone-based feedback more or less effective in promoting cooperation compared to time-based feedback? Second, do larger and more challenging milestones promote or hinder cooperation compared to milestones that are smaller and easier to reach? To our knowledge, this is the first study to systematically evaluate the use of milestones as a feedback mechanism in motivating cooperation in social dilemma contexts.

To answer these questions, we present results from two studies. Study 1 is based on three treatments which differ in terms of the information provided to team members about the status of the joint project at the beginning of each contribution round. In the baseline time-based

feedback treatment (T), team members are informed at the beginning of each contribution round the total contributions that have been accumulated in the joint project up to that point. This feedback mechanism is a default in many team settings, e.g., where members receive an update on the overall progress of the team in regular team meetings, and it is also commonly used in many fundraising campaigns (e.g., GoFundMe). In addition, we design two milestone treatments where team members receive information only when the joint project reaches one of several pre-determined milestones. In the milestone-15 treatment (M15), the pre-determined milestones are 15, 30, 45, 60, 75, or 90 tokens. In the milestone-30 treatment (M30), the pre-determined milestones, given by 30, 60, and 90, are larger and more challenging for the team to meet. Hence, treatment M30 is designed to address the second research question about the impact of the size of the milestones on team cooperation. Importantly, in the two milestone treatments, team members do not receive information on the exact level of aggregate contributions. Moreover, reaching the milestones has no payoff implications. They are designed simply as a way of structuring information sharing within teams.

We posit in the conceptual framework presented in Section 3.2 that the use of milestones as a feedback mechanism may influence team behavior through three possible channels. First, drawing on the insights from Ambrus and Pathak (2011), team members (both conditional cooperators and self-interested types) in a dynamic context may contribute early on to signal their intention to cooperate and induce contributions by conditional cooperators who may exist in the team. This *signaling effect* refers to the fact that sending a signal about their intention to cooperate is costlier for team members under milestone-based feedback than under time-based feedback because they need to contribute a higher amount to make sure that the team reaches a milestone. This implies that whether the signaling effect increases contributions depends on the magnitude of the milestones. Second, milestones serve as a coarser source of information about the team's progress, making the presence of free riders less salient. As the potential benefits from signaling decrease over time for self-interested individuals, their contributions are expected to decline in later contribution rounds. The *information effect* suggests that this behavior of self-interested individuals would be less salient under milestone-based feedback than under time-based feedback since not meeting a milestone in a given round does not necessarily imply zero contributions. Hence, cooperation is likely to decay more slowly under milestone-based feedback. Finally, by serving as goals for the team to strive towards, milestones may have the potential to promote collaborative efforts amongst team members through a *goal effect* (Heath, Larrick, and Wu, 1999). However, because milestones represent intermediate goals, their overall effect on contributions is ambiguous. While contributions may

increase as teams strive to reach each milestone, the attainment of each milestone may also have a dampening impact on contributions due to a complacency effect.

We find that contributions accumulated in the joint project are 46% to 67% higher on average when teams are provided with milestone-based feedback than with time-based feedback. The average contributions do not differ between the two milestone treatments we consider. We leverage participants' decisions in a separate conditional cooperation task carried out at the end of the experiment to independently classify participants as either conditional cooperators or self-interested individuals (Fischbacher, Gächter, and Fehr, 2001; Fischbacher and Gächter, 2010). Using this classification, we find that conditional cooperators respond to the use of milestones by increasing their contributions, but self-interested individuals do not. We also show that the positive treatment effect associated with milestone-based feedback is due to an increase in the number of teams reaching the different contribution thresholds (which are equivalent to the milestones set in the milestone treatments). Conditional on reaching a given contribution threshold, teams on average take the same number of rounds to arrive at that threshold across treatments.

Based on these findings, Study 2 presents results from a new treatment designed to examine which of the three channels mentioned above are driving our main treatment effects. In this new treatment, presented in Section 4, we combine the feedback mechanisms of both treatments T and M15. Hence, in the time-milestone-15 treatment (TM15), team members are informed at the beginning of each contribution round of both: (i) the total contributions accumulated in the joint project (as in treatment T), and (ii) whether the team contributions have exceeded 15, 30, 45, 60, 75, or 90 tokens (as in treatment M15).

Overall, we find evidence that all three channels contribute to the presence of higher cooperation rates under milestone-based feedback as compared with time-based feedback. Moreover, when we investigate contribution behavior before and after reaching a milestone, we find that milestones provide a positive goal effect through both a *motivational* channel (in the lead-up toward the next goal) (e.g., see Locke and Latham, 1990; Heath, Larrick, and Wu, 1999), and an *efficacy* channel (where team contributions increase immediately after the team has reached a new milestone) (e.g., see Bandura and Schunk, 1981; Bandura, 1997). We do not find evidence in support of a *complacency* effect. We present these results in Section 5.

Overall, our findings imply that the use of milestones, rather than regular time-based updates, may be more effective in alleviating the collective action problem often present in team environments. Beyond the motivational effect that milestones provide, team members use

milestones both strategically (to induce cooperation from others), and as a way to respond to the behavior of others.

2 Related Literature

In the large literature on VCM games, the typical assumption is that participants receive regular feedback on contributions after every period. Our study is related to the papers in the VCM literature which consider the impact of feedback on behavior. This literature primarily focuses on a setting with fixed matching where the players participate in a series of one-shot games (see, e.g., surveys by Ledyard, 1995; Chaudhuri, 2011). While some studies have focused on the impact of feedback frequency on contributions (Neugebauer, Perote, Schmidt, and Loos, 2009; Chaudhuri, Paichayontvijit, and Smith, 2017), others have investigated the role of providing different types of feedback, such as feedback about aggregate or individual contributions (Sell and Wilson, 1991; Weimann, 1994; Kurzban, McCabe, Smith, and Wilson, 2001; Savikhin and Sheremeta, 2010; Bigoni and Suetens, 2012; Hartig, Irlenbusch, and Kölle, 2015; Irlenbusch, Rilke, and Walkowitz, 2019; Pereda et al., 2019), feedback about other members' earnings (Nikiforakis, 2010; Bigoni and Suetens, 2012), and feedback provided to subgroups of individuals (Hashim, Kannan, and Maximiano, 2017).

In these one-shot contribution environments, contributions affect members' payoffs in each period. Unlike these previous studies, we focus on a dynamic setting where team members can make multiple contributions to the project prior to the realization of payoffs.[2,3] Hence, the timing of contributions (i.e., whether they are made earlier or later in the game) affects only the feedback received by other members of the team, but it does not have direct payoff implications. This allows team members to consider the strategic impact of their contributions without worrying about the immediate payoff consequences.

[2] Battaglini, Nunnari, and Palfrey (2016) and Gallier and Sturm (2021) consider dynamic VCM games where individuals' endowments are renewed after each period. Another class of studies examine dynamic contributions to a threshold public good, where the group faces the risk of losing all of their endowment if the target is not reached or the contributions are unable to cover the cost of providing the public good (e.g., see Choi, Gale, and Kariv, 2008; Milinski et al., 2008; Choi, Gale, Kariv, and Palfrey, 2011; Milinski, Röhl, and Marotzke, 2011; Tavoni, Dannenberg, Kallis, and Löschel, 2011; Freytag, Güth, Koppel, and Wangler, 2014). Unlike these studies, in our setup, team members' endowments are not renewed in each contribution period, nor they do face the threat of zero/negative payoffs if the goal or threshold is not met.

[3] A class of studies consider continuous-time contributions, where individuals are able to observe other members' contributions in real time and then adjust their contributions accordingly (Dorsey, 1992; Kurzban, McCabe, Smith, and Wilson, 2001; Goren, Kurzban, and Rapoport, 2003; Ishii and Kurzban, 2008; Oprea, Charness, and Friedman, 2014; He and Zhu, 2023). Our study differs from these studies by focusing on contributions in discrete time intervals, which mirror many real-world teamwork environments where members receive updates about the team's progress in discrete time (e.g., via regular meetings) rather than continuously.

Closest to our paper in this literature is Duffy, Ochs, and Vesterlund (2007), who evaluate whether cooperation is impacted by the provision of information about aggregate group contributions between contribution rounds. They find that feedback does not significantly affect cooperation as compared to when no feedback is provided. We differ from this paper and contribute to the broader literature on VCM games by examining the effectiveness of using milestones as a feedback mechanism to motivate dynamic contributions in VCM games. Ours is the first paper to examine the impact of milestones as a feedback mechanism in teamwork settings involving dynamic contributions.[4]

We also contribute to the literature examining the role of goals in motivating effort provision, both individually (Locke and Latham, 1990, 2013), and in team environments (Kleingeld, van Mierlo, and Arends, 2011; Kramer, Thayer, and Salas, 2013). The consensus in this literature is that setting goals can help motivate individuals and boost their performance. In our study, we focus on the role of pre-determined milestones in motivating cooperation in teams. Milestones may be perceived as subgoals that team members can strive to achieve. Evidence suggests that the impact of subgoals on performance can be mixed. While some studies have found that providing or setting subgoals can induce higher motivation and effort provision (e.g., see Locke and Latham, 1990; Heath, Larrick, and Wu, 1999; Latham and Seijts, 1999; Sun and Frese, 2013; Huang, Jin, and Zhang, 2017), others find that the use of subgoals may lead to complacency by individuals or distract their attention from the final goal, which may decrease performance (Fishbach, Dhar, and Zhang, 2006; Amir and Ariely, 2008). These papers focus on individual performance and investigate the motivational impact of setting subgoals in addition to a final goal.[5] Our focus is different from these papers in that we investigate the role of subgoals in overcoming the free-riding problem commonly observed in team settings. In contrast with these studies, we emphasize the role milestones play as a source of information in teamwork.

3 Study 1

3.1 Experimental Design and Procedures

3.1.1 Dynamic Voluntary Contributions Mechanism (VCM) Game

[4] See Chen, Mostagir, and Yeckehzaare (2023) on information design in a competitive setting. In the context of innovation contests, they compare three information mechanisms which allow contestants to monitor their rival's progress in different ways.

[5] Weldon and Yun (2000) investigate the same question within a team setting and find that teams working toward both proximal and distal goals outperform teams working toward distal goals alone.

We interpret teamwork as a group of individuals who work on a joint project over multiple periods. To represent teamwork, we use a dynamic VCM game. Participants play 10 sequences of the dynamic VCM game in teams of three. They get randomly rematched after each sequence.[6]

Each sequence consists of 6 contribution rounds. At the beginning of each sequence, each team member receives an endowment of 30 tokens that they can use to contribute to the joint project over the 6 contribution rounds. The endowment represents, for example, the total effort units that each team member has. Contributions represent working on the joint project and cannot be reversed. The payoff from each sequence is realized at the end of the sequence (i.e., after the sixth contribution round). The marginal per capita return (MPCR) is 0.4. Hence, at the end of each sequence, each team member (i) receives 0.4 tokens for each token contributed to the joint project, and (ii) keeps any token(s) that they have not contributed to the joint project. We can write each team member's payoff from each sequence as:

$$\pi_i = 30 - \Sigma_{t=1}^{6} c_{i,t} + 0.4 \times \Sigma_{j=1}^{3} \Sigma_{t=1}^{6} c_{j,t} \quad (1)$$

where $c_{j,t}$ is the contribution of member $j \in \{1, 2, 3\}$ in round $t \in \{1, 2, 3, 4, 5, 6\}$.

3.1.2 Treatments

We design three treatments to examine the impact milestone-based feedback has on team contributions as compared to time-based feedback. The treatments differ in the information provided to team members about the status of the joint project at the beginning of each contribution round.

In the baseline time-based feedback treatment (T), team members are informed at the beginning of each contribution round of the total contributions that have been accumulated in the joint project up to that point in the sequence. Specifically, members are told the additional contributions made by the team in the previous round as well as the total number of tokens accumulated so far. This feedback is also represented using a progress bar on the screen. Figure 1 shows an example of the feedback screen displayed to participants in treatment T. In the figure, the green portion of the bar represents the state of the joint project at the beginning of the previous round, while the yellow portion represents the additional contributions made in that round. Importantly, participants are not given information about the contributions made by individual members.

[6] Experimental instructions can be found in Appendix A. In the experiment, we refer to teams and the joint project as "groups" and the "group account", respectively.

In the two milestone treatments, team members are given information as to whether the joint project has reached any of the pre-determined milestones. Specifically, in the milestone-15 treatment (M15), members are informed at the beginning of each round whether the team contributions have exceeded 15, 30, 45, 60, 75, or 90 tokens. In the milestone-30 treatment (M30), these milestones are 30, 60, and 90. Team members in these two treatments are simply told whether the joint project has met any of these milestones. Unlike treatment T, they do not learn the exact number of tokens that have been contributed to the joint project. Panel (a) of Figure 2 shows an example of the feedback screen from treatment M15.[7] In this example, the green portion of the bar indicates that the team had already reached the milestone of 15 before the previous round. The yellow portion of the bar indicates that the team reached a new milestone of 30 in the previous round. As a result, the members know that the total number of tokens accumulated in the joint project could be anywhere between 30 and 44.

Reaching a new milestone may happen at different times across different teams. It is therefore possible for a team not to meet any milestones in a given round, in which case all members are given this information explicitly (as illustrated in panel b of Figure 2). It is also possible for a team to meet multiple milestones in a given round (as illustrated in panel c of Figure 2). In this case, the members are told that the team has met two milestones (30 and 45) in a single round.

Importantly, reaching the milestones has no payoff implications in our design. This feature therefore allows us to focus on the role milestones play as sources of information and motivation. The additional treatment we design in Study 2 aims to separate these two roles.

3.1.3 Conditional Cooperation Task

After completing 10 sequences of the dynamic VCM game, participants are asked to complete a one-shot conditional cooperation task (Fischbacher, Gächter, and Fehr, 2001; Fischbacher and Gächter, 2010). We use participants' behavior in this task to classify them as either conditional cooperators or self-interested individuals (or free riders).

Specifically, the task employs a strategy method to elicit participants' contributions contingent on the contributions of the other team members. We follow the parametrization used in the dynamic VCM game. That is, participants are put into new teams of three, and each team member is given an endowment of 30 tokens to make a one-shot contribution to the joint project (which has an MPCR of 0.4). Each participant is asked to make two decisions. First,

[7] Feedback screens in the M30 treatment are designed in a similar fashion.

participants make an unconditional contribution to the joint project absent any information about the contributions made by the other team members. Second, participants are asked to complete a conditional contribution table. In this table, each participant is presented with a list of possible average contributions that could be made by the other two team members, ranging from 0 to 30 in intervals of 2 tokens. They are then asked to indicate how many tokens they would like to contribute to the joint project conditional on the average contribution made by the other two team members.

Participants are informed that, at the end of the experiment, the unconditional contributions of two randomly chosen team members will determine their contributions to the joint project. The average of the contributions of these two team members (rounded to the nearest even number) will determine the contribution of the third team member. That is, the third member's contribution will be determined by what they indicate as their contribution conditional on the average contribution made by the other two members in the conditional contribution table. Based on the contributions of the members (two unconditional decisions and one conditional decision), the payoffs of each team member are determined as in equation (1), where $t \in \{1\}$ for a one-shot VCM game.

