Are Teams Conditionally Cooperative? Experimental Evidence from a Public Goods Game*

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Abstract

We study whether teams are conditional cooperators in a one-shot public goods game and to what extent this conditionality differs from that when the decisions are made by individuals. We find teams under a majority rule do not exhibit significantly different levels of conditionally cooperative behavior than individuals in isolation. In addition, we find teams under a random representative rule are less conditionally cooperative than teams under a majority rule. This result implies majority rule enhances conditional cooperation compared to a dictatorship. This thereby may lead to more prosocial outcomes which is indeed what our experiment finds.

1. Introduction

Individuals' decisions to engage in prosocial activities are not only affected by economic incentives and their own ethics but also, perhaps more importantly, by the surrounding social environment. The literature has shown that individuals have a tendency to follow others' actions in undertaking prosocial activities such as charitable giving, energy conservation, and recycling (Viscusi et al., 2011; Cialdini et al., 1990; Allcott, 2011; Shang and Croson, 2009). This peer influence could be revoked by multiple reasons, examples of which include others' behavior signals socially desirable behavior, individuals have underlying preferences for inequality aversion, reciprocity, and/or concerns for social images which pressure them to conform to social norms (Fowler et al., 2005; Fischbacher et al., 2001; Gächter et al., 2013; Frey and Meier, 2004).

The peer influence on prosocial behavior can be demonstrated by individuals' conditionally cooperative behavior found in public goods experiments, i.e., individuals are willing to contribute more when others contribute more (Fischbacher et al., 2001; Keser and Van Winden, 2000). However, in reality many prosocial decisions are made by teams rather than by individuals. For instance, households decide whether to invest in costly energy conservation technologies. Companies decide whether to adopt corporate social responsibility policies. Municipalities decide whether to enact stringent environmental by-laws. And national governments decide whether to implement state-wide climate change policies. This raises the question of whether the conditionally cooperative behavior observed from studies on individual decisions carries over to team decisions. The literature has documented behavioral differences between teams and individuals (see surveys by Charness and Sutter (2012) and Kugler et al. (2012)). If teams have a different tendency to conditional cooperation from that of individuals, given that conditional cooperation to a great extent explains why players in public goods experiments do not act as selfish as what game theoretic models predicts, results from economic experiments with individuals being decision makers may serve as a biased predictor of the outcomes when teams are the decision makers. In addition, policymakers may benefit from knowing the extent of peer influence among teams relative to individuals, as it can shed light on the effectiveness of using social-comparison-based instruments targeted at organizations to encourage prosocial activities.

To study whether teams are conditional cooperators in undertaking prosocial activities and to what extent the conditionality differ from that of individuals, it is important to incorporate different team decision rules. For instance, one can expect the degree of democracy in a team's decision rule to affect conditional cooperative behavior. The existing literature, however, has rarely studied such interaction. This paper provides a first step in understanding conditional cooperation among individuals compared to that of teams under various decision rules.

We designed a public goods experiment with the goal of answering three main questions: 1) To what extent does the conditionally cooperative behavior differ between teams and individuals? 2) How do team decision rules affect this difference (or lack thereof)? 3) What are the mechanisms that explain this difference (or lack thereof)? Four between-subjects treatments are implemented accordingly. Treatment A: The baseline where all participants make decisions individually in a 4-person public goods game with unconditional and conditional contribution rounds. Treatment B: A majority rule treatment where participants are randomized into teams of 3, with in-team communication allowed prior to the submission of contribution amounts. The majority vote determines each team's decision in a 4-team public goods game. Treatment C: A random ballot rule treatment where participants are randomized into teams of 3, with communication not allowed among team members. A representative is randomly drawn for each team, whose decision determines the team's contribution in a 4-team public goods game. Treatment D: A random ballot rule treatment otherwise identical to Treatment C but with in-team communication allowed prior to the submission of contribution amounts.

The first two research questions are investigated by comparing teams' public goods contribution, under a majority rule versus a random ballot rule with and without communication, to a baseline of individuals' contribution. Decisions determined by a majority rule preceded by communication closely mimic many situations of democratic team decision-making. Whereas decisions determined by a random representative rule represent a situation where decisions are made by a dictator. This decision-making rule is called random ballot in an electoral system.[1] To gain insights into the mechanism behind the difference (or lack thereof) of the conditionally cooperative behavior between teams and individuals, we first examine whether participants change their behavior when they are members of a team rather than individuals in isolation, i.e., the mere effect of group membership. To do so, we examine whether individuals would change their behavior when they are in a team under the random ballot rule when communication is not allowed prior to the decisions. We then examine how communication between team members affects individuals' behavior in a team. For this purpose, we compare individuals' decisions in a team with random ballot rule preceded by communication to an all-else-equal treatment while communication is not permitted. Finally, after isolating the effects of group membership and communication, we identify the effect of decision rules on teams' conditionally cooperative behavior.

We find that individuals in team making decisions under a majority rule do not exhibit significantly different levels of conditionally cooperative behavior than individuals in isolation. Under this rule, the percentage of teams that are conditional cooperators are also not significantly different from that of individuals. They, however, display the conditionally cooperative behavior with significantly more self-serving bias, consistent with previous literature's general finding that teams are more rational than individuals.[2] This implies that teams' cooperation is expected to deteriorate faster than individuals' under repeated interaction.