Following the methodology introduced by Fischbacher, Gächter, and Fehr (2001), a participant is classified as a "conditional cooperator" if there is a significant positive correlation (at 1% level) between their contributions and those of their team members, while a participant is classified as "self-interested" if they contribute zero to the joint project regardless of the contributions of their team members. Participants who do not fall under either category are classified under "other". Pooling across all treatments, 60.2% of our participants are conditional cooperators, 19.1% are self-interested individuals, and 20.7% do not fall into either category.[8] Figure B1 presents the distribution of participant classifications in each of the three treatments. We observe that the distribution of types does not differ significantly across the three treatments (Fisher's exact test: p-value = 0.306). Hence, participants' experience with different treatments in the dynamic VCM game does not affect their behavior in the conditional cooperation task at the end of the experiment. We are therefore able to use these classifications

[8] As robustness check, we replicate all our analyses by relaxing the definition of these classifications. Specifically, we consider two alternative specifications where participants are classified as conditional cooperators if the positive correlation between their contributions and those of their team members is significant at the 10% and 20% levels. Under these two alternative specifications, 63.4% (17.5%) and 66.7% (14.2%) of participants are classified as conditional cooperators (other), respectively. Our results are robust to these alternative classifications of participants.

to examine heterogeneity in responses to the experimental treatments along these classifications.

3.1.4 Experimental Procedures

The experiments were conducted in the Experimental Economics Laboratory (E^2MU) at the University of Melbourne. We pre-registered the design and treatments on the American Economic Association's registry for randomized controlled trials (AEARCTR-0009334).[9]

Participants were mainly undergraduate university students recruited across different disciplines using ORSEE (Greiner, 2015). On arrival, participants were seated at individual computer terminals, and instructions were displayed on their computer screens. Participants first read the instructions individually at their own pace, and then an experimenter read aloud a summary of the instructions. Before starting the first sequence of the dynamic VCM game, participants were asked to answer a set of comprehension questions correctly. They also went through one practice sequence with robot participants to familiarize themselves with the decision screens.

After completing 10 sequences of the dynamic VCM game and the one-shot conditional cooperation task as described above, participants filled out a questionnaire which elicited their demographic characteristics, reasons for their decisions in the experiment, and decisions in a one-shot risk task (Gneezy and Potters, 1997).

We conducted seven to eight sessions for each of the three treatments, with a total of 309 participants. This provided data for 1,030 team-sequences of the dynamic VCM game. Table 1 summarizes the treatments and sessions in Study 1. Majority of the sessions had between 12 and 18 participants, and each session lasted up to 90 minutes.[10] At the end of the experiment, participants were paid for their decisions in either one randomly determined sequence of the dynamic VCM game or the conditional cooperation task. Participants earned 27.61 AUD on average, including a participation fee of 5 AUD.

3.2 Conceptual Framework

In this section, we provide a conceptual framework to explain why we may expect to find differences between the two feedback mechanisms we consider. We study an environment where teams may consist of free riders and conditional cooperators, and team members have

[9] See https://doi.org/10.1257/rct.9334-1.1.
[10] Two sessions had only 9 participants each due to low show-up rate.

private information about their types. In such an environment, feedback helps members to send signals about their intentions and to learn about the intentions of others.

Under both feedback mechanisms we consider, team members receive information every period, but the nature of the information they receive is different. While under time-based feedback, team members receive precise information on team contributions at the beginning of every contribution round, under milestone-based feedback, they only receive information on whether or not the next milestone has been reached. Apart from this, they do not learn the exact level of the team contributions. Moreover, under milestone-based feedback, team members can affect the time of arrival of new information with their contribution behavior. Hence, if they would like to signal that they are a "contributor" type, then they need to contribute sufficiently so that the milestone is reached.

Based on these differences between the two feedback structures, we conjecture that treatment differences may be driven by a combination of three effects: a signaling effect, an information effect, and a goal effect. The first two effects relate to the strategic impact of the information received through feedback. That is, feedback enables team members to do two things. First, they can send signals about their own types or intentions. Second, they can condition their own contributions on the information they receive about others' behavior. The third effect expresses the impact milestones may have on contributions by serving as goals for the teams to strive towards.

We now explain each of these mechanisms in further detail.

Signaling Effect. Unlike static public goods games, where team members do not make any contributions under the Nash equilibrium, it is possible for positive contributions to be supported in equilibrium in a dynamic setting. In dynamic environments, individuals can divide their contributions into consecutive small contributions both to signal to others their intention to contribute, and to condition their contributions on the cooperation of other team members (Schelling, 1960). In finitely repeated one-shot games with fixed matching, Ambrus and Pathak (2011) show that there exists a subgame perfect Nash equilibrium in which self-interested individuals have the incentive to contribute early to induce the contributions from the conditional cooperators.[11]

[11] Ambrus and Pathak (2011) consider complete information where the preferences of individuals are common knowledge. In our experiment, individuals are unaware of the preferences of members they are faced with. Marx and Matthews (2000) show that a contribution equilibrium can be achieved in the presence of a completion benefit. However, they only consider self-interested individuals in their model (i.e., no conditional cooperators exists).

Drawing on the insights from these theoretical papers, we posit that individuals (both conditional cooperators and self-interested types) may contribute early on to signal their intention to cooperate and induce contributions by other conditional cooperators who may exist in the team. Specifically, conditional cooperators may make consecutive contributions over rounds conditional on information about the contributions of the team members (Fischbacher and Gächter, 2010). Hence, anticipating the existence of conditional cooperators, individuals have a (forward-looking) strategic incentive to contribute early to encourage future contributions (Ambrus and Pathak, 2011; Steiger and Zultan, 2014; Cox and Stoddard, 2018).

Crucially, this signaling channel relies on feedback being provided about the contributions of team members. With milestone-based feedback, a signal of positive contributions by team members is provided only if a milestone is met by the team. Hence, team members in the milestone-based feedback treatments have to make larger contributions than those in the time-based feedback treatment in order to send a positive signal of their intention to contribute. While the cost of signaling is higher under milestone-based feedback, if sent in a timely fashion, signals may have a larger impact because contributions are likely to be larger. This implies that contribution decisions will depend on whether the expected benefit from signaling outweighs the cost of signaling. As a result, whether contributions will be higher under treatment M15 than under treatment T due to the signaling channel depends on whether the cost of signaling is deemed to be too high.

Information Effect. The framework of Ambrus and Pathak (2011) also postulates that contributions by self-interested individuals will decline in later rounds as the potential benefits from signaling decrease toward the endgame.[12] The presence of self-interested participants is likely to be less salient with milestone-based feedback than with time-based feedback since milestone-based feedback provides coarser (less precise) information about the contributions of team members. That is, members receive precise updates after each round about others' contributions with time-based feedback while they only get a positive update when the team

Arifovic and Ledyard (2012) consider a learning model where individuals have other-regarding preferences, and they learn to behave either selfishly, altruistically, or as conditional cooperators over time.

[12] The pattern of declining contributions in public goods games has been captured in many studies (e.g., Ledyard, 1995). This observation has been attributed to the existence of both free riders and imperfect conditional cooperators which create the spiral downward trend (see Chaudhuri, 2011 for a review). Evidence also suggests that providing more frequent feedback may reduce contributions in repeated simultaneous-move (Neugebauer, Perote, Schmidt, and Loos, 2009; Chaudhuri, Paichayontvijit, and Smith, 2017) and sequential-move public goods games (Steiger and Zultan, 2014). Moreover, conditional cooperators react more strongly to low contributions than high contributions (e.g., Croson and Shang, 2008; Bigoni and Suetens, 2012; Hartig, Irlenbusch, and Kölle, 2015).

reaches a new milestone with milestone-based feedback. Since team members learn about free riders with a delay under milestone-based feedback, the decline in contributions is likely to be faster with time-based feedback than milestone-based feedback. As a result, we expect overall contributions to be lower with time-based feedback. Moreover, given that information about the presence of self-interested participants is coarser under treatment M30 than treatment M15, we expect the decline in contributions to be even slower in treatment M30.

Goal effect. While reaching the different milestones does not bring any additional monetary benefits to the team, the milestones can still serve as targets that team members strive to attain. Since milestones represent intermediate goals (subgoals), their net impact on contributions depends on how team members behave before and after reaching a milestone. On the one hand, the use of milestones may motivate behavior through the psychological satisfaction team members hope to achieve when they attain the different milestones (e.g., Locke, Shaw, Saari, and Latham, 1981; Locke and Latham, 1990; Kleingeld, van Mierlo, and Arends, 2011; Kramer, Thayer, and Salas, 2013).[13] On the other hand, upon meeting a milestone, team contributions may be influenced by either an efficacy effect and/or a complacency effect. An efficacy effect exists if attaining a milestone boosts team members' confidence that the team is progressing well and creates a sense of collective efficacy. Collective efficacy has been shown to be positively correlated with team performance (see Stajkovic, Lee, and Nyberg, 2009 for a meta-analysis), including in public goods games (Seijts and Latham, 2000; Seijts, Latham, and Whyte, 2000). A complacency effect exists if attaining a milestone creates a sense of accomplishment which results in relaxation and a sense of complacency (Fishbach, Dhar, and Zhang, 2006; Amir and Ariely, 2008).

Summary. To sum up, providing milestone-based feedback as opposed to time-based feedback can induce a signaling effect, an information effect, and a goal effect. Column (1) of Table 2 summarizes the direction of each channel in treatment M15 as compared to treatment T, while column (2) evaluates the direction of each channel in treatment M30 as compared to treatment M15. As shown in the table, the differences in average team contributions across treatments will depend on the direction and relative sizes of the channels described above. The signaling

[13] The motivation effect associated with goals can also be modeled by the goal-gradient (or goal as a reference point) hypothesis (Kahneman and Tversky, 1979; Heath, Larrick, and Wu, 1999). Note that the motivation effect may depend on the size of the goals to be attained since goals that are perceived to be too high or too challenging may reduce the positive motivation effect. Hence, contributions in treatment M30 may be lower than those in treatment M15 if the milestones in treatment 30 are perceived to be too challenging for the team to meet.

effect may or may not result in higher contributions in treatment M15 relative to treatment T, and this will depend on whether the expected benefit from signaling outweighs the cost of signaling. Similarly, whether the goal effect will result in higher contributions in treatment M15 depends on the magnitude of the complacency effect. Our conjecture for the information effect is that it will lead to higher contributions in treatment M15 than in treatment T.

Between treatments M15 and M30, the information effect will lead to even higher contributions in treatment M30 than in treatment M15, as the presence of free riders is even less salient with coarser information. However, it is ambiguous whether the signaling and goal effects would lead to lower contributions in treatment M30 as compared to treatment M15. In treatment M30, the cost of signaling is higher (since members have to contribute even more to send a positive signal) and the milestones are harder to achieve. Both of these factors may cause contributions to be higher in treatment M30 if team members regard the benefits as sufficiently high.

Consequently, the net treatment effects are ambiguous. In addition, the relative size of the different effects is expected to change across rounds. While the signaling effect is likely to be more relevant in the earlier rounds, the information effect is likely to be more relevant in the later rounds.

3.3 Results

To investigate the effect of different feedback mechanisms, we first compare average team contributions across the different treatments. We then analyze heterogeneity in individual responses by studying differences between those classified as conditional cooperators, self-interested, and other.

We first examine the overall contributions accumulated by the team within each sequence. Figure 3 presents the empirical cumulative distributions of team contributions in all 10 sequences, separately for each treatment. The figure reveals that accumulated team contributions are lower in treatment T than in both treatments M15 and M30. Between the two milestone treatments, accumulated team contributions are higher in treatment M15 than in treatment M30. Pairwise Kolmogorov-Smirnov tests reveal that the distributions of accumulated team contributions are different across all three treatments: (i) T versus M15: p-value < 0.001; (ii) T versus M30: p-value < 0.001; and (iii) M15 versus M30: p-value $= 0.001$.

Figure 4 presents the average contributions accumulated by the team within each sequence, pooling across all 10 sequences (panel a) and separately for each sequence (panel b). In both panels, the average contributions are computed at the team-sequence level. In panel (a),

95% confidence interval bars are derived using standard errors that are clustered at the session level.

Consistent with Figure 3, panel (a) of Figure 4 reveals that total team contributions are higher on average under the two milestone treatments than under the time-based feedback treatment (p-values: T versus M15 = 0.003; T versus M30 = 0.011). However, there are no statistically significant differences in average team contributions between the M15 and M30 treatments (p-value = 0.364).[14] On average, teams in treatment T contribute 20.3 tokens to the joint project. This increases to 33.9 tokens and 29.6 tokens, respectively, in treatments M15 and M30. Hence, taking treatment T as a baseline, the use of milestones leads to a 46% to 67% increase in average team contributions.

Examining team cooperation across sequences, panel (b) reveals that average team contributions are declining across sequences in all treatments. This behavior is consistent with findings from repeated one-shot public goods games, where team contributions tend to decline over time even when teams are randomly rematched after each period. The decline in average contributions is the sharpest for M30, making especially the treatment difference between M30 and T considerably smaller in later sequences.

Table 3 presents estimates from ordinary least squares (OLS) regressions of total team contributions at the end of each sequence against the treatment variables. Column (1) pools the data for all sequences, while columns (2) and (3) split the analysis by earlier and later sequences, respectively. In all specifications, treatment T is the baseline, and standard errors are clustered at the session level. We also include controls for the proportion of self-interested individuals within each team and the sequence number.

The estimates in Table 3 are consistent with our conclusions above. At the pooled level (column 1), team contributions are higher on average in treatments M15 and M30 than in treatment T (p-values = 0.012 and 0.002, respectively, for M15 and M30), and there is no statistically significant difference in team contributions between treatments M15 and M30 on average (p-value = 0.607). Columns (2) and (3) reveal that the magnitude of the treatment effects of M15 and M30 are stronger in earlier sequences. Specifically, the effects are statistically significant in earlier sequences (p-values = 0.003 and < 0.001, respectively, for M15 and M30), but they are marginally statistically significant (M15) or not statistically

[14] p-values are calculated using t-tests with standard errors clustered at the session level. Figure B2 in Appendix B considers a more conservative approach where we consider the session as a unit of observation and compute the average team contributions across sessions. The conclusions remain the same under this alternative approach to the analysis.

significant (M30) in later sequences (p-values = 0.064 and 0.102, respectively, for M15 and M30).

Overall, both Figure 4 and Table 3 reveal important insights on the role of different feedback mechanisms on cooperation in dynamic VCM games. Milestone-based feedback leads to greater contributions than time-based feedback. The size of the milestones does not seem to have a significant impact on team contributions when we compare milestones of 15 and 30. Moreover, the positive impact of milestone-based feedback relative to time-based feedback declines across sequences.

We summarize our main result as follows.

Result 1:

(a) Average team contributions accumulated in a sequence are higher with milestone-based feedback than with time-based feedback.

(b) Increasing the size of the milestones from 15 to 30 does not have an impact on team contributions.

Figure B3 presents the distribution of teams with accumulated contributions exceeding specific contribution thresholds (panel a) and the average number of rounds taken to exceed these contribution thresholds (panel b). Specifically, we consider six contribution thresholds that coincide with the six pre-determined milestones in the M15 treatment. The key takeaway from the two panels of Figure B3 is that the main treatment effect associated with milestone-based feedback is on the extensive margin. That is, panel (a) reveals that the channel through which milestones lead to greater contributions by teams is by increasing the number of teams reaching each contribution threshold (milestone). Conditional on reaching each contribution threshold, teams on average take the same number of rounds to arrive at that threshold across treatments.

We next investigate heterogeneity in individuals' responses to the different treatments. Figure 5 presents the average contributions made by participants within each sequence, separately by treatment and based on the classification of their type (i.e., conditional cooperator, self-interested, or other). The figure reveals that the differences observed between the milestone treatments and treatment T hold for both conditional cooperators (panel a) and those classified as "other" (panel c), but not for the self-interested individuals (panel b).

The regression analysis presented in Table 4 is broadly consistent with our conclusions above. Columns (1)-(3) reveal that conditional cooperators contribute more on average in the

milestone treatments than in treatment T at the pooled level, as well as when we consider earlier and later sequences separately (p-values for M15 = 0.009, 0.004, and 0.031, respectively; p-values for M30 = 0.006, 0.002, and 0.086, respectively). For those participants who are neither classified as conditional cooperators nor self-interested (columns 7-9), their overall contributions are higher on average in treatment M30, but not in treatment M15, than in treatment T. When we consider the earlier sequences only, contributions in both milestone treatments are higher than that in treatment T (p-values for M15 = 0.182, 0.050, and 0.471, respectively; p-values for M30 = 0.004, 0.001, and 0.140, respectively).

In contrast, columns (4)-(6) of Table 4 reveal that there is no statistically significant difference in the average contributions made by self-interested individuals across treatments. Specifically, the contributions by these individuals are not statistically significantly different neither between treatments T and M15 (p-values = 0.974, 0.581, and 0.330, respectively), nor between treatments T and M30 (p-values = 0.790, 0.586, and 0.204, respectively).

Hence, we observe evidence that participants classified as conditional cooperators (and to some extent, those classified as "other") respond to milestones as a feedback mechanism by increasing their contributions. However, self-interested individuals do not respond to different feedback mechanisms in their contribution behavior. We summarize our main result as follows.

Result 2: *The use of milestone-based feedback instead of time-based feedback has no significant impact on the contributions of self-interested individuals. However, conditional cooperators, as well as those classified as "other", respond to milestone-based feedback by increasing their contributions.*

We next explore how the dynamics of contributions within each sequence vary by team composition. Figure B4 presents the average accumulated team contributions across the six rounds in any given sequence for each treatment. Using individual members' classifications in the conditional cooperation task, panels (a), (b), and (c) present the dynamics displayed by teams with zero self-interested individuals, exactly one self-interested individual, and two or three self-interested individuals, respectively.

From the graphs, we observe that accumulated contributions tend to be lower across all rounds in teams with more self-interested individuals. However, self-interested individuals still make some positive contributions (in contrast with their behavior in the conditional cooperation task, where they make zero contributions). This is especially so in earlier rounds, as evidenced by the flattening out of the contributions after round 1 (which indicates lower marginal

contributions in later rounds). These observations suggest that, as predicted by Ambrus and Pathak (2011), the self-interested individuals take into account the dynamic nature of the game they are playing and make positive contributions possibly to induce contributions by their team members. A second observation from Figure B4 is that the positive effect of milestone-based feedback on team contributions tends to be more pronounced in teams with no self-interested individuals.

Why is milestone-based feedback more effective than time-based feedback in boosting cooperation within teams? As discussed in Section 3.2, there are at least three channels through which milestones may influence team cooperation, which we denote as the signaling, information, and goal effects. As shown in Table 2, our conjecture is that the signaling effect may or may not result in higher contributions in the milestone treatments depending on the relative importance of two factors. On the one hand, individual team members have to contribute more to send a positive signal. On the other hand, the cost of signaling is higher, which may deter contributions. Similarly, our conjecture for the goal effect is ambiguous (depending on the magnitude of the complacency effect), but our conjecture for the information effect is that it will lead to higher contributions under the milestone treatments than in treatment T. Our results so far indicate that the overall effect of using milestones on contributions is positive. In Study 2, we design a new treatment that allows us to analyze whether there is evidence for the existence of the different channels mentioned above.

4 Study 2

4.1 Experimental Design and Procedures

We introduce an additional treatment in Study 2 where participants receive both time-based and milestone-based feedback simultaneously.[15] Specifically, in the time-milestone-15 treatment (TM15), team members are informed at the beginning of each contribution round of: (i) the total contributions accumulated in the joint project (as in treatment T), and (ii) whether the team contributions have exceeded 15, 30, 45, 60, 75, or 90 tokens (as in treatment M15). Figure 6 provides an example of the feedback screen used in treatment TM15. As in treatment T, the green portion of the bar represents the number of tokens already accumulated at the beginning of the previous round, while the orange portion of the bar represents the additional

[15] This treatment was not in our original pre-registration. We decided to run this treatment following our findings from Study 1.

contributions made in the previous round. The blue vertical lines represent the milestones as in the M15 treatment.

In this treatment, feedback on whether or not the team has met a new milestone does not convey any new information since team members receive precise information on accumulated team contributions at the beginning of each round. Our goal in designing this treatment is the following. A comparison of behavior between T and TM15 helps us analyze the impact of the goal effect since between these two treatments, we keep the information content of feedback constant, but we vary the effect of working toward and/or attaining a set of pre-determined goals. On the other hand, a comparison of behavior between M15 and TM15 helps us study the signaling and information effects since between these two treatments, we keep the goal effect constant, but we vary the information content of the feedback structure.

The experiments for treatment TM15 were also conducted at the E^2MU at the University of Melbourne. The experimental procedures were the same as those implemented in Study 1. We collected data from an additional 114 participants over eight sessions, providing us with observations from 380 team-sequences. Participants earned 27.05 AUD on average, including a participation fee of 5 AUD.

4.2 Results: Treatments T, TM15, and M15

We first compare behavior in treatments T and TM15 to evaluate the goal effect, controlling for the signaling and information effects. We then compare behavior in treatments M15 and TM15 to evaluate the signaling and information effects, controlling for the goal effect.

Goal Effect. Figure 7 presents the average team contributions within each sequence, pooling across all sequences (panel a) and separately for each sequence (panel b), in treatments T, TM15, and M15.[16] Panel (a) in Figure 7 reveals that the total team contributions in treatment TM15 are on average higher than those in treatment T (p-value = 0.095). Panel (b) reveals that this holds for most of the 10 sequences.

Table 5 reports OLS regression estimates of total team contributions at the end of each sequence. The difference in contributions between treatments T and TM15 is statistically significant both overall and when we consider earlier and later sequences separately (p-values = 0.043, 0.032, and 0.083, respectively). We further examine behavior based on whether individuals are classified as conditional cooperators, self-interested, or other in Table B1 of

[16] Figure B5 in Appendix B provides a similar graph using the session as a unit of observation.

Appendix B. The estimates reveal that the difference we find between T and TM15 is driven by the conditional cooperators.

We summarize our results as follows.

Result 3: *We find evidence of a positive goal effect. Total team contributions in TM15 are higher than those in treatment T on average. The goal effect primarily affects the behavior of conditional cooperators.*

Signaling and Information Effects. Panel (a) of Figure 7 reveals that the total team contributions in treatment M15 are higher than those in treatment TM15 on average (p-value = 0.073). Panel (b) shows that this pattern holds for most of the 10 sequences. This suggests that the signaling and information effects lead to higher contributions under milestone-based feedback. However, the estimates in Table 5 reveal that the difference in contributions between treatments M15 and TM15 is not statistically significant (p-values = 0.320, 0.200, and 0.510, respectively, across columns 1-3). Hence, on aggregate, while it appears that contributions in treatment M15 are higher on average than those in treatment TM15, the statistical significance of this difference is not robust to regression analysis.

We next turn to round-specific analysis to further investigate the presence of each of these two effects. We start with the signaling effect, which posits that individuals need to contribute more under milestone-based feedback than under time-based feedback in order to send a positive signal of their intention to contribute to the public good. Depending on the cost of sending signals, this may lead to individuals being willing to contribute more with milestone-based feedback, or it may lead to them not contributing at all.

To evaluate whether a signaling effect is present, we compare the *first-round behavior of individual team members between treatments M15 and TM15*. Earlier in the game, individuals are more likely to have incentives to engage in behavior that will motivate their team members to contribute. We specifically focus on first-round behavior so that we can analyze the signaling effect in isolation because in the first round, our analysis cannot be affected by differences in information shared about behavior in the previous rounds (which gives rise to the information effect).

Table 6 presents estimates of OLS regressions of individual contributions in round 1 of each sequence in treatments M15 and TM15, separately for those classified as conditional cooperators, self-interested, or other. In the regressions, treatment TM15 is the baseline comparison group. The coefficient estimates reveal that individual contributions in the first

round of each sequence are higher on average in treatment M15 than in treatment TM15 for conditional cooperators (p-value = 0.004), but not for the other types (p-values = 0.636 and 0.468, respectively, for self-interested and other). These results are consistent with a signaling effect being present and leading to higher contributions by conditional cooperators when milestones are used as a feedback mechanism.

Result 4: *There is evidence of a signaling effect increasing the contributions of conditional cooperators under milestone-based feedback as compared to time-based feedback.*

We next turn to the information effect, which stems from differential response under the time-based versus milestone-based feedback mechanisms to information about others' contributions in the previous periods. The differential response is due to the difference in the precision of information received under the two feedback structures. To evaluate whether an information effect is present, we focus on the *final-round behavior of individual team members in treatments M15 and TM15*. Focusing on the final round allows us to isolate the information effect since team members have no incentives to send signals about future intentions in the final round (which gives rise to the signaling effect).

Table 7 presents estimates of OLS regressions of individual contributions in round 6 of each sequence in treatments M15 and TM15, separately for those classified as conditional cooperators, self-interested, or other. Treatment M15 is taken to be the baseline comparison group. The coefficients of interest are "Contributions by other members in round 5" and its interaction with the treatment variable, i.e., "TM15 × Contributions by other members in round 5". The first coefficient represents the marginal effect on individual contributions (in round 6) of having an additional token contributed by the other two team members in the previous round of the baseline M15 treatment. Since team members do not know the precise number of tokens in the joint project with milestone-based feedback (and therefore are unable to infer what other members have contributed), we expect this variable to have no statistically significant impact on final-round contributions. Indeed, the estimated coefficient of contributions made by other members in round 5 is not statistically significant across all three member types (p-values = 0.465, 0.352, and 0.400, respectively).

Crucially, the interaction term ("TM15 × Contributions by other members in round 5") represents the effect of explicitly providing precise information about the contributions made by other members in the previous round on final-round contributions in treatment TM15. The estimate in column (1) reveals that conditional cooperators respond to this information by

contributing an additional 0.1 token for each token contributed by the other members to the joint project in the previous round, as compared to what they would do in the absence of such information (p-value = 0.022). This is consistent with our expectation of conditional cooperators reciprocating positively to the positive contributions made by other members of their team. Conversely, this implies that conditional cooperators reciprocate *negatively* if they are informed that the other members have contributed *fewer tokens* to the joint project. This lends support for the presence of the information effect. A decline in cooperation is more salient with time-based feedback than with milestone-based feedback, leading to lower contributions under time-based feedback by conditional cooperators for the same decrease in the contributions made by other members of the team. On the other hand, we find no statistically significant evidence that neither self-interested individuals nor those classified as "other" respond to precise information provided about the contributions made by other members in the previous round (p-values = 0.740 and 0.471, respectively).

Result 5: *There is evidence of an information effect increasing the contributions of conditional coordinators under milestone-based feedback as compared to time-based feedback.*

5 Further Analysis: Dynamics of the Goal Effect

The goal effect relates to behavioral responses by individuals towards goal attainment. As team members work together to reach a milestone, the goal effect may manifest itself in the form of a positive motivation effect. However, after team members reach a milestone, the goal effect can play a positive or a negative role. On the one hand, attaining a milestone may motivate team members to cooperate even more and work harder to achieve the subsequent milestone due to an efficacy effect. On the other hand, attaining a milestone may lead to a complacency effect where members no longer feel the motivation to contribute to the public good given that a goal has already been met.

To evaluate how the goal effect presents itself, we focus on the behavior of individual team members in treatments T and TM15. Compared to treatment T, treatment TM15 provides information on whether the team has met any of the pre-determined milestones, but it does not provide any additional information on team contributions. Hence, a comparison between these two treatments allows us to identify whether the inclusion of milestones leads to an efficacy or complacency effect.

Table 8 presents estimates of OLS regressions of individual contributions in each round of each sequence in treatments T and TM15, separately for those classified as conditional

cooperators, self-interested, or other. In all specifications, treatment T is the baseline comparison group. Data from the first round is excluded to allow for lagged contributions to be controlled for in the regressions.

The first coefficient of interest in the table is "TM15 × Met milestone in previous round", which represents the marginal effect on individual contributions in the current round of being explicitly informed about the attainment of a new milestone in the previous round. While the estimate in column (1) reveals that conditional cooperators respond to this information by increasing their contributions on average (p-value = 0.008), columns (2) and (3) reveal that this information does not have a significant impact on the contributions of the self-interested individuals or those classified as "other" (p-values = 0.639 and 0.300, respectively). Hence, meeting a milestone has a significant positive motivational effect on individual contributions, but this effect is significant for conditional cooperators only.

The second coefficient of interest in Table 8 is "TM15 × Distance to next milestone at beginning of round", which represents the effect on individual contributions in the current round of the distance to the next milestone. The estimate in column (1) reveals that an increase in the gap between the team contributions and the next milestone leads to a statistically significant decrease in contributions by the conditional cooperators on average (p-value < 0.001). This implies that the conditional cooperators experience a motivational effect and as a result, contribute more to the joint project when the team is closer to the next milestone. The estimates in columns (2) and (3) reveal that the distance to the next milestone has no statistically significant impact on the contributions of the self-interested individuals or those classified as "other" (p-values = 0.777 and 0.399, respectively).

We summarize our results as follows:

Result 6: *The presence of milestones results in a goal effect for the conditional cooperators only. Specifically:*

(a) After meeting a new milestone, conditional cooperators experience an efficacy effect which increases their average contributions.

(b) When working towards a new milestone, a shorter distance to the milestone leads to a positive motivation effect for conditional cooperators which increases their average contributions.

6 Discussion

Solving the social dilemma problem in teamwork has important implications for workforce productivity and efficient provision of public goods in the economy. In the context of dynamic contributions to teamwork, we investigate the use of milestones as a feedback mechanism. Setting appropriate milestones has been proven to be an effective way of incentivizing performance (Locke and Latham, 2019). In this paper, we explore the role milestones play in information sharing in the context of teamwork where individuals face uncertainty regarding their team members' contributions.

Using a series of controlled laboratory experiments, we find that providing information about the team's progress using milestones substantially improves cooperation as compared to providing information with regular updates between contribution rounds. The increase in cooperation with milestones is mainly driven by the behavior of conditional cooperators. When we increase the milestone size by 100%, we do not find a significant difference between the two milestone sizes in terms of their influence on team cooperation.