On the other hand, our results show individuals in teams making decisions under random ballot rule are less conditionally cooperative than when individuals make decisions in isolation. Furthermore, the majority rule leads to stronger conditional cooperative behavior

[1] This rule has been applied in the literature when a group representative makes decisions for the group (Song, 2008; Charness and Jackson, 2009)

[2] The "conditional cooperation with a self-serving bias" is also found for conditional cooperators in Fischbacher et al. (2001)

than random ballot. ~~This implies majority rule can enhance conditional cooperation compared to a dictatorship, and thereby may lead to more prosocial outcomes when teams are the decision makers.[3] We indeed find that individuals in teams deciding by majority rules contribute more to the public pool than in teams deciding by random ballot.~~

To explain the results above, first we find that individuals contribute less and exhibit a significantly lower degree of conditionally cooperative behavior when they belong to a team, i.e., the effect of mere group membership. In addition, communication significantly increases the percentage of free-riders in a team. However, the need to reach an agreement of majority in a team with majority rule converts many to become conditionally cooperative, as the conditional cooperators are the predominant type in this treatment. This might explain why individuals in teams with majority rule have similar degree of conditional cooperative behavior as individuals in isolation. Because more individuals contribute less when they belong to a team and also when they communicate, the degree of self-serving bias increases in the conditionally cooperative behavior. However, for the teams deciding by random ballot, without pressure to reach a majority agreement, individuals are more able to stick to their intended behavior rather than conform to the majority behavior which is conditionally cooperative. Therefore individuals in these two treatments are less conditionally cooperative than individuals in isolation.

The next section reviews the literature on the behavioral differences between teams and individuals in related games. Section 3 describes the experimental design. Descriptive analysis and regression results are presented in section 4. Section 5 offers discussion that aim to uncover the blackbox of team decision making process. Section 6 concludes.

2. LITERATURE REVIEW

There are extensive surveys on the behavioral difference between teams and individuals in social psychology (Kugler et al., 2012) and in economics (Charness and Sutter, 2012). The

[3] The survey by Chaudhuri (2011) suggests that conditional cooperators are often able to sustain cooperation through monetary sanction or display of disapproval of free-riders.

overwhelming finding is that teams behave more in line with game theoretical prediction than individuals. For example, the literature shows that teams are less trusting (Cox, 2002; Kugler et al., 2007; Song, 2008), less subject to self-control problems (Babcock et al., 2011), less myopically loss averse (Sutter, 2007), and less over-confident (Camerer and Lovallo, 1999). Among all the findings on the difference in behavioral traits between teams and individuals, the literature directly relevant to conditionally cooperative behavior addresses three aspects: Whether teams are more or less 1) inequality averse; 2) reciprocal; and 3) subject to the pressure to abide by the social norm of cooperation. We discuss each of these below.

One possible reason for conditionally cooperative behavior is the preference for inequality aversion. Evidence on individual and team's preference toward inequality aversion is mixed. Balafoutas et al. (2014) find that individuals in a team that facilitates electronic communication are less inequality averse than when they are in isolation. This is because, through computerized communication, efficiency lovers in the team are more likely to get their choices passed through the team as the final choice. However, He and Villeval (2017), allowing team members to coordinate only through proposals, find that individuals' initial proposals in teams exhibit more inequality aversion than when making decisions in isolation, but the final team decision shows similar degree of inequality aversion compared to individuals. One possible explanation for the different results is that electronic communication has been shown to lead to more self-interested behavior in a team. Since communication in He and Villeval (2017) is restricted, therefore its effect on encouraging self-interested behavior in a team environment is lower than the effect of electronic communications in Balafoutas et al. (2014). Since our experiment includes computerized chat, we project that our findings are more comparable to Balafoutas et al. (2014)'s than He and Villeval (2017)'s.

Individuals' inherent preference for reciprocity is another reason for conditionally cooperative behavior. The literature typically uses either trust games or gift exchange games to examine the difference in the degree of reciprocity between teams and individuals. The majority of the literature finds that teams tend to reciprocate less than individuals do. For example, using a trust game, both Cox (2002) and Song (2008) show that group trustees return significantly smaller amounts conditional on the amounts sent by the trustors. Using a gift exchange game, Ambrus et al. (2015) find that teams also reciprocate less than individuals. The reason is that the group choice tends to be driven by the median member's choice, and the median member's reciprocity level is below that of the mean. Contrary to these findings, Kugler et al. (2007) in a trust game find similar degree of reciprocity between groups and individuals. They did not detect a significant difference in the relative return (ratio of the amounts returned to the trustors to the amounts sent to the trustees) between group and individual trustees.

Finally, social norm conformity could be responsible for conditionally cooperative behavior. The more others contribute, the more individuals feel pressure to contribute. However, teams may provide a "social shelter" in that the group's decision cannot be traced back to individual members (Insko et al., 1998; Schopler et al., 1995). Individuals in a team thus can be less affected by the norm. These lessons from the literature suggest mixed predication on the degree of conditional cooperation of teams versus individuals, and therefore merits further empirical study.

Our experiment also builds upon the literature that compares the unconditional public goods contribution between teams and individuals. Auerswald et al. (2018) study 3-person team's decisions in a fixed-matching repeated public goods game. They find that teams with unanimity decision rules contribute slightly more than individuals and there is no significant difference if the decision follows a majority rule. In their experiment communications are allowed but limited: team members can coordinate through proposals. In contrast, Cox and Stoddard (2018) find that 2-person teams, in a fixed-matching repeated public goods game, contribute overall similar amounts as individuals, although initial contributions are larger for teams. They also find that teams are significantly more self-interested than individuals towards later rounds of the game. The reason for the different results could be due to free-form electronic communication and/or the 2-person team design adopted by Cox and Stoddard (2018). Gillet et al. (2009) examines teams' behavior versus individuals' in an intertemporal common pool resource game. They separate an inter-temporal common's dilemma into two parts: a non-strategic part where players make decisions on how many fish to catch and how many to leave for future catches when players' actions only affect themselves; and a strategic part where players' actions affect other players' payoffs through market price of the fish and the consequence of their catch on the future population of the fish. They find that teams make less myopic decisions in the non-strategic part, but are more competitive in the strategic part. The net result is that teams deciding by a majority rule make less efficient decisions than individuals do in an inter-temporal common pool resource game.

Finally, the paper relates to a strand of literature on the effects of elected leaders compared to the effects of non-elected leaders on the prosocial outcomes. The general finding is that elected leaders lead to more prosocial outcomes than non-elected leaders (Schories, 2022; Drazen and Ozbay, 2019; Hamman et al., 2011; Corazzini et al., 2014). Our paper differs from this literature such that in our context the voting rules are applied within a team and teams are the decision-making unit, whereas the previous literature applies the voting rules to individuals who are the decision-making units.