Overall, our results provide a guide on how feedback structures can be designed in team environments and in the dynamic provision of public goods so as to improve cooperation. On the practical front, our results imply that team managers should consider structuring team updates around the attainment of milestones instead of providing information with regular (e.g., weekly) updates. We find that the effectiveness of milestones arises from three different mechanisms: (i) team members contribute more to reach the milestones so that they can encourage others to contribute (signaling effect); (ii) information about the presence of free riders is less salient under milestones (information effect); and (iii) milestones serve as goals for the team to work toward (goal effect).

A key feature of our design is that the feedback structure is imposed on the team (e.g., by a manager or a supervisor). An important question from a managerial perspective may be whether feedback choice should be exogenous or endogenous. That is, a manager may want to know whether it is better to impose a feedback structure on teams or to let them choose their own feedback structure. How teams select a feedback mechanism to monitor themselves and whether it is better to have feedback structures determined endogenously or exogenously remain as open questions which we leave for future work.

References

Aksoy, B., Krasteva, S. (2020). When does less information translate into more giving to public goods? *Experimental Economics, 23*(4), 1148-1177.

Ambrus, A., Pathak, P. A. (2011). Cooperation over finite horizons: A theory and experiments. *Journal of Public Economics, 95*(7-8), 500-512.

Amir, O., Ariely, D. (2008). Resting on laurels: the effects of discrete progress markers as subgoals on task performance and preferences. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 34*(5), 1158-1171.

Arifovic, J., Ledyard, J. (2012). Individual evolutionary learning, other-regarding preferences, and the voluntary contributions mechanism. *Journal of Public Economics, 96*(9-10), 808-823.

Balliet, D., Mulder, L. B., Van Lange, P. A. (2011). Reward, punishment, and cooperation: A meta-analysis. *Psychological Bulletin, 137*(4), 594-615.

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. W H Freeman/Times Books/ Henry Holt & Co.

Bandura, A., Schunk, D. H. (1981). Cultivating competence, self-efficacy, and intrinsic interest through proximal self-motivation. *Journal of Personality and Social Psychology, 41*(3), 586-598.

Battaglini, M., Nunnari, S., Palfrey, T. R. (2016). The dynamic free rider problem: A laboratory study. *American Economic Journal: Microeconomics, 8*(4), 268-308.

Bigoni, M., Suetens, S. (2012). Feedback and dynamics in public good experiments. *Journal of Economic Behavior & Organization, 82*(1), 86-95.

Cedefop. (2022). *Setting Europe on course for a human digital transition: New evidence from Cedefop's second European skills and jobs survey.* Luxembourg: Publications Office; Cedefop reference series; No 123.

Chaudhuri, A. (2011). Sustaining cooperation in laboratory public goods experiments: a selective survey of the literature. *Experimental Economics, 14*(1), 47-83.

Chaudhuri, A., Paichayontvijit, T., Smith, A. (2017). Belief heterogeneity and contributions decay among conditional cooperators in public goods games. *Journal of Economic Psychology, 58*, 15-30.

Chen, Y., Mostagir, M., Yeckehzaare, I. (2023). Strategic experimentation and information design in dynamic contests: An experimental study. *Working Paper*.

Choi, S., Gale, D., Kariv, S. (2008). Sequential equilibrium in monotone games: A theory-based analysis of experimental data. *Journal of Economic Theory, 143*(1), 302-330.

Choi, S., Gale, D., Kariv, S., Palfrey, T. (2011). Network architecture, salience and coordination. *Games and Economic Behavior, 73*(1), 76-90.

Cox, C. A., Stoddard, B. (2018). Strategic thinking in public goods games with teams. *Journal of Public Economics, 161*, 31-43.

Croson, R., Shang, J. Y. (2008). The impact of downward social information on contribution decisions. *Experimental Economics, 11*(3), 221-233.

Dorsey, R. E. (1992). The voluntary contributions mechanism with real time revisions. *Public Choice, 73*(3), 261-282.

Duffy, J., Ochs, J., Vesterlund, L. (2007). Giving little by little: Dynamic voluntary contribution games. *Journal of Public Economics, 91*(9), 1708-1730.

Fischbacher, U., Gächter, S. (2010). Social preferences, beliefs, and the dynamics of free riding in public goods experiments. *American Economic Review, 100*(1), 541-556.

Fischbacher, U., Gächter, S., Fehr, E. (2001). Are people conditionally cooperative? Evidence from a public goods experiment. *Economics Letters, 71*(3), 397-404.

Fishbach, A., Dhar, R., Zhang, Y. (2006). Subgoals as substitutes or complements: The role of goal accessibility. *Journal of Personality and Social Psychology, 91*(2), 232-242.

Freytag, A., Güth, W., Koppel, H., Wangler, L. (2014). Is regulation by milestones efficiency enhancing? An experimental study of environmental protection. *European Journal of Political Economy, 33*, 71-84.
Gallier, C., Sturm, B. (2021). The ratchet effect in social dilemmas. *Journal of Economic Behavior & Organization, 186*, 251-268.
Gensler. (2022). *U.S. Workplace Survey*. Retrieved from https://www.gensler.com/gri/us-workplace-survey-2022
Gneezy, U., Potters, J. (1997). An experiment on risk taking and evaluation periods. *The Quarterly Journal of Economics, 112*(2), 631-645.
Goren, H., Kurzban, R., Rapoport, A. (2003). Social loafing vs. social enhancement: Public goods provisioning in real-time with irrevocable commitments. *Organizational Behavior and Human Decision Processes, 90*(2), 277-290.
Greiner, B. (2015). Subject pool recruitment procedures: organizing experiments with ORSEE. *Journal of the Economic Science Association, 1*(1), 114-125.
Guido, A., Robbett, A., Romaniuc, R. (2019). Group formation and cooperation in social dilemmas: A survey and meta-analytic evidence. *Journal of Economic Behavior & Organization, 159*, 192-209.
Hartig, B., Irlenbusch, B., Kölle, F. (2015). Conditioning on what? Heterogeneous contributions and conditional cooperation. *Journal of Behavioral and Experimental Economics, 55*, 48-64.
Hashim, M. J., Kannan, K. N., Maximiano, S. (2017). Information feedback, targeting, and coordination: An experimental study. *Information Systems Research, 28*(2), 289-308.
He, S., Zhu, X. (2023). Real-time monitoring in a public-goods game. *Working Paper*.
Heath, C., Larrick, R. P., Wu, G. (1999). Goals as reference points. *Cognitive Psychology, 38*(1), 79-109.
Huang, S.-c., Jin, L., Zhang, Y. (2017). Step by step: Sub-goals as a source of motivation. *Organizational Behavior and Human Decision Processes, 141*, 1-15.
Irlenbusch, B., Rilke, R. M., Walkowitz, G. (2019). Designing feedback in voluntary contribution games: the role of transparency. *Experimental Economics, 22*(2), 552-576.
Ishii, K., Kurzban, R. (2008). Public goods games in Japan. *Human Nature, 19*(2), 138-156.
Kahneman, D., Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica, 47*(2), 263-291.
Kleingeld, A., van Mierlo, H., Arends, L. (2011). The effect of goal setting on group performance: A meta-analysis. *Journal of Applied Psychology, 96*(6), 1289-1304.
Kramer, W. S., Thayer, A. L., Salas, E. (2013). Goal setting in teams. In E. A. Locke & G. P. Latham (Eds.), *New Developments in Goal Setting and Task Performance* (pp. 287-310). New York: Routledge.
Kurzban, R., McCabe, K., Smith, V. L., Wilson, B. J. (2001). Incremental commitment and reciprocity in a real-time public goods game. *Personality and Social Psychology Bulletin, 27*(12), 1662-1673.
Latham, G. P., Seijts, G. H. (1999). The effects of proximal and distal goals on performance on a moderately complex task. *Journal of Organizational Behavior, 20*(4), 421-429.
Ledyard, J. O. (1995). Public goods: A survey of experimental research. In *The Handbook of Experimental Economics* (pp. 111-194). Princeton: Princeton University Press.
Locke, E. A., Latham, G. P. (1990). *A Theory of Goal Setting & Task Performance*. Prentice-Hall, Inc.
Locke, E. A., Latham, G. P. (2013). *New Developments in Goal Setting and Task Performance*. New York: Routledge.
Locke, E. A., Latham, G. P. (2019). The development of goal setting theory: A half century retrospective. *Motivation Science, 5*(2), 93-105.

Locke, E. A., Shaw, K. N., Saari, L. M., Latham, G. P. (1981). Goal setting and task performance: 1969–1980. *Psychological Bulletin, 90*(1), 125-152.
Marx, L. M., Matthews, S. A. (2000). Dynamic voluntary contribution to a public project. *The Review of Economic Studies, 67*(2), 327-358.
Mashek, D. (2022). Collaboration is a key skill. So why aren't we teaching it? *MIT Sloan Management Review, 63*(4), 1-4.
Milinski, M., Röhl, T., Marotzke, J. (2011). Cooperative interaction of rich and poor can be catalyzed by intermediate climate targets. *Climatic Change, 109*(3), 807-814.
Milinski, M., Sommerfeld, R. D., Krambeck, H.-J., Reed, F. A., Marotzke, J. (2008). The collective-risk social dilemma and the prevention of simulated dangerous climate change. *Proceedings of the National Academy of Sciences, 105*(7), 2291-2294.
NACE. (2023). *Job Outlook 2023*. National Association of Colleges and Employers.
Neugebauer, T., Perote, J., Schmidt, U., Loos, M. (2009). Selfish-biased conditional cooperation: On the decline of contributions in repeated public goods experiments. *Journal of Economic Psychology, 30*(1), 52-60.
Nikiforakis, N. (2010). Feedback, punishment and cooperation in public good experiments. *Games and Economic Behavior, 68*(2), 689-702.
OECD. (2021). *An Assessment of the Impact of COVID-19 on Job and Skills Demand Using Online Job Vacancy Data*. OECD Publishing.
Oprea, R., Charness, G., Friedman, D. (2014). Continuous time and communication in a public-goods experiment. *Journal of Economic Behavior & Organization, 108*, 212-223.
Pereda, M., Tamarit, I., Antonioni, A., Cuesta, J. A., Hernández, P., Sánchez, A. (2019). Large scale and information effects on cooperation in public good games. *Scientific Reports, 9*(1), 1-10.
Savikhin, A., Sheremeta, R. M. (2010). Visibility of contributions and cost of information: An experiment on public goods. *Working Paper*.
Schelling, T. C. (1960). *The Strategy of Conflict*. Cambridge: Harvard University Press.
Seijts, G. H., Latham, G. P. (2000). The effects of goal setting and group size on performance in a social dilemma. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement, 32*(2), 104-116.
Seijts, G. H., Latham, G. P., Whyte, G. (2000). Effect of self-and group efficacy on group performance in a mixed-motive situation. *Human Performance, 13*(3), 279-298.
Sell, J., Wilson, R. K. (1991). Levels of information and contributions to public goods. *Social Forces, 70*(1), 107-124.
Stajkovic, A. D., Lee, D., Nyberg, A. J. (2009). Collective efficacy, group potency, and group performance: meta-analyses of their relationships, and test of a mediation model. *Journal of Applied Psychology, 94*(3), 814-828.
Steiger, E.-M., Zultan, R. i. (2014). See no evil: Information chains and reciprocity. *Journal of Public Economics, 109*, 1-12.
Sun, S. H., Frese, M. (2013). Multiple goal pursuit. In *New Developments in Goal Setting and Task Performance* (pp. 177-194). New York: Routledge.
Tavoni, A., Dannenberg, A., Kallis, G., Löschel, A. (2011). Inequality, communication, and the avoidance of disastrous climate change in a public goods game. *Proceedings of the National Academy of Sciences, 108*(29), 11825-11829.
Villeval, M. C. (2020). Public goods, norms and cooperation. In C. M. Capra, R. T. A. Croson, M. L. Rigdon, & T. S. Rosenblat (Eds.), *Handbook of Experimental Game Theory* (pp. 184–212). Edward Elgar Publishing.
Weimann, J. (1994). Individual behaviour in a free riding experiment. *Journal of Public Economics, 54*(2), 185-200.

Weldon, E., Yun, S. (2000). The effects of proximal and distal goals on goal level, strategy development, and group performance. *The Journal of Applied Behavioral Science, 36*(3), 336-344.

List of Tables

Table 1: Summary of experimental sessions (Study 1)

Treatment	Feedback at beginning of each round	Number of sessions	Number of participants
Time (T)	Total contributions accumulated in the joint project.	8	102
Milestone-15 (M15)	Whether the joint project has reached a milestone of 15, 30, 45, 60, 75, or 90.	7	105
Milestone-30 (M30)	Whether the joint project has reached a milestone of 30, 60, or 90.	7	102

Table 2: Summary of possible mechanisms driving contribution behavior

Mechanisms	M15 relative to T	M30 relative to M15
Signaling effect	?	?
Information effect	+	+
Goal effect	?	?

Table 3: OLS regressions of team contributions accumulated in sequence (Study 1)

	Dependent variable: Team contributions accumulated in a sequence		
Variables	All sequences (1)	Sequence 1-5 (2)	Sequence 6-10 (3)
M15	10.563**	13.067***	8.040*
	(3.841)	(3.903)	(4.109)
M30	8.445***	12.062***	4.823
	(2.342)	(2.482)	(2.821)
% self-interested individuals in team	-30.268***	-32.506***	-28.225***
	(3.150)	(4.179)	(3.177)
Sequence	-2.217***	-3.003***	-1.425***
	(0.227)	(0.345)	(0.360)
Constant	39.584***	40.328***	34.914***
	(2.032)	(2.103)	(2.342)
M15 – M30	2.118	1.005	3.217
	(4.055)	(4.029)	(4.620)
Observations	1,030	515	515
# sessions (clusters)	22	22	22
R-squared	0.274	0.262	0.182

Standard errors clustered at the session level in parentheses. Treatment T is the baseline in all specifications.
* p<0.10, ** p<0.05, *** p<0.01.

Table 4: OLS regressions of individual contributions in each sequence by individual participants' type (Study 1)

	Dependent variable: Individual contributions in each sequence								
	Conditional Cooperator			Self-Interested			Other Type		
Variables	All sequences (1)	Sequence 1-5 (2)	Sequence 6-10 (3)	All sequences (4)	Sequence 1-5 (5)	Sequence 6-10 (6)	All sequences (7)	Sequence 1-5 (8)	Sequence 6-10 (9)
M15	4.722***	5.414***	4.026**	-0.045	1.018	-1.115	3.037	4.102**	1.960
	(1.645)	(1.650)	(1.741)	(1.340)	(1.812)	(1.117)	(2.195)	(1.962)	(2.668)
M30	3.721***	4.882***	2.537*	-0.308	0.816	-1.404	3.682***	4.952***	2.388
	(1.227)	(1.406)	(1.409)	(1.141)	(1.472)	(1.068)	(1.147)	(1.212)	(1.555)
% other members who are self-interested	-3.934***	-4.549***	-3.324***	-2.917**	-3.258*	-2.427**	-2.345*	-1.871	-2.910
	(0.954)	(1.356)	(1.081)	(1.071)	(1.632)	(1.149)	(1.328)	(1.650)	(1.799)
Sequence	-0.783***	-1.074***	-0.520***	-0.640***	-1.042***	-0.470***	-0.704***	-0.777***	-0.349
	(0.101)	(0.123)	(0.165)	(0.103)	(0.321)	(0.149)	(0.131)	(0.178)	(0.318)
Constant	12.960***	13.313***	11.383***	7.864***	8.374***	7.146***	12.153***	11.622***	10.091***
	(0.891)	(0.967)	(1.293)	(1.037)	(1.498)	(1.410)	(1.185)	(1.011)	(2.707)
M15 – M30	1.001	0.532	1.490	0.263	0.202	0.290	-0.645	-0.850	-0.429
	(1.808)	(1.863)	(2.061)	(1.454)	(2.021)	(1.013)	(2.036)	(1.830)	(2.518)
Observations	1,860	930	930	590	295	295	640	320	320
# sessions (clusters)	22	22	22	21	21	21	21	21	21
R-squared	0.139	0.132	0.066	0.079	0.051	0.036	0.084	0.075	0.026

Standard errors clustered at the session level in parentheses. Treatment T is the baseline in all specifications.
* p<0.10, ** p<0.05, *** p<0.01.

Table 5: OLS regressions of team contributions accumulated in sequence (Study 2)

	Dependent variable: Team contributions accumulated in sequence		
	All sequences	Sequence 1-5	Sequence 6-10
Variables	(1)	(2)	(3)
M15	10.804**	13.632***	7.990*
	(3.855)	(3.880)	(4.139)
TM15	6.320**	7.701**	4.934*
	(2.941)	(3.369)	(2.720)
% self-interested individuals in team	-27.908***	-26.962***	-28.712***
	(3.540)	(4.626)	(3.459)
Sequence	-1.994***	-2.788***	-1.673***
	(0.183)	(0.359)	(0.401)
Constant	37.805***	38.378***	37.010***
	(1.876)	(2.107)	(3.001)
M15 – TM15	4.484	5.930	3.057
	(4.411)	(4.504)	(4.572)
Observations	1,070	535	535
# sessions (clusters)	23	23	23
R-squared	0.245	0.224	0.189

Standard errors clustered at the session level in parentheses. Treatment T is the baseline in all specifications.
* p<0.10, ** p<0.05, *** p<0.01.

Table 6: Individual contributions in round 1 of sequence by type (M15 and TM15)

	Dependent variable: Individual contributions in round 1 of sequence		
Variables	Conditional Cooperator (1)	Self-Interested (2)	Other Type (3)
M15	1.796***	0.355	-1.202
	(0.613)	(0.746)	(1.638)
Sequence	-0.262***	-0.198***	-0.211***
	(0.051)	(0.069)	(0.072)
Constant	5.145***	2.571***	5.668***
	(0.530)	(0.605)	(1.735)
Observations	1,400	450	340
# participants (clusters)	140	45	34
R-squared	0.044	0.022	0.024

Standard errors clustered at the participant level in parentheses. Treatment TM15 is the baseline in all specifications.

* p<0.10, ** p<0.05, *** p<0.01.

Table 7: Individual contributions in round 6 of sequence by type (M15 and TM15)

Variables	Dependent variable: Individual contributions in round 6 of sequence		
	Conditional Cooperator (1)	Self-Interested (2)	Other Type (3)
TM15	-0.174	-0.142	-0.638
	(0.107)	(0.090)	(0.470)
Contributions by other members in round 5	-0.016	0.021	-0.054
	(0.022)	(0.022)	(0.063)
TM15	0.099**	0.014	0.061
× Contributions by other members in round 5	(0.043)	(0.042)	(0.084)
Met milestone in round 5	0.832***	-0.073	0.145
	(0.216)	(0.062)	(0.336)
# tokens in joint project at beginning of round 6	0.013*	-0.001	-0.005
	(0.008)	(0.003)	(0.009)
# tokens remaining (not contributed to joint project)	0.008	-0.030*	-0.039***
	(0.020)	(0.016)	(0.013)
% conditional cooperators in team	0.087	-0.181	0.017
	(0.206)	(0.164)	(0.509)
% other type in team	0.233	0.015	-0.110
	(0.400)	(0.232)	(0.460)
Sequence	-0.044***	-0.013*	-0.048
	(0.013)	(0.007)	(0.034)
Constant	0.146	1.142*	2.316***
	(0.525)	(0.570)	(0.726)
Observations	1,400	450	340
# participants (clusters)	140	45	34
R-squared	0.107	0.167	0.040

Standard errors clustered at the participant level in parentheses. Treatment M15 is the baseline in all specifications.
* p<0.10, ** p<0.05, *** p<0.01.

Table 8: Individual contributions in rounds 2-6 of sequence by type (T and TM15)

	Dependent variable: Individual contributions in each round of sequence		
Variables	Conditional Cooperator (1)	Self-Interested (2)	Other Type (3)
TM15	0.705***	-0.106	0.225
	(0.154)	(0.288)	(0.339)
Met milestone in previous round	0.310	0.310	0.272
	(0.198)	(0.353)	(0.263)
Distance to next milestone at beginning of round	-0.004	-0.021	-0.033
	(0.011)	(0.021)	(0.021)
TM15	0.605***	-0.237	0.421
× Met milestone in previous round	(0.223)	(0.502)	(0.399)
TM15	-0.060***	0.007	-0.024
× Distance to next milestone at beginning of round	(0.014)	(0.023)	(0.028)
Team contributions in the previous round	0.094***	0.093***	0.035*
	(0.018)	(0.024)	(0.018)
# tokens in joint project at beginning of round	0.016***	0.002	0.005
	(0.006)	(0.006)	(0.006)
# tokens remaining (not contributed to joint project)	0.032*	0.003	-0.003
	(0.019)	(0.019)	(0.022)
% conditional cooperators in team	0.351***	-0.147	0.396
	(0.122)	(0.237)	(0.301)
% other type in team	0.071	-0.036	0.413
	(0.161)	(0.182)	(0.396)
Sequence	-0.038***	-0.023	-0.060***
	(0.009)	(0.016)	(0.018)
Round	-0.225***	-0.041	-0.237***
	(0.028)	(0.033)	(0.034)
Constant	0.297	0.558	1.907**
	(0.591)	(0.719)	(0.712)
Observations	6,241	2,750	1,800
# participants (clusters)	125	55	36
R-squared	0.230	0.116	0.118

Standard errors clustered at the participant level in parentheses. Treatment T is the baseline in all specifications.
* p<0.10, ** p<0.05, *** p<0.01.

List of Figures

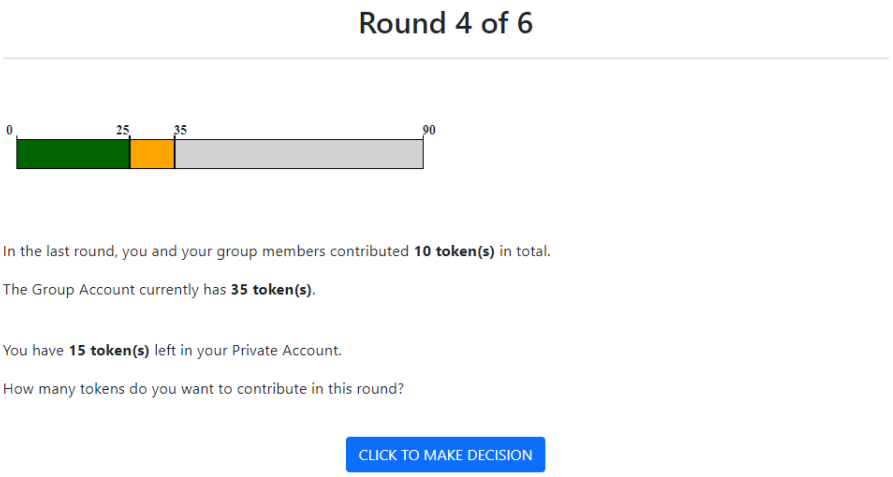
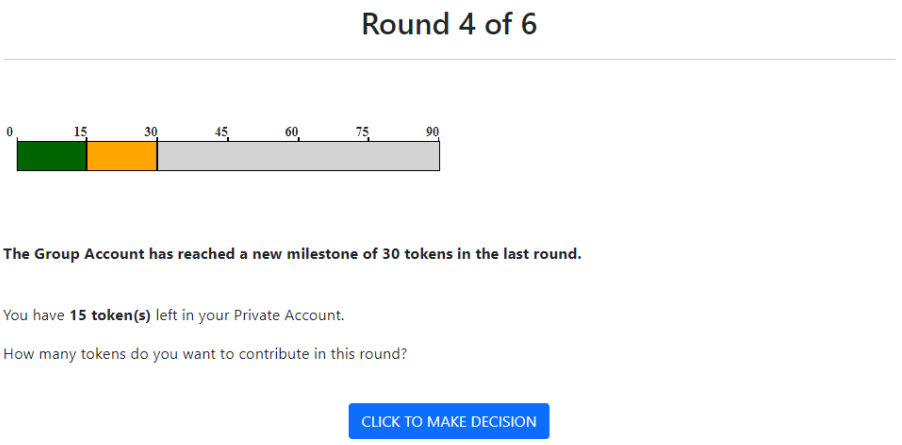
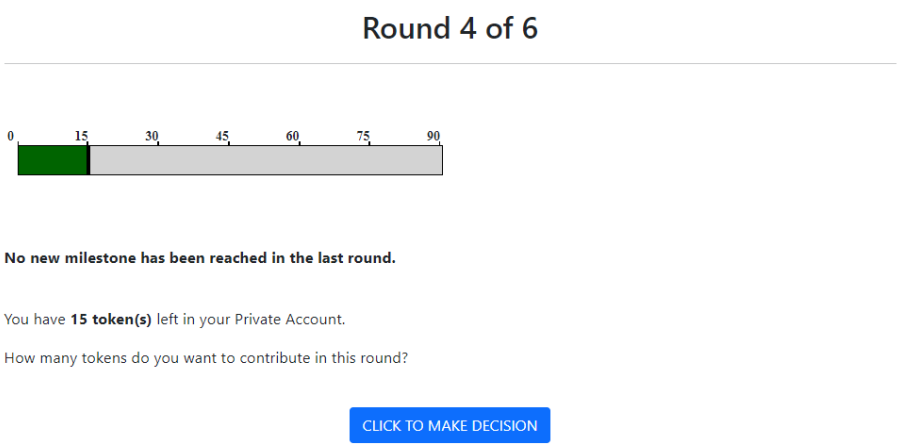


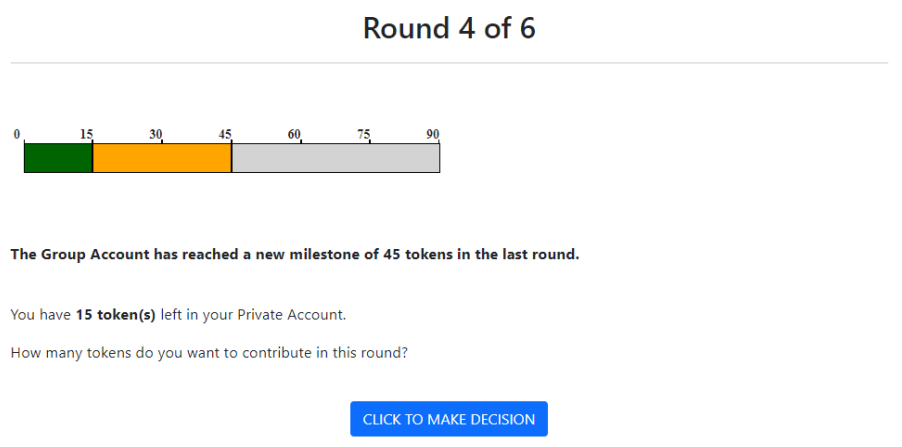
Figure 1: Example of Feedback Screen in Treatment T



(a) When the team has reached a new milestone



(b) When the team has not reached any milestone



(c) When the team reaches multiple milestones

Figure 2: Examples of Feedback Screen in Treatment M15

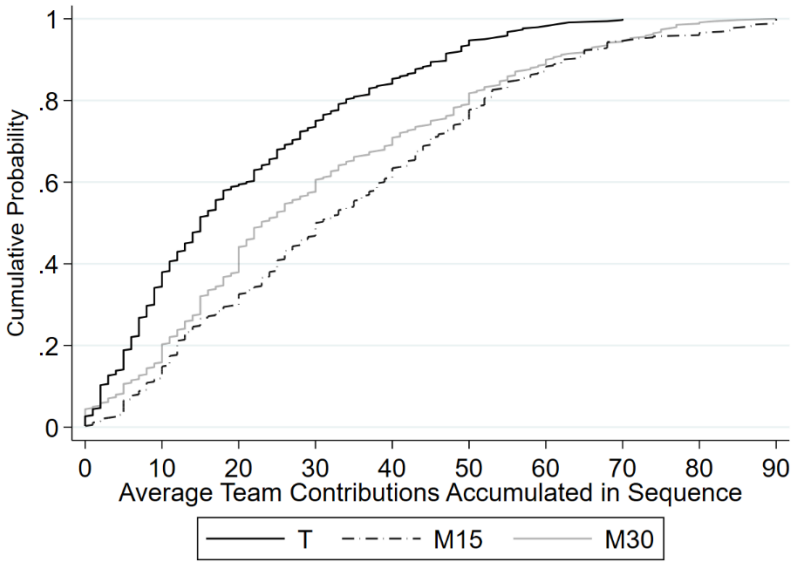
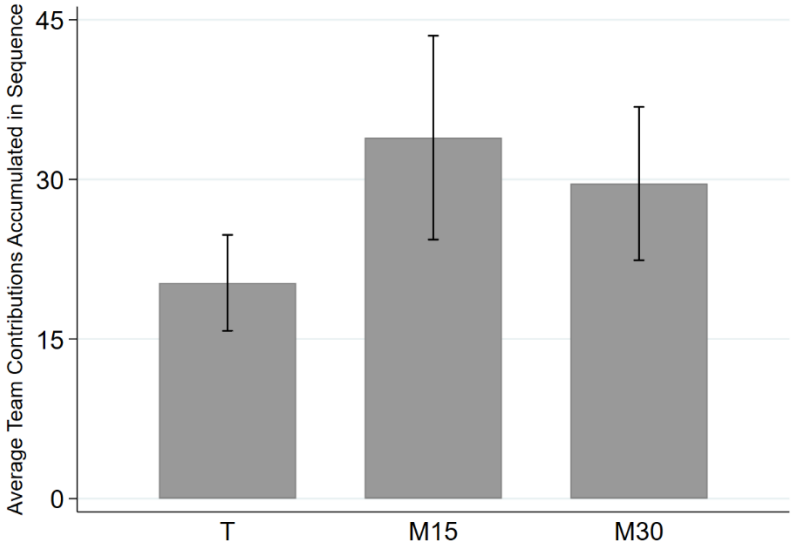
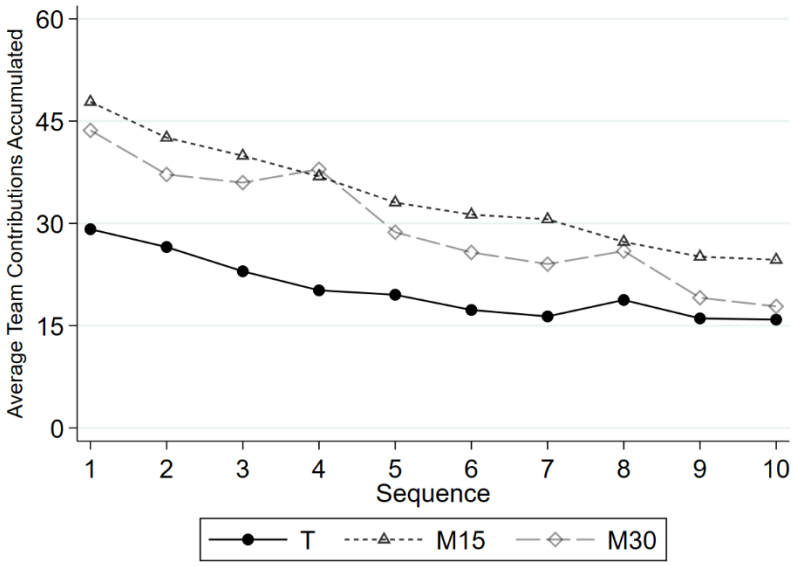