This study combines important factors examined in streams of literature discussed above and investigates the conditional cooperative behavior of individuals versus teams under various decision rules.

3. Experimental design and procedures

The conditional contribution mechanism of this experimental design is based on Fischbacher et al. (2001). The key feature of the design used to elicit players' willingness for conditional cooperation is based on a variant of "strategy method" (Selten, 1965). The experiment includes four between-subjects treatments: the baseline — individual treatment (IND), a majority team treatment with communication (MAJ), a random ballot team treatment without communication (RAND_WC), and a random ballot team treatment with communication (RAND).

3.1. **Individual treatment**

In this baseline treatment, a group of four individuals shared a public pool. Each member was endowed with 20 tokens at the beginning of the experiment. A participant could either keep the tokens for themselves or contribute any amount (with an upper bound of 20) to the pool. The total contribution to the pool will be multiplied by 2 and then evenly shared by each player, regardless of their contribution to the pool. To summarize, each player's payoff was

$$\pi_i = 20 - g_i + 0.5 \sum_{m=1}^{4} g_m, \tag{1}$$

where g_i is the individual contribution by player i. The Nash equilibrium prediction of each participant's contributions is $g_i = 0$, while the socially optimal contribution $\forall i$ is 20. In the experiment, participants were asked to make two types of decisions sequentially. The first type of decision was unconditional contribution where each participant decided how many of the 20 tokens she wanted to contribute to the pool. After the unconditional decision was made, participants were then asked to indicate their conditional contributions for each of the 21 levels, {0, 1, ..., 20}, of average contribution of their peers. Each of these 21 conditional contribution decisions was made on a separate screen page. The experiment was played only for one iteration. The reason for this design is that we want to avoid confounding preferences with inter-temporal strategic considerations. To make sure all decisions were incentive-compatible, participants were paid according to the following scheme. At the end of the experiment, in each group for one randomly selected individual, the conditional contribution decision would be relevant for her payment. For the other three individuals, the unconditional contribution decision would be the relevant decision[4]. This scheme ensures all decisions were potentially payoff relevant. In the end, each individual learned whether they

[4] The following example illustrates this procedure. Suppose four individuals in a group contributed 0, 8, 10, and 12 respectively for the unconditional contribution decision. Assume the first individual, the one who contributed 0, was selected by the random mechanism, for whom the conditional contribution was the payoff relevant contribution. This implies the other three's unconditional contributions were their payoff relevant contributions. The average contribution of these three individuals was thus $(8 + 10 + 12)/3 = 10$. Suppose the first individual in the conditional contribution decision indicated that she would contribute 20 if others contributed 10 on average. Then her contribution to the pool was taken to be 20. And the total group contribution to the pool was $20 + 8 + 10 + 12 = 50$. Thus, the first individual's final payoff was $20 - 20 + 0.5 * 50 = 25$; and the other three individuals' payoffs were $20 - 8 + 0.5 * 50 = 37$, $20 - 10 + 0.5 * 50 = 35$, and $20 - 12 + 0.5 * 50 = 33$, respectively.

were randomly selected as the conditional contributor or not, the group's total contributions, and their own payoff.

3.2. **Majority team treatment**

This treatment is otherwise same as the baseline except that a group of four teams rather than four individuals shared a public pool. Each team was composed of three individual players, randomly matched at the beginning of each session and without re-matching throughout the session. When making decisions, each team member could propose the number of tokens for the team contribution and all proposed contributions were shown to the team. If all three members proposed different amounts, the team members would need to propose again. A team decision was reached when any two or more members proposed the same amount. This amount would be the team's contribution. In the end, each team member's payoff was identical. Within a team, the team members were allowed to communicate through an computerized chat box before proposing.

3.3. **Random ballot team treatments without and with chat**

The random ballot treatments differed from the majority team treatment in the team decision rule. In these two treatments, after each team member submitted a proposed contribution, one of the proposed amounts was randomly chosen to be the team's decision. The random ballot treatments include two variations: one without and the other with electronic communication among team members.

3.4. **Experimental procedures**

The experiment was conducted in-person at the University of Guelph's FARE Laboratory for Experimental and Applied Economics in summer 2021. Participants were recruited from the lab's participant pool of more than 1,000 individuals that contain both university students and non-student adults. These individuals are mainly from Ontario, Canada, while a small number of them are from other parts of North America.

The public goods game was programmed using Python - oTree (Chen et al., 2016). Upon participants' arrival, they were seated in separate booths with privacy, each equipped with an iPad showing the experimental interface. Participants read and signed the consent form[5], and then the instructions were distributed and read aloud. An overview of the experiment, public goods game simulations, numerical examples, and a quiz were provided (Instructions are included in Appendix A). The public goods game did not begin until all participants in a session passed all quiz questions. At the end of the experiment, we gathered participants' anonymous social demographic information.

In total, 156 participants attended the experiment in 21 independent sessions. Table 1 summarizes the number of sessions and participants for each treatment, showing a balanced sample. The average participant made $25 CAD and the sessions lasted 1 to 1.5 hours.

Table 1. Overview of the treatments

	# of Sessions	# of Participants	# of Teams
IND	12	48	—
MAJ	3	36	12
RAND_WITHOUT	3	36	12
RAND	3	36	12

4. Results

4.1. Descriptive analysis

Table 2 contains the summary statistics on both the unconditional and conditional contributions across different treatments. Comparing individuals' contributions between the individual and the majority treatment, although the average unconditional contributions are similar, the average conditional contributions are lower in the majority treatment. One

[5] This study has been approved by University of Guelph REB 21-05-011

~~possible explanation is the 21 rounds of conditional contribution decisions allow more learning than the one shot unconditional contribution decision. This learning effect may be supported by the smaller average conditional contributions compared to the unconditional contributions for all treatments except random ballot without chat.~~ The table also shows that participants' contributions in random ballot treatments are much less than in the individual treatment. Using Mann-Whitney U-tests, the second and third rows in table 3 shows that these differences are statistically significant ($p - value < 0.05$ for all). This implies that team decisions determined by a random dictator leads to worse social outcome than individuals' decisions. Comparing MAJ treatment to RAND treatment (the fifth row in 3), we see that both conditional and unconditional contribution are significantly smaller in the RAND treatment ($p - value < 0.05$), indicating that democratic system with majority voting rule leads to more prosocial outcomes than dictatorship.

Table 2. Summary statistics for contributions across treatments

	Unconditional contribution			Conditional contribution		
	N	Mean	St.dev	N	Mean	St.dev
IND	48	9.643	5.767	1008	7.969	4.754
MAJ	36	8.778	4.952	756	6.033	3.319
RAND_WITHOUT	36	6.861	6.188	756	6.906	3.623
RAND	36	5.778	5.446	756	4.877	4.368

Our main interest concerns ~~participants'~~ conditionally cooperative behavior, i.e., whether an individual/team is willing to contribute more when others contribute more. Figure 1 shows that for both individual and majority team treatments, the mean contributions are visibly increasing as the average of others' contributions increases. However, this is not the case for the two random ballot treatments. Contributions in these treatments seem to be unaffected by the average contributions of the other teams. To further compare the tendency to conditional cooperate between individuals and teams, we calculate the percentage of conditional cooperators in each treatment.

Table 3. Pairwise comparison in contributions using Mann-Whitney U-test

	Unconditional contribution	Conditional contribution
IND versus MAJ	0.700	0.000^{***}
IND versus RAND_WITHOUT	0.012^{**}	0.001^{***}
IND versus RAND	0.004^{***}	0.000^{***}
MAJ versus RAND_WITHOUT	0.051^{*}	0.000^{***}
MAJ versus RAND	0.012^{**}	0.017^{***}
RAND_WITHOUT versus RAND	0.546	0.000^{***}

Notes: The reported numbers represent p-values from the Mann-Whitney U-test.

The literature often categorizes players in the public goods games into the following behavioral types: conditional cooperators, free-riders, unconditional cooperators, hump-shaped, and other patterns (Fischbacher et al., 2001; Rustagi et al., 2010). Since the behavior of hump-shaped players provide little insight into the conditional cooperative behavior, we incorporate the hump-shaped players with the "other patterns" players in our classifications. Following Thöni and Volk (2018), we define a player as a conditional cooperator (CC) if the Pearson correlation coefficients between her public goods contribution and the average contribution of other members is greater than 0.5. A player is a free-rider (FR) if she consistently contributes 0 regardless of other members' contribution level. Finally, a player is an unconditional cooperator (UC) if she contributes a constant nonzero amount regardless of what others do. Figure 2 shows a similar percentage of conditional cooperators in the individual and the majority team treatment (around 67% and 64% respectively; they are insignificantly different with $p-value = 0.7661$ with Chi-squared test). And these percentages are significantly higher than the percentages in both random ballot treatments (around 42% and 39% for the random ballot with and without chat treatments, respectively). This finding offers an explanation on the stronger conditionally cooperative behavior in both individual and majority treatments shown in figure 1. Note there is a significantly higher percentage of free-riders in the random ballot with chat treatment than the one without chat ($p - value = 0.000$ with Chi-squared test). This implies communication leads to more self-interest behavior, consistent with the literature (e.g., Charness and Sutter (2012) and Ambrus et al. (2015)).

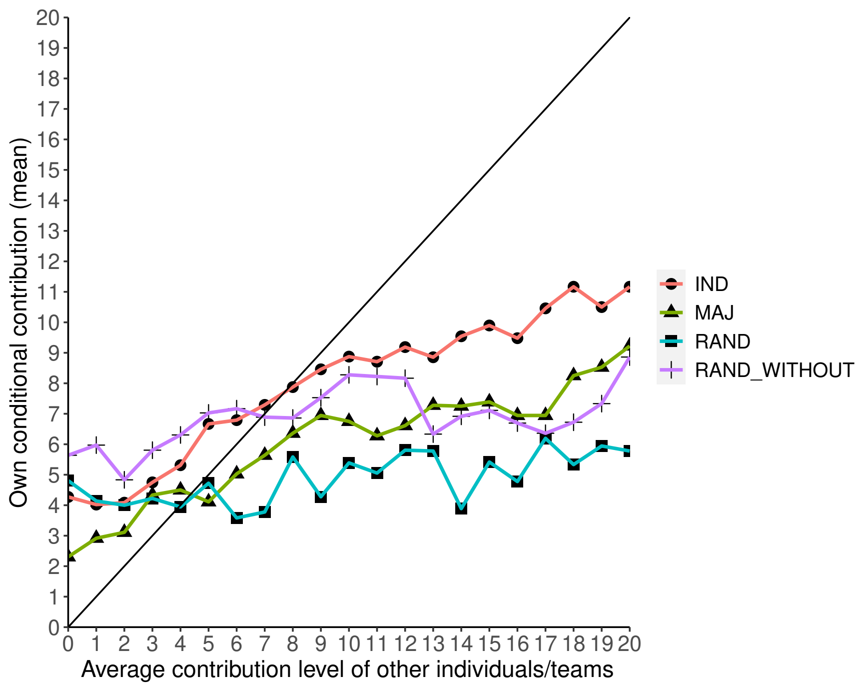

FIGURE 1. Mean extraction as a function of average contributions of others.

Figure 1 also shows that even though participants in the majority team treatment has a similar degree of conditional cooperation as in the individual treatment, the contributions on average are much smaller for any given average contributions of others (Mann-Whitney U-test, $p{-}value = 0.000$). Figure 3 further shows that even among the conditional cooperators, the conditional cooperative behavior in all team treatments exhibit more self-serving bias than in the individual treatments (Mann-Whitney U-test, $p - value = 0.000$ for all three team treatments).