Figure 3: Empirical cumulative distribution of team contributions accumulated in sequence, pooled across all 10 sequences (Study 1)



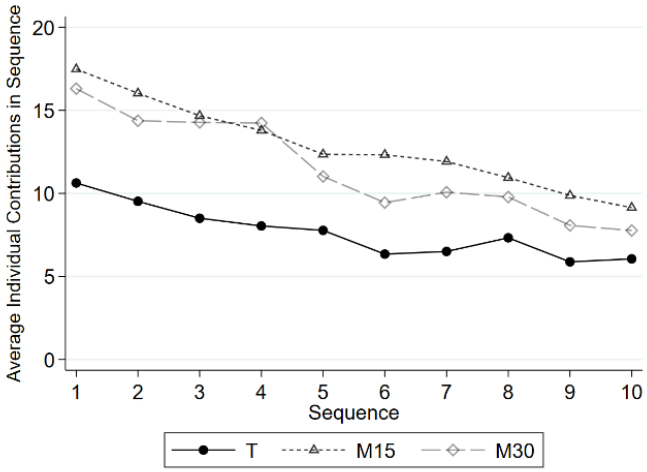
(a) Pooled across all 10 sequences



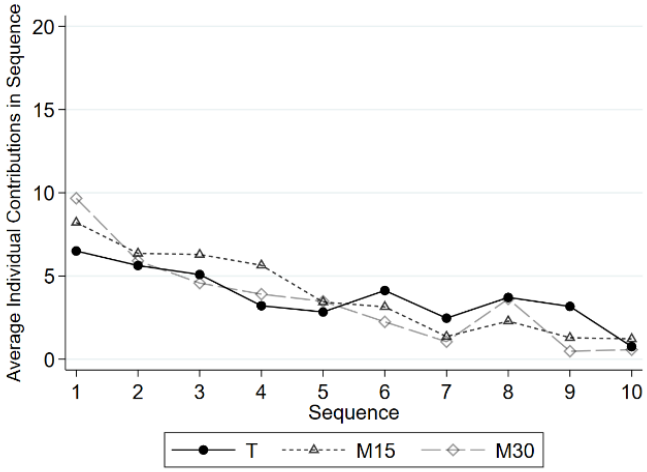
(b) By sequence

Figure 4: Average team contributions accumulated in sequence (Study 1)

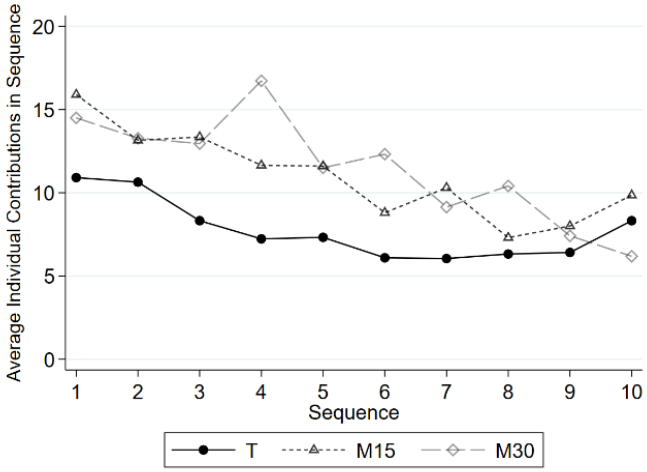
Note: Averages computed over individual team-sequences. Bars represent 95% confidence intervals accounting for standard errors clustered at the session level.



(a) Conditional cooperators



(b) Self-interested



(c) Other types

Figure 5: Average individual contributions in each sequence by individual participants' type (Study 1)

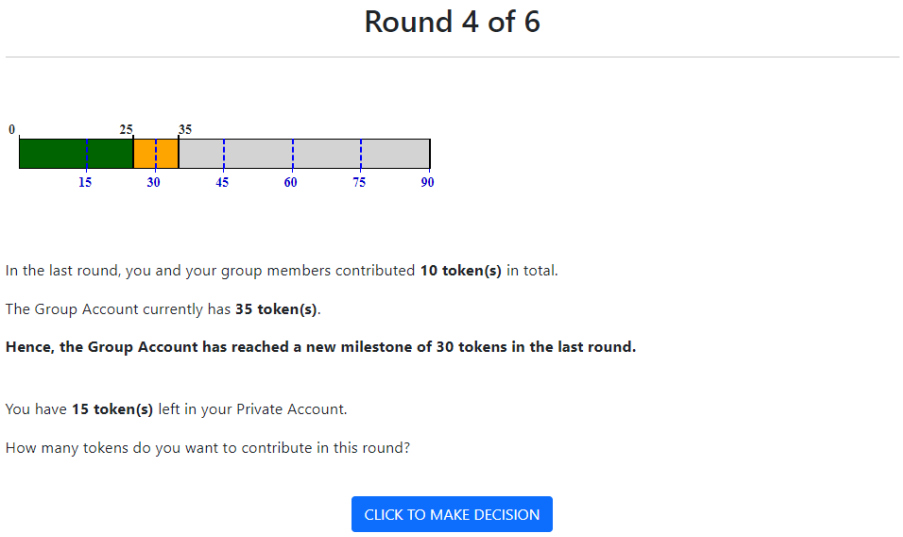
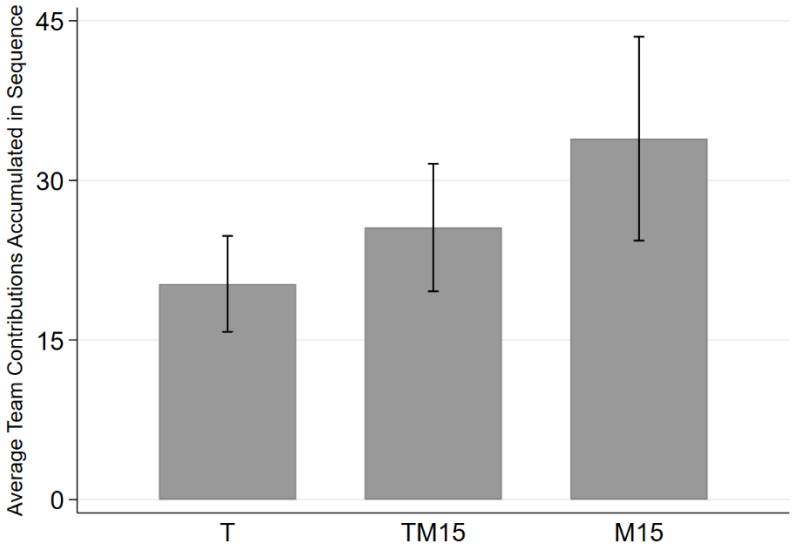
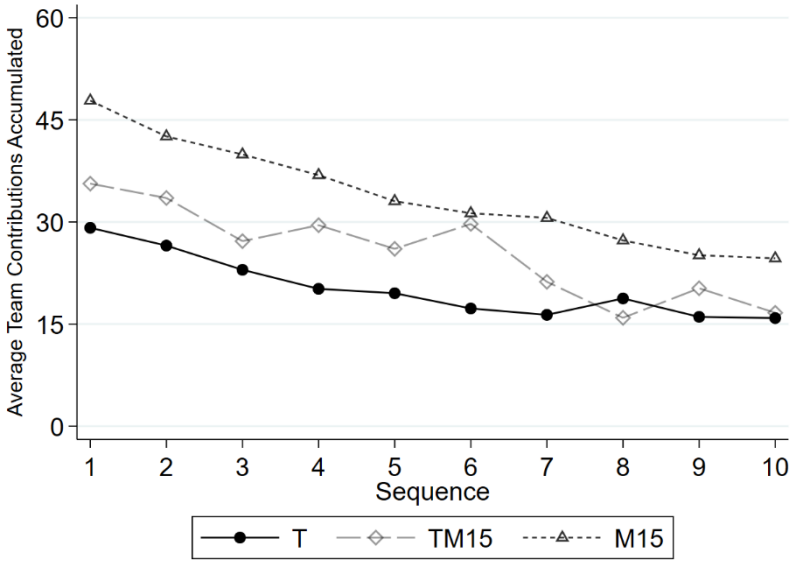


Figure 6: Example of Feedback Screen in Treatment TM15



(a) Pooled across all 10 sequences



(b) By sequence

Figure 7: Average team contributions accumulated in sequence (Study 2)

Note: Averages computed over individual team-sequences. Bars represent 95% confidence intervals accounting for standard errors clustered at the session level.

ONLINE APPENDIX

Appendix A Experimental Instructions

This appendix includes the instructions for the experiment reported in the paper.

OVERVIEW (ALL TREATMENTS)

WELCOME and thank you for participating!

This is an experiment in decision making. Please read all the instructions carefully. A clear understanding of the instructions will help you make better decisions and increase your earnings from the experiment.

There are two parts to the experiment. You will receive instructions for Part II once Part I is completed. You will also be asked to complete a short survey after Part II. At the end of the experiment, either Part I or Part II will be randomly chosen by the computer for payment.

In this experiment, all earnings are expressed in tokens. Your earnings will be converted to Australian dollars (AUD) at a rate of 2 tokens = 1 AUD and paid to you privately at the end of the experiment. In addition to the earnings from the experiment, you will receive a participation fee of $5. At the end of the experiment, you will be paid via bank transfer in private.

If you have any questions, please raise your hand and we will answer your questions privately.

PART I (TREATMENT T)

Instruction for Part I

The basic idea

In Part I, you will participate in **10 sequences** of the same tasks. Each sequence consists of **6 decision rounds**.

At the beginning of each sequence, you will be randomly matched with 2 other participants into **a group of 3**. You will remain in the **same group** throughout the 6 decision rounds in a given sequence, but you will be matched to a **new group** at the beginning of each sequence. The other members of your group will not know your identity, nor will you know their identities.

In each sequence, each group member will make a contribution decision in each of the 6 decision rounds. Your earnings will depend on the contributions made by you and the other members in your group.

This is what each sequence will entail.

At the beginning of the sequence, you and your group members will each receive **30 tokens** in your **Private Accounts**. **These 30 tokens will last you for all 6 decision rounds in the sequence**.

In each round you can decide how many tokens you want to contribute to the **Group Account**, with **the rest remaining in your Private Account**. This is done in the following way:

1. In the first round, you will make a contribution from your initial 30 tokens.
2. In the subsequent 5 rounds, you will make a contribution from the **remaining** tokens in your Private Account. In each round, you can choose any contribution from 0 to the number of tokens remaining in your Private Account from the previous round.
3. You will not be allowed to remove any tokens from the Group Account. Once made, any contributions made to the Group Account cannot be reversed and will remain in the Group Account until the end of the sequence.

All the contributions have to be made in **whole numbers**.

Each round will last for 1 minute. If you do not make a decision within 1 minute, then your contribution in that round will be recorded as 0.

This is what happens between decision rounds.

At the end of each round, before you make your decision for the next round, you will receive information on:

1. The total number of tokens in the Group Account.
This is equal to the **accumulated sum** of tokens that you and the other group members have contributed up to this point in the sequence.

2. The number of tokens that you have left in the Private Account.
This is equal to 30 minus the total number of tokens that you have contributed up to this point in the sequence.

This is how your earnings will be determined.

Your earnings from each sequence will be determined after round 6 in the following manner.

Your earnings will depend on the number of tokens in your Private Account and the Group Account. You will keep any tokens remaining in your Private Account. Additionally, you and each group member will receive **0.4** tokens for each token there is in the Group Account.

Hence, your earnings in each sequence will be given by:
Your earnings = Tokens in your Private Account + 0.4 × Sum of tokens in the Group Account

It is worth noting that your contribution to the Group Account also increases the earnings of the other group members. For each token you contribute, the earnings of both you and your group members will increase by 0.4 tokens. Similarly, for each token your group members contribute, your earnings will increase by 0.4 tokens. Your earnings will increase by 1 token for each token in your Private Account.

Example: Suppose that at the end of the 6 rounds you have contributed 20 tokens and kept 10 tokens in your Private Account. The other 2 members of your group make a total contribution of 40 tokens. Then, the Group Account has 20 + 40 = 60 tokens. Your earnings in the sequence will be 10 + (0.4 × 60) = 34 tokens.

At the end of today's experiment, if Part I is chosen for payment, the computer will randomly select one of the 10 sequences to determine your earnings.

This is what happens between sequences.

After 6 rounds of a sequence, you will be matched with two other participants to form a **new group.** You and your new group members will then proceed to the next sequence.

At the beginning of each sequence, all Private and Group Accounts will be **reset to zero**. You will then **receive a new endowment of 30 tokens** in your Private Account.

Summary of Part I

1. There are 10 sequences and each sequence consists of 6 decision rounds.
2. At the beginning of each sequence:
    i. You will be matched to a new group of 3.
    ii. All Private Accounts and Group Accounts will be reset to zero.
    iii. Each group member will receive a new endowment of 30 tokens in their Private Accounts.
3. In each decision round of a sequence, you will decide how many tokens you want to contribute to the Group Account, with the rest remaining in your Private Account for the next round.
4. At the end of each round of a sequence, you will receive information on:
    i. The total number of tokens accumulated in the Group Account up to this point in the sequence.
    ii. The number of tokens that you have left in the Private Account.
5. Your earnings in a sequence will be determined after the last decision round of the sequence in the following way:
    i. You will keep any tokens remaining in your Private Account.
    ii. You and each group member will receive 0.4 tokens for each token there is in the Group Account.
6. If Part I is chosen for payment, you will be paid for one randomly selected sequence.

PART I (TREATMENT M15)

Instruction for Part I

The basic idea

In Part I, you will participate in **10 sequences** of the same tasks. Each sequence consists of **6 decision rounds.**

At the beginning of each sequence, you will be randomly matched with 2 other participants into **a group of 3**. You will remain in the **same group** throughout the 6 decision rounds in a given sequence, but you will be matched to a **new group** at the beginning of each sequence. The other members of your group will not know your identity, nor will you know their identities.

In each sequence, each group member will make a contribution decision in each of the 6 decision rounds. Your earnings will depend on the contributions made by you and the other members in your group.