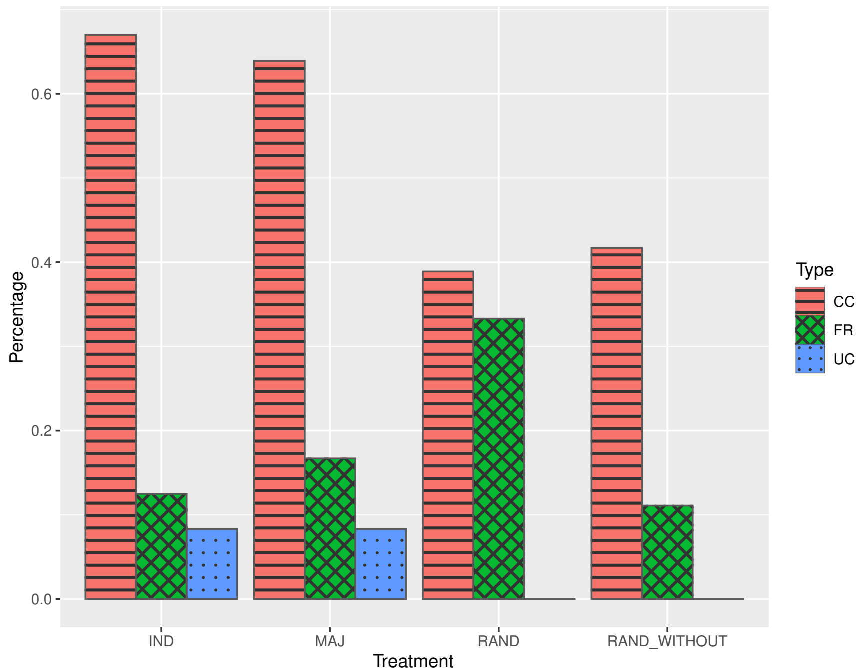

FIGURE 2. Distributions of "types" across treatments.

Note: The table shows that there are no unconditional cooperators in both RAND and RAND_WITHOUT treatments.

4.2. **Econometric estimation**

To complement the descriptive analysis above, we now proceed to econometric estimation. We first compare individual contributions in the three team treatments to that in the individual treatment. We have estimated an OLS as well as a Tobit model for this purpose. Table 4 shows that individuals in both random ballot treatments contribute significantly less than in the individual treatments, for both conditional and unconditional contribution decisions. These results resonate with the general conclusion from the literature that teams are more self-interested. The table also shows that there is no significant difference between unconditional contributions in the MAJ treatment and in the IND treatment. However, individuals' conditional contribution in the MAJ treatment is significantly less than in the

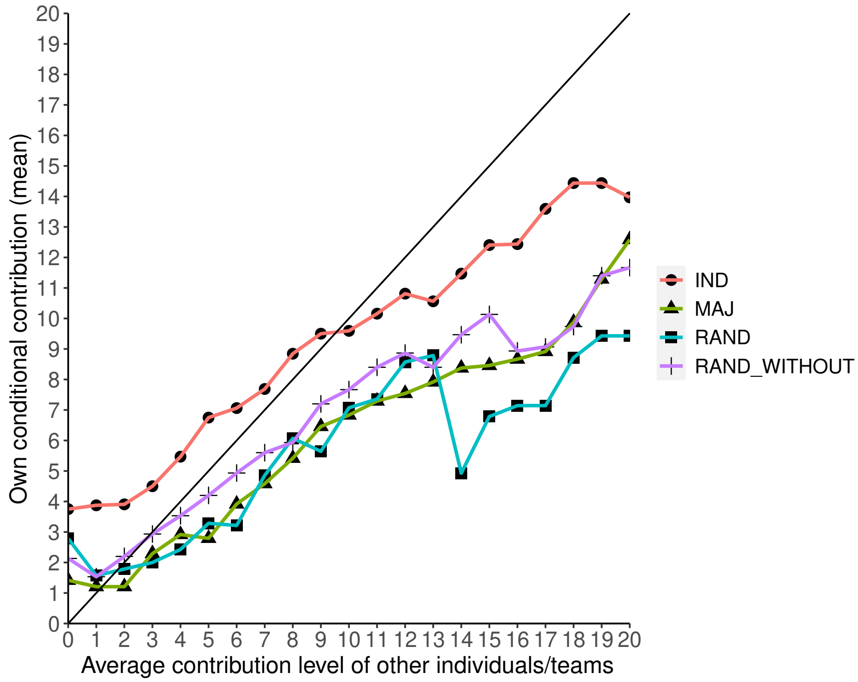

FIGURE 3. Conditional cooperative behavior by conditional cooperators across treatments.

IND treatment. Specifically, participants in teams deciding by the majority rule on average contributes 2.631 tokens (the Tobit model) less than individuals in isolation.

Next we explore the average treatment effects on the conditional cooperative behavior. We estimate both OLS and Tobit models of the following form:

$$Y_{ijk} = \beta_0 + \beta_1 \boldsymbol{D_j} + \beta_2 k + \beta_3 \boldsymbol{D_j} k + v_{ij} + \epsilon_{ijk}, \tag{2}$$

where Y_{ijk} is the contribution of individual i in treatment j when the average contributions of the other individuals/teams is k with $k \in \{0, 1, ..., 20\}$; $\boldsymbol{D_j}$ is a vector of dummy variables with $\boldsymbol{D_j} = 0$ for subjects in the baseline and $\boldsymbol{D_j} = 1$ for subjects in treatment j. To account for the panel nature of the data, we include a random effects error term v_{ij} to control for the unobservable individual specific effects and an idiosycratic error term ϵ_{ijk}. The coefficient for

TABLE 4. Average treatment effects on both unconditional and conditional contributions

	Unconditional contribution		Conditional contribution	
	OLS	Tobit	OLS	Tobit
	(1)	(2)	(3)	(4)
MAJ	-0.868	-1.250	-1.936^{***}	-2.631^{***}
	(1.158)	(1.585)	(0.282)	(0.410)
RAND_WITHOUT	-2.785^{**}	-3.768^{**}	-1.063^{***}	-1.427^{***}
	(1.309)	(1.602)	(0.300)	(0.409)
RAND	-3.868^{***}	-5.241^{***}	-3.092^{***}	-4.960^{***}
	(1.216)	(1.613)	(0.295)	(0.420)
Constant	9.646^{***}	9.909^{***}	7.969^{***}	7.507^{***}
	(0.824)	(1.043)	(0.204)	(0.267)
Observations	156	156	3276	3,276
R^2/Log Likelihood	0.07247	-441.104	0.0364	$-8{,}926.864$

Notes: The baseline is the contribution of the individual treatment. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

the interaction term, β_3, indicates the effect of being in team treatment j on the conditionally cooperative behavior and is thus the main coefficient of interest.