This is what each sequence will entail.

At the beginning of the sequence, you and your group members will each receive **30 tokens** in your **Private Accounts**. **These 30 tokens will last you for all 6 decision rounds in the sequence**.

In each round you can decide how many tokens you want to contribute to the **Group Account**, with **the rest remaining in your Private Account**. This is done in the following way:

1. In the first round, you will make a contribution from your initial 30 tokens.
2. In the subsequent 5 rounds, you will make a contribution from the **remaining** tokens in your Private Account. In each round, you can choose any contribution from 0 to the number of tokens remaining in your Private Account from the previous round.
3. You will not be allowed to remove any tokens from the Group Account. Once made, any contributions made to the Group Account cannot be reversed and will remain in the Group Account until the end of the sequence.

All the contributions have to be made in **whole numbers**.

Each round will last for 1 minute. If you do not make a decision within 1 minute, then your contribution in that round will be recorded as 0.

<u>This is what happens between decision rounds.</u>

At the end of each round, before you make the decision for the next round, you will receive information on the status of your Private Account and the Group Account. The information given on the Group Account will be based on **6 milestones: 15, 30, 45, 60, 75, and 90**. Specifically, you will receive information on:

1. Whether the total number of tokens in the Group Account has reached a milestone.
This is equal to the **accumulated sum** of tokens that you and the other group members have contributed up to this point in the sequence. You will be told whether this number has reached the milestone of 15, 30, 45, 60, 75, or 90.

2. The number of tokens that you have left in the Private Account.
This is equal to 30 minus the total number of tokens that you have contributed up to this point in the sequence.

<u>This is how your earnings will be determined.</u>

Your earnings from each sequence will be determined after round 6 in the following manner.

Your earnings will depend on the number of tokens in your Private Account and the Group Account. You will keep any tokens remaining in your Private Account. Additionally, you and each group member will receive **0.4** tokens for each token there is in the Group Account.

Hence, your earnings in each sequence will be given by:
Your earnings = Tokens in your Private Account + 0.4 × Sum of tokens in the Group Account

It is worth noting that your contribution to the Group Account also increases the earnings of the other group members. For each token you contribute, the earnings of both you and your group members will increase by 0.4 tokens. Similarly, for each token your group members contribute, your earnings will increase by 0.4 tokens. Your earnings will increase by 1 token for each token in your Private Account.

Example: Suppose that at the end of the 6 rounds you have contributed 20 tokens and kept 10 tokens in your Private Account. The other 2 members of your group make a total contribution of 40 tokens. Then, the Group Account has 20 + 40 = 60 tokens. Your earnings in the sequence will be 10 + (0.4 × 60) = 34 tokens.

At the end of today's experiment, if Part I is chosen for payment, the computer will randomly select one of the 10 sequences to determine your earnings.

This is what happens between sequences.

After 6 rounds of a sequence, you will be matched with two other participants to form a **new group**. You and your new group members will then proceed to the next sequence.
At the beginning of each sequence, all Private and Group Accounts will be **reset to zero**. You will then **receive a new endowment of 30 tokens** in your Private Account.

Summary of Part I

1. There are 10 sequences and each sequence consists of 6 decision rounds.
2. At the beginning of each sequence:
    i. You will be matched to a new group of 3.
    ii. All Private Accounts and Group Accounts will be reset to zero.
    iii. Each group member will receive a new endowment of 30 tokens in their Private Accounts.
3. In each decision round of a sequence, you will decide how many tokens you want to contribute to the Group Account, with the rest remaining in your Private Account for the next round.
4. At the end of each round of a sequence, you will receive information on:
    i. Whether the total number of tokens accumulated in the Group Account up to this point in the sequence has reached the milestone of 15, 30, 45, 60, 75, or 90.
    ii. The number of tokens that you have left in the Private Account.
5. Your earnings in a sequence will be determined after the last decision round of the sequence in the following way:
    i. You will keep any tokens remaining in your Private Account.
    ii. You and each group member will receive 0.4 tokens for each token there is in the Group Account.
6. If Part I is chosen for payment, you will be paid for one randomly selected sequence.

PART I (TREATMENT M30)

Instruction for Part I

The basic idea

In Part I, you will participate in **10 sequences** of the same tasks. Each sequence consists of **6 decision rounds**.

At the beginning of each sequence, you will be randomly matched with 2 other participants into **a group of 3**. You will remain in the **same group** throughout the 6 decision rounds in a given sequence, but you will be matched to a **new group** at the beginning of each sequence. The other members of your group will not know your identity, nor will you know their identities.

In each sequence, each group member will make a contribution decision in each of the 6 decision rounds. Your earnings will depend on the contributions made by you and the other members in your group.

This is what each sequence will entail.

At the beginning of the sequence, you and your group members will each receive **30 tokens** in your **Private Accounts**. **These 30 tokens will last you for all 6 decision rounds in the sequence**.

In each round you can decide how many tokens you want to contribute to the **Group Account**, with **the rest remaining in your Private Account**. This is done in the following way:

1. In the first round, you will make a contribution from your initial 30 tokens.
2. In the subsequent 5 rounds, you will make a contribution from the **remaining** tokens in your Private Account. In each round, you can choose any contribution from 0 to the number of tokens remaining in your Private Account from the previous round.
3. You will not be allowed to remove any tokens from the Group Account. Once made, any contributions made to the Group Account cannot be reversed and will remain in the Group Account until the end of the sequence.

All the contributions have to be made in **whole numbers**.

Each round will last for 1 minute. If you do not make a decision within 1 minute, then your contribution in that round will be recorded as 0.

This is what happens between decision rounds.

At the end of each round, before you make the decision for the next round, you will receive information on the status of your Private Account and the Group Account. The information given on the Group Account will be based on **3 milestones: 30, 60, and 90**. Specifically, you will receive information on:

1. Whether the total number of tokens in the Group Account has reached a milestone.
This is equal to the **accumulated sum** of tokens that you and the other group members have contributed up to this point in the sequence. You will be told whether this number has reached the milestone of 30, 60, or 90.

2. The number of tokens that you have left in the Private Account.
This is equal to 30 minus the total number of tokens that you have contributed up to this point in the sequence.

This is how your earnings will be determined.

Your earnings from each sequence will be determined after round 6 in the following manner.

Your earnings will depend on the number of tokens in your Private Account and the Group Account. You will keep any tokens remaining in your Private Account. Additionally, you and each group member will receive **0.4** tokens for each token there is in the Group Account.

Hence, your earnings in each sequence will be given by:
Your earnings = Tokens in your Private Account + 0.4 × Sum of tokens in the Group Account

It is worth noting that your contribution to the Group Account also increases the earnings of the other group members. For each token you contribute, the earnings of both you and your group members will increase by 0.4 tokens. Similarly, for each token your group members contribute, your earnings will increase by 0.4 tokens. Your earnings will increase by 1 token for each token in your Private Account.

Example: Suppose that at the end of the 6 rounds you have contributed 20 tokens and kept 10 tokens in your Private Account. The other 2 members of your group make a total contribution of 40 tokens. Then, the Group Account has 20 + 40 = 60 tokens. Your earnings in the sequence will be 10 + (0.4 × 60) = 34 tokens.

At the end of today's experiment, if Part I is chosen for payment, the computer will randomly select one of the 10 sequences to determine your earnings.

This is what happens between sequences.

After 6 rounds of a sequence, you will be matched with two other participants to form a **new group**. You and your new group members will then proceed to the next sequence.
At the beginning of each sequence, all Private and Group Accounts will be **reset to zero**. You will then **receive a new endowment of 30 tokens** in your Private Account.

Summary of Part I

1. There are 10 sequences and each sequence consists of 6 decision rounds.
2. At the beginning of each sequence:
    i. You will be matched to a new group of 3.
    ii. All Private Accounts and Group Accounts will be reset to zero.
    iii. Each group member will receive a new endowment of 30 tokens in their Private Accounts.
3. In each decision round of a sequence, you will decide how many tokens you want to contribute to the Group Account, with the rest remaining in your Private Account for the next round.
4. At the end of each round of a sequence, you will receive information on:
    i. Whether the total number of tokens accumulated in the Group Account up to this point in the sequence has reached the milestone of 30, 60, or 90.
    ii. The number of tokens that you have left in the Private Account.
5. Your earnings in a sequence will be determined after the last decision round of the sequence in the following way:
    i. You will keep any tokens remaining in your Private Account.
    ii. You and each group member will receive 0.4 tokens for each token there is in the Group Account.
6. If Part I is chosen for payment, you will be paid for one randomly selected sequence.

PART I (TREATMENT TM15)

Instruction for Part I

The basic idea

In Part I, you will participate in **10 sequences** of the same tasks. Each sequence consists of **6 decision rounds**.

At the beginning of each sequence, you will be randomly matched with 2 other participants into **a group of 3**. You will remain in the **same group** throughout the 6 decision rounds in a given sequence, but you will be matched to a **new group** at the beginning of each sequence. The other members of your group will not know your identity, nor will you know their identities.

In each sequence, each group member will make a contribution decision in each of the 6 decision rounds. Your earnings will depend on the contributions made by you and the other members in your group.

This is what each sequence will entail.

At the beginning of the sequence, you and your group members will each receive **30 tokens** in your **Private Accounts**. **These 30 tokens will last you for all 6 decision rounds in the sequence**.

In each round you can decide how many tokens you want to contribute to the **Group Account**, with **the rest remaining in your Private Account**. This is done in the following way:

1. In the first round, you will make a contribution from your initial 30 tokens.
2. In the subsequent 5 rounds, you will make a contribution from the **remaining** tokens in your Private Account. In each round, you can choose any contribution from 0 to the number of tokens remaining in your Private Account from the previous round.
3. You will not be allowed to remove any tokens from the Group Account. Once made, any contributions made to the Group Account cannot be reversed and will remain in the Group Account until the end of the sequence.

All the contributions have to be made in **whole numbers**.

Each round will last for 1 minute. If you do not make a decision within 1 minute, then your contribution in that round will be recorded as 0.

This is what happens between decision rounds.

At the end of each round, before you make your decision for the next round, you will receive information on the status of your Private Account and the Group Account. The information given on the Group Account will relate to **6 milestones: 15, 30, 45, 60, 75, and 90**.

1. **The total number of tokens in the Group Account and whether this number has reached a milestone.**

That is, you will be told the **accumulated sum** of tokens that you and the other group members have contributed up to this point in the sequence, **and** whether this sum has reached the milestone of 15, 30, 45, 60, 75, or 90.

2. **The number of tokens that you have left in the Private Account.**

This is equal to 30 minus the total number of tokens that you have contributed up to this point in the sequence.

This is how your earnings will be determined.

Your earnings from each sequence will be determined after round 6 in the following manner.

Your earnings will depend on the number of tokens in your Private Account and the Group Account. You will keep any tokens remaining in your Private Account. Additionally, you and each group member will receive **0.4** tokens for each token there is in the Group Account.

Hence, your earnings in each sequence will be given by:
Your earnings = Tokens in your Private Account + 0.4 × Sum of tokens in the Group Account

It is worth noting that your contribution to the Group Account also increases the earnings of the other group members. For each token you contribute, the earnings of both you and your group members will increase by 0.4 tokens. Similarly, for each token your group members contribute, your earnings will increase by 0.4 tokens. Your earnings will increase by 1 token for each token in your Private Account.

Example: Suppose that at the end of the 6 rounds you have contributed 20 tokens and kept 10 tokens in your Private Account. The other 2 members of your group make a total contribution of 40 tokens. Then, the Group Account has 20 + 40 = 60 tokens. Your earnings in the sequence will be 10 + (0.4 × 60) = 34 tokens.

At the end of today's experiment, if Part I is chosen for payment, the computer will randomly select one of the 10 sequences to determine your earnings.

This is what happens between sequences.

After 6 rounds of a sequence, you will be matched with two other participants to form a **new group.** You and your new group members will then proceed to the next sequence.
At the beginning of each sequence, all Private and Group Accounts will be **reset to zero**. You will then **receive a new endowment of 30 tokens** in your Private Account.

Summary of Part I

1. There are 10 sequences and each sequence consists of 6 decision rounds.
2. At the beginning of each sequence:
    i. You will be matched to a new group of 3.
    ii. All Private Accounts and Group Accounts will be reset to zero.
    iii. Each group member will receive a new endowment of 30 tokens in their Private Accounts.
3. In each decision round of a sequence, you will decide how many tokens you want to contribute to the Group Account, with the rest remaining in your Private Account for the next round.
4. At the end of each round of a sequence, you will receive information on:
    i. The total number of tokens accumulated in the Group Account up to this point in the sequence.
    ii. Whether the number of tokens in the Group Account has reached the milestone of 15, 30, 45, 60, 75, or 90.
    iii. The number of tokens that you have left in the Private Account.
5. Your earnings in a sequence will be determined after the last decision round of the sequence in the following way:
    i. You will keep any tokens remaining in your Private Account.
    ii. You and each group member will receive 0.4 tokens for each token there is in the Group Account.
6. If Part I is chosen for payment, you will be paid for one randomly selected sequence.

PART II (ALL TREATMENTS)

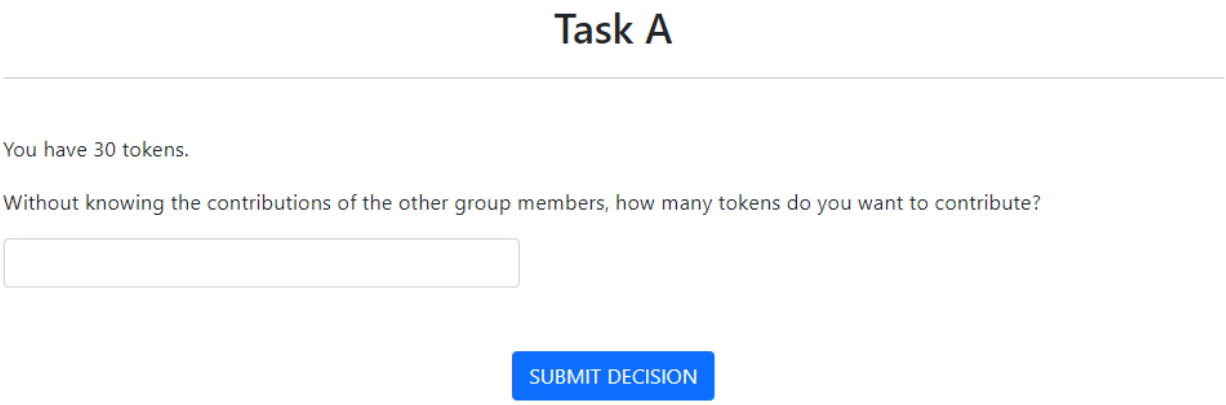
In Part II, you will be matched into **a new group** of 3, and each group member will be given **an endowment of 30 tokens**. As in Part I, you and each group member will make contributions to the Group Account with the 30 tokens.

However, **unlike Part I,** you will only participate in this task **once**, and you will only be making your contribution **once**. In other words, you and each group member will only have one opportunity to decide how many tokens you want to contribute, with the rest remaining in your Private Account.