Table 5 shows that individuals in the baseline treatment (IND) exhibit conditionally cooperative behavior, as implied by the significantly positive coefficients on the average contributions of other group members (the first row in table 5). Specifically, individuals in the IND treatment contribute 0.368 (for OLS model) or 0.455 (for Tobit model) more tokens when other individuals contribute 1 more token on average. In addition, participants in all team treatments exhibit conditionally cooperative behavior, as demonstrated by significantly positive values for the sum of coefficients on Other.Contri and on the interaction terms. For instance, using Tobit model, for MAJ sum = 0.447 - 0.055 = 0.392 with $p-value = 0.000$; for RAND_WITHOUT, sum = 0.455 - 0.371 = 0.084 with $p-value = 0.046$; for RAND, sum = 0.463 - 0.349 = 0.114 with $p-value = 0.020$, all using general linear hypothesis test.

In addition, as demonstrated by the significantly negative coefficients on the interaction between the random ballot treatment dummies and the average contributions of other group members, participants in both random ballot treatments display a significantly lower degree of conditionally cooperative behavior than in the individual treatment. Specifically, participants in the RAND_WITHOUT and RAND treatments respectively contribute 0.371 and 0.349 fewer tokens (the Tobit model) than individuals in IND treatment when other teams/individuals contribute 1 more token on average. In contrast, there is no significant difference in the degree of conditional cooperation between teams under majority rule and individual decision-making. The coefficient on the interaction term between the MAJ dummy and the average contributions of other group members is negative but not statistically significant. In a separate model specification where the baseline treatment is RAND (with results reported in Appendix B), we find that the majority rule leads to significantly higher degree of conditional cooperative behavior than the random ballot rule with communication, implying that democratic system with majority rule enhances conditional cooperation than dictatorship.

5. Team decision-making process

To gain insights into why teams with majority rule show a significantly higher level of conditional cooperative behavior than teams with random ballot rule, we separate the total effects of the majority treatment on the conditional cooperative behavior into the following: the effect of being in a group with common payoff for its members, the effect of electronic communication, and the effect of the democratic majority rule.

The effect of being in a team with common payoff for its members: The literature has shown that individuals' decisions change when they are a member of a team (Billig and Tajfel, 1973; Charness et al., 2007), and when their decisions affect the outcome of the other team members (Charness et al., 2007; Chen and Li, 2009; Ambrus et al., 2015). In general, individuals' actions become more supportive of their teammates and more hostile towards other teams. There are several reasons for this. First, they may try to avoid blame or

Table 5. Average treatment effects on the conditional cooperative behavior

	MAJ		RAND_WITHOUT		RAND	
	OLS (1)	Tobit (2)	OLS (3)	Tobit (4)	OLS (5)	Tobit (6)
Other.Contri	0.368*** (0.034)	0.447*** (0.040)	0.368*** (0.034)	0.455*** (0.043)	0.368*** (0.034)	0.463*** (0.047)
MAJ	−1.081** (0.523)	−1.976** (0.775)				
MAJ * Other.Contri	−0.078 (0.048)	−0.055 (0.061)				
RAND_WITHOUT			2.033*** (0.605)	2.681*** (0.831)		
RAND_WITHOUT * Other.Contri			−0.281*** (0.052)	−0.371*** (0.066)		
RAND					−0.003 (0.569)	−1.210 (0.912)
RAND * Other.Contri					−0.281*** (0.051)	−0.349*** (0.073)
Constant	3.918*** (0.380)	2.644*** (0.502)	3.918*** (0.380)	2.505*** (0.546)	3.918*** (0.380)	2.383*** (0.586)
Observations	1,764	1,764	1,764	1,764	1,764	1,764
R^2/Log Likelihood	0.137	−4,901.799	0.081	−4,984.872	0.129	−4,665.683

Notes: Other.Contri represents the average contribution of other individuals/teams. Standard deviations are in parentheses. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

letting down their teammates (Dufwenberg and Gneezy, 2000; Charness and Jackson, 2009). Second, individuals may genuinely care about their teammates. In addition, individuals when categorized into a team have a tendency to perceive members of other teams to be more selfish and less trustworthy than their own team (Insko et al., 1993). Given that empirical research has suggested people often believe they are morally superior to others and thereby overestimate the self-interest of their teammates (Miller and Ratner, 1998; Diekmann et al., 2003), individuals in a team with payoff commonality may thus behave more selfishly in a public goods game than they are in isolation. This effect is especially relevant when decisions are made in teams based on perceived preferences of others. This is indeed what we observed. As shown in table 4, individuals' contributions are significantly less in random ballot without chat treatment than in the individual treatment for both conditional and unconditional contribution decisions.

The effect of electronic communication: Electronic communication has been shown to induce behavior more in line with the game-theoretic prediction than without. The process of discussion with team members makes them consider more about other teams' potential strategies and this induces the team to choose the strategy that is the best response to other teams' most likely strategy (Charness and Sutter, 2012). In addition, communication between team members allows more learning than without communication, and therefore more likely shifts team choices towards the Nash equilibrium (Ambrus et al., 2015). Finally, Balafoutas et al. (2014) show that with electronic chat efficiency-lovers are more assertive and they are more able to get their choices passed through the team as the final team choice. We find evidence that electronic chat leads to more selfish behavior. As shown by table 3, by comparing random ballot with and without chat treatments, electronic communication leads to significantly less contribution for the conditional contribution decisions (p-value = 0.000). In addition, figure 2 shows that there is a significantly higher percentage of free-riders in the random ballot with chat than without chat treatments (33.3% versus 11.1%, with p-value = 0.000 using Chi-squared test).