Your earnings will be determined in the same way as in Part I. Specifically, you will keep all the tokens in your Private Account, and you and each group member will receive 0.4 tokens for each token there is in the Group Account.

You will make your decisions in two different tasks: Task A and Task B.

In Task A, you will decide how many tokens you want to contribute **without knowing how many tokens your group members have contributed**. You will see the following decision screen in Task A:



In Task B, you will decide how many tokens you want to contribute **conditional on information given to you about the contributions made by your group members**. You will see the following table in Task B:

Task B

The numbers under the **Average column** are the possible **average** number of tokens contributed by the other group members. For each possible case, indicate the number of tokens you want to contribute in the corresponding box.

Average (of the other two members)	Your contribution	Average (of the other two members)	Your contribution
0		16	
2		18	
4		20	
6		22	
8		24	
10		26	
12		28	
14		30	

SUBMIT DECISION

The numbers under the **Average column** are the possible **average** number of tokens contributed by your group members. **For each possible case, you will be asked to decide how many tokens you want to contribute**. For example, in the fourth line of the second column, you will be asked to decide how many tokens you want to contribute if your group members contribute 6 tokens each on average.

At the end of the experiment, **one of the three group members** will be randomly selected, and their **Task B** decisions will be implemented. For the **other two members**, their **Task A** decisions will be implemented.

Specifically, if you are selected to play Task A, your contribution will be your Task A decision. On the other hand, if you are selected to play Task B, your contribution will depend on the **average** contribution of your group members. The average contribution of your group members

will be rounded to the nearest even number. Then, your contribution will be your Task B decision corresponding to your group members' rounded average contribution.

Example: Suppose your Task B decisions are implemented. Then, your group members' Task A decisions are implemented. Suppose also that your group members contributed 18 and 22 tokens in Task A. This gives an average of 20 tokens. In Task B, suppose you indicated that you want to contribute 20 tokens if the others contribute 20 tokens on average. Then, the Group Account has 18 + 22 + 20 = 60 tokens in total. Hence, you and each group member will receive 0.4 × 60 = 24 tokens from the Group Account. Since you kept 30 – 20 = 10 tokens in your Private Account, your total payoff will be 24 + 10 = 34 tokens.

Since you do not know whether Task A or Task B decisions will be implemented, it is advisable that you think carefully about all the decisions you make.

Appendix B Additional Tables and Figures

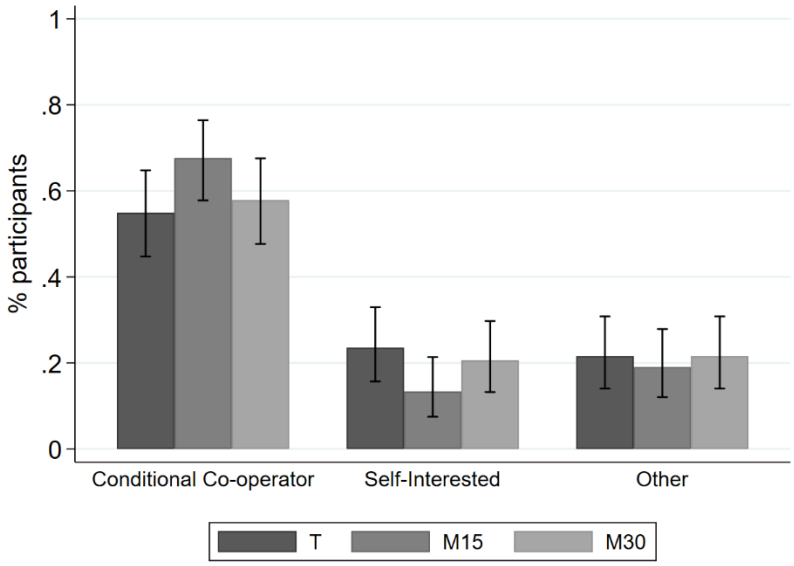


Figure B1: Classification of participants based on decisions in the conditional cooperation task (Study 1)

Note: Bars represent 95% confidence intervals.

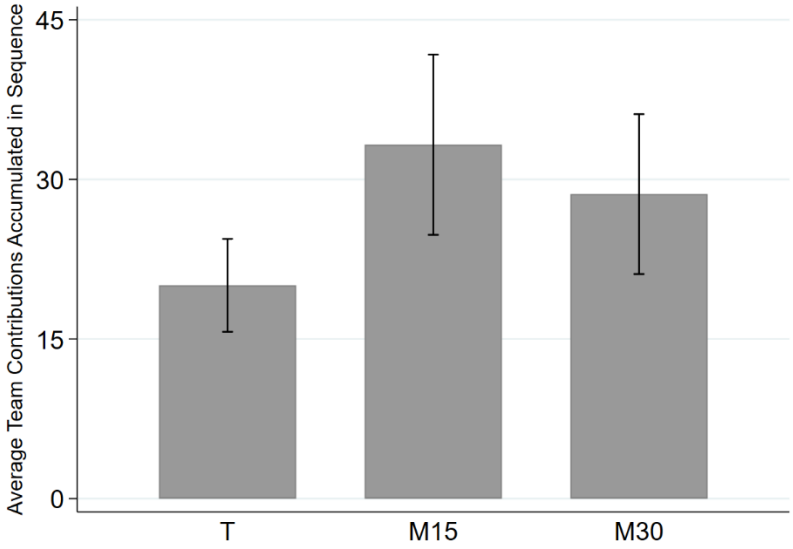
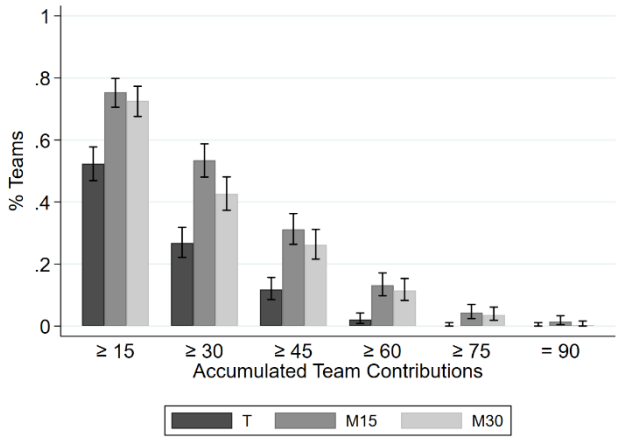
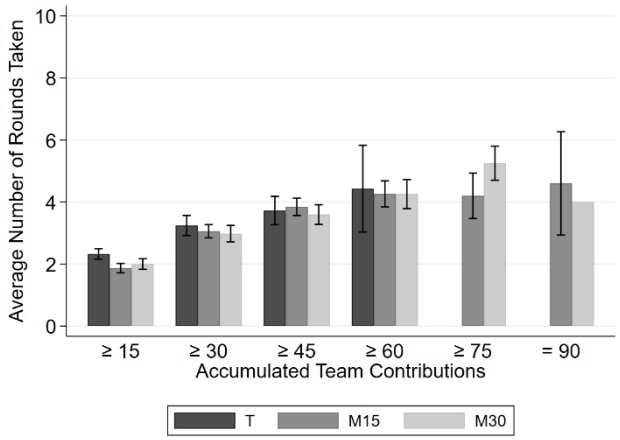


Figure B2: Average team contributions accumulated in sequence using session average as a unit of observation (Study 1)

Note: Averages computed over sessions. Bars represent 95% confidence intervals. The conclusions from non-parametric analyses in this figure are the same as those reported in the main text. Specifically, p-values of rank-sum tests for comparisons between: (i) T and M15 = 0.001; (ii) T and M30 = 0.029; and (iii) M15 and M30 = 0.620.

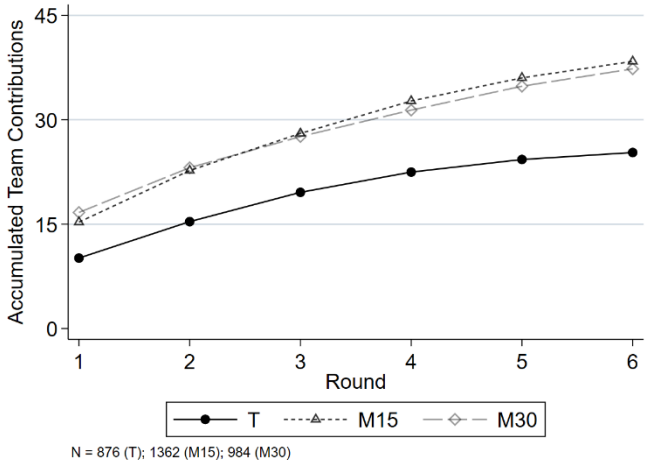


(a) Percentage of teams with accumulated contributions exceeding specific thresholds, by treatment

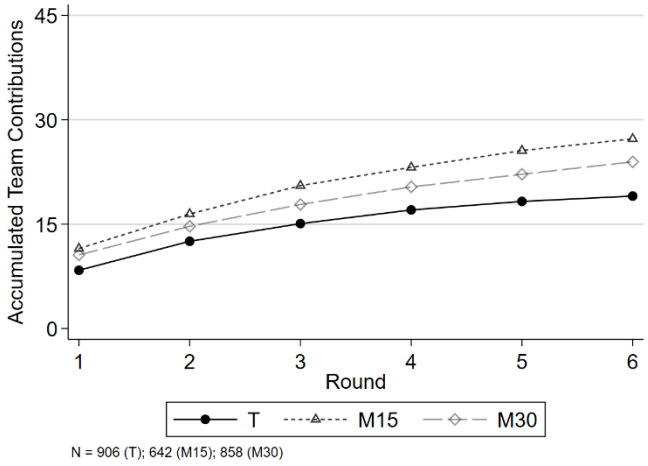


(b) Average number of rounds taken by team to exceed specific thresholds (conditional on exceeding the threshold), by treatment

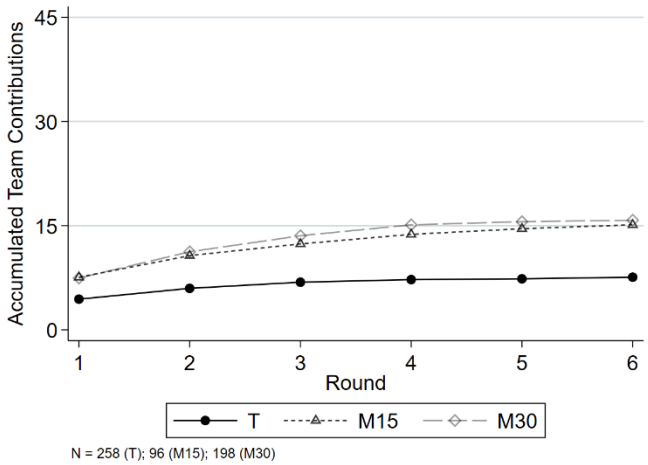
Figure B3: Teams with accumulated contributions exceeding specific thresholds by treatment (Study 1)



(a) No self-interested individual in team



(b) 1 self-interested individual in team



(c) 2 or 3 self-interested individuals in team

Figure B4: Average team contributions accumulated in each round by team composition (Study 1)

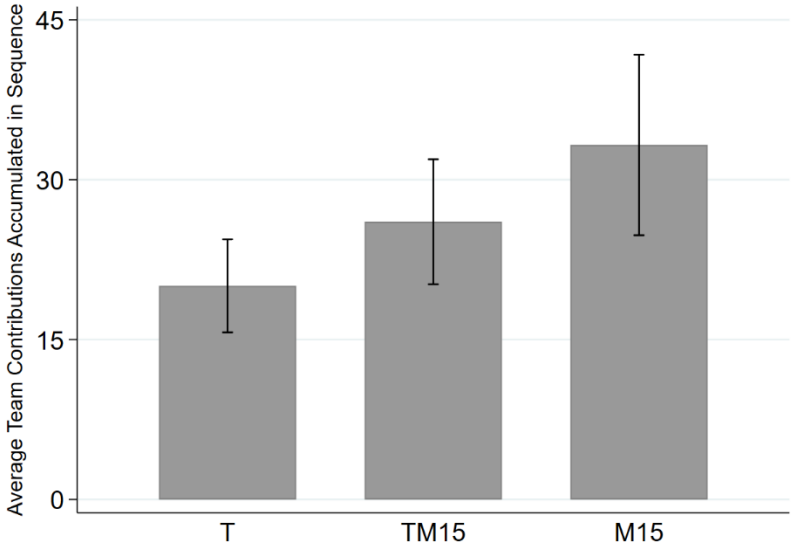


Figure B5: Average team contributions accumulated in sequence using session average as a unit of observation (Study 2)

Note: Averages computed over sessions. Bars represent 95% confidence intervals. The conclusions from non-parametric analyses in this figure are the same as those reported in the main text. Specifically, p-values of rank-sum tests for comparisons between: (i) T and M15 = 0.001; (ii) T and M30 = 0.029; and (iii) M15 and M30 = 0.620.

Table B1: OLS regressions of individual contributions in each sequence by individual participants' type (Study 2)

	Dependent variable: Individual contributions in each sequence								
	Conditional Cooperator			Self-Interested			Other Type		
Variables	All sequences (1)	Sequence 1-5 (2)	Sequence 6-10 (3)	All sequences (4)	Sequence 1-5 (5)	Sequence 6-10 (6)	All sequences (7)	Sequence 1-5 (8)	Sequence 6-10 (9)
M15	4.711***	5.575***	3.849**	0.029	1.269	-1.128	3.114	4.185**	2.048
	(1.648)	(1.644)	(1.750)	(1.354)	(1.876)	(1.106)	(2.198)	(1.955)	(2.688)
TM15	2.892**	3.431**	2.356*	0.019	0.160	-0.138	2.133	2.707	1.525
	(1.213)	(1.295)	(1.178)	(1.104)	(1.612)	(0.954)	(2.540)	(2.910)	(2.422)
% other members who are self-interested	-4.024***	-3.248***	-4.814***	-1.940*	-0.680	-2.678***	-1.413	-0.814	-1.900
	(0.859)	(1.063)	(1.147)	(1.110)	(2.363)	(0.749)	(1.492)	(1.600)	(2.242)
Sequence	-0.742***	-1.025***	-0.714***	-0.500***	-0.701***	-0.450***	-0.626***	-0.919***	-0.169
	(0.058)	(0.137)	(0.168)	(0.126)	(0.247)	(0.138)	(0.123)	(0.172)	(0.302)
Constant	12.755***	12.824***	13.303***	6.890***	6.877***	7.043***	11.515***	11.817***	8.423***
	(0.757)	(0.885)	(1.395)	(1.027)	(1.367)	(1.264)	(1.168)	(0.979)	(2.694)
M15 – TM15	1.819	2.144	1.493	0.010	1.110	-0.990	0.981	1.477	0.522
	(1.860)	(1.802)	(1.970)	(1.391)	(2.048)	(0.957)	(3.023)	(3.228)	(3.077)
Observations	1,960	980	980	690	345	345	560	280	280
# sessions (clusters)	23	23	23	22	22	22	21	21	21
R-squared	0.130	0.114	0.082	0.053	0.021	0.044	0.066	0.064	0.017

Standard errors clustered at the session level in parentheses. Treatment T is the baseline in all specifications.
* p<0.10, ** p<0.05, *** p<0.01.