The effect of democratic majority rule: Finally, after isolating the effect of being in a group with common payoff for its members and the effect of electronic communication, any difference between the results in the majority treatment and in the random ballot with chat treatment can be attributed to the influence of the democratic majority rule. There are two possible reasons why the majority rule leads to stronger conditionally cooperative behavior than the random ballot.

First, the majority rule entailed the need to reach an agreement of the majority. Even though individuals tended to behave more selfishly after communication, this need possibly made them more conditionally cooperative if the conditional cooperators were the predominant types prior to communication. Individuals' decisions in the RAND_WITHOUT treatment can approximate what the individuals would want the team to do prior to communication and making final contribution decisions in the MAJ and RAND treatments. As shown in Figure 2, conditional cooperators were the predominant type in the RAND_WITHOUT treatment and thus were indeed the predominate type before communication and making final decisions in both MAJ and RAND treatments. We can also see from the figure that there is a higher percentage of "CC" type and a lower percentage of "FR" type in the MAJ compared to the RAND treatment. A viable explanation is the need to reach a majority agreement converted some free riders to become conditional cooperators. Participants in the RAND treatment, on the contrary, have less pressure to conform to other members' decisions and thereby are more able to stick to their intended behavior. Table 6 shows that there is a significant portion of teams (26.2%) where the three team members propose different levels of contribution, suggesting they were indeed more able stick to their intended choices after communication.

An alternative explanation for why the majority rule leads to stronger conditionally cooperative behavior than the random ballot is that participants in the MAJ treatment are subject to more social pressure from the other teams to cooperate than the RAND treatments. This is because at least two of the three members are responsible for the team decisions while in the RAND treatment only one is. Participants in the MAJ teams that contribute zero thus may perceive a higher chance to stand out as being selfish than the RAND treatment. This explanation has limitations. First, in our experiment teams are anonymous and team members do not know whom their teammates are. Furthermore, Andreoni and Petrie (2004) in a public goods game show that only when *both* an individual's identity and the information on their contribution are revealed does identification have significant effects on the contribution. In addition, using ultimatum and dictator games, He and Villeval (2017) show that social pressure is not responsible for the higher degree of inequality aversion of teams compared to individuals when they made initial proposals. In their experiment even when individuals can identify their team members and know the members' decisions, the degree of inequality aversion did not change.

Table 6. Percentage of teams that reaches agreement of unanimity and majority and that did not reach either agreement

	Unanimity	Majority	Disagreement
MAJ	69.4%	30.6%	—
RAND_WITHOUT	2.0%	24.2%	73.8%
RAND	43.7%	30.1%	26.2%

6. CONCLUSION

A seminal paper by Fischbacher et al. (2001) finds individuals exhibit conditional cooperation in the public goods game, and thereby can explain why individuals are not as self-interested as predicted by game theoretical models. In this paper, we explore whether teams are also conditionally cooperative and examine how the degree of the conditional cooperation differ from that of individuals. We further examine the impacts of team decision rules on the conditional cooperative behavior.

We find that a majority rule, which is often used in reality, results in similar degrees of conditional cooperation between teams and individuals. However a random ballot rule, which randomly selects a team member as representative whose decision determines the entire team's outcome, leads to a smaller degree of conditional cooperation compared to individual decision-making. This implies majority rule can enhance conditional cooperation than a dictatorship. This thereby may lead to more prosocial outcomes which is indeed what we find in our public goods game. We observe evidence on a possible reason for the difference: The majority rule leads to preference convergence towards the majority decision and most individuals are conditional cooperators, whereas in the random ballot rule participants are more able to insist on their own preferences.

An extension to the paper might involve changing the chat format to face-to-face or meeting via virtual platforms. In practice, team decisions are often made after face-to-face deliberation, while during the COVID-19 pandemic online meetings become increasingly common. The literature has suggested teams behave more selfishly with anonymous electronic communication than in a face-to-face environment (Kocher and Sutter, 2007). It is suggested that if a group communicates face-to-face, they want to present themselves to be more favorable than the average person (the Social Comparison Theory in social psychology (Brown, 1986; Myers et al., 1980)). This implies teams that communicate face-to-face might exhibit a different degree of conditional cooperation compared to communicating through electronic chat.

Another extension could look at the degree of conditional cooperation when teams in a public goods game also compete in other aspects. This mimics the climate change dilemma where countries compete economically but also needs cooperation to reduce greenhouse gases. As another example, fishing companies compete with each other to maximize profits but they also need to cooperate to overcome the tragedy of the commons.

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Appendix A. Experimental Instructions

A.1. **IND treatment**

Welcome to the experiment. This is an experiment funded by research foundations to study decision making. You will be paid \$5 CAD for showing up and \$5 CAD for completing the questionnaire at the end. You may receive additional earnings depending on the outcomes in this session. All earnings that you make will be in "tokens". At the end of the experiment, the total amount of tokens you have earned will be converted to Canadian dollars as follows:

$$1 \text{ token} = \$0.5 \text{ CAD}$$

Today's session will take approximately 1.5 hours. It is prohibited to communicate with anyone else during the experiment.

The basic decision situation:

You will learn later how the experiment will be implemented. But first we will introduce the basic decision situation upon which the experiment is based.

You are in a group of four. The identity of the other players of your group will not be revealed. Each group member will receive 20 tokens at the beginning and must decide how many tokens to contribute to a shared POOL that will yield a return to each member. You can contribute any number between 0 and 20 and only **whole numbers** will be accepted.

You will keep any remaining tokens for yourself. Your payoff consists of the number of tokens you kept for yourself and the return from the POOL. That is:

$$\text{Your payoff} = 20 - \text{your contribution to the POOL} + \text{return from the POOL}$$

Each member's return from the POOL is calculated as follows: The total contribution to the POOL from all group members is multiplied by a factor of 2, which is the total return from the POOL for the group. The total return is then split equally among all 4 group members, regardless of their contribution to the POOL. To summarize, your payoff is:

$$\text{Your payoff} = 20 - \text{your contributed tokens} + \text{total group contribution to the POOL} * 2 * 1/4$$

Example 1: You decide to contribute 0 tokens and other group members contribute 8, 10, and 12 respectively. Thus, the total contribution to the POOL from all members is 30; each member's return from the POOL is 30 * 2 * 1/4 = 15. Therefore, your payoff is 20 – 0 + 15 = 35.

Example 2: You decide to contribute 10 tokens and other group members contribute 0, 10, and 20 respectively. Thus, the total contribution to the POOL from all members is 40; each member's return from the POOL is 40 * 2 * 1/4 = 20. Therefore, your payoff is 20 – 10 + 20 = 30.

Example 3: You decide to contribute 20 tokens and other group members contribute 0, 5, and 10 respectively. Thus, the total contribution to the POOL from all members is 35; each member's return from the POOL is 35 * 2 * 1/4 = 17.5. Therefore, your payoff is 20 – 20 + 17.5 = 17.5.

If you have any questions, please raise your hand and the experimenter will personally explain to you.

Quiz for the Basic Decision Situation. 1. If you contribute nothing to the POOL while each of the other three group members contributes 20 tokens to the POOL, what's your payoff (in tokens)? What's the payoff for each of the other group members (in tokens)?

A 50,30; B 25,40; C 40,60; D 45,25

2. If you contribute 16 to the POOL while each of the other three group members contributes 20 to the POOL, what's your payoff (in tokens)? What's the payoff for each of the other group members (in tokens)? :

A 20, 40; B 50, 25 C 42, 38; D 36, 28

3. If you contribute 8 to the POOL while each of the other three group members contributes 8 to the POOL, what's your payoff (in tokens)? What's the payoff for each of the other group members (in tokens)?

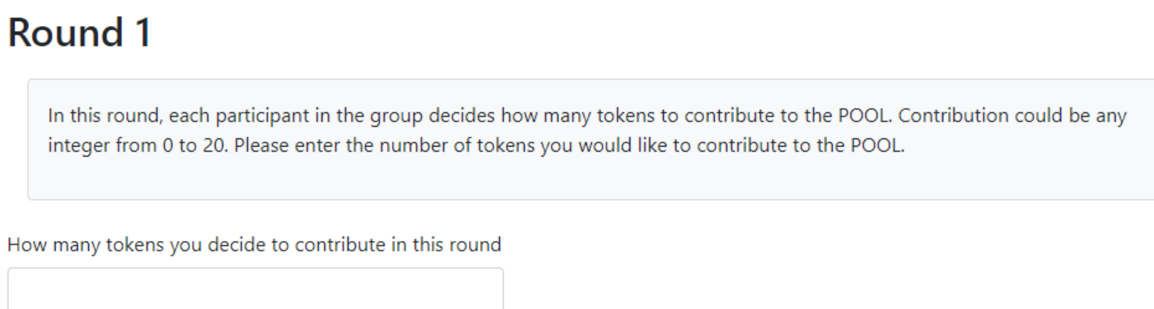
A 20, 20; B 28, 28; C 32, 32; D 36, 36

4. If you contribute 8 to the POOL while each of the other three group members contributes 20 to the POOL, what's your payoff (in tokens)? What's the payoff for each of the other group members (in tokens)? :

A 32, 28; B 46, 34; C 30, 16; D 40, 28

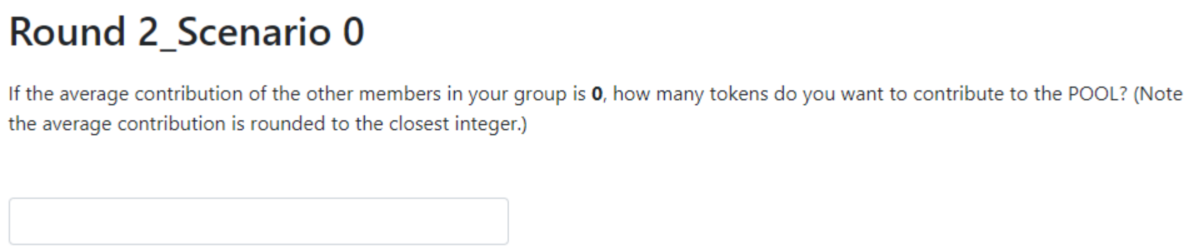
Overview of the Experiment. The experiment contains the basic decision situation you just saw. At the end of the experiment, you will be paid according to your payoff from the experiment.

The experiment has **two rounds**: an "unconditional contribution" round and a "conditional contribution" round. In round 1 (unconditional contribution round), each group member decides how many of the 20 tokens to keep, and how much to contribute to a shared POOL that will yield a return to each member: You can contribute any number between 0 and 20 and only whole numbers will be accepted. An example of the decision screen is shown below.



In round 2 (conditional contribution round), you will decide your level of contribution in response to each of the 21 possible average contribution levels {0, 1, 2, . . . , 20} of your groupmates (rounded to the closest integer). As we can see from the following screenshot, this will be framed as an 'if/then' decision. Note when you make this decision, you will not know other members' decisions in the first round.

After the two types of decisions are made, the computer program will randomly select one member in the group. For that member, the conditional contribution (second-round decision) is the payoff-relevant contribution. For the other three members, the unconditional contribution (first-round decision) is the payoff-relevant contribution. When you make both



Round 2_Scenario 0

If the average contribution of the other members in your group is **0**, how many tokens do you want to contribute to the POOL? (Note the average contribution is rounded to the closest integer.)

types of decisions, you will not know whether you will be selected by the random mechanism. You will therefore have to think carefully about both types of decisions as either can become relevant to you.

The group's total contribution to the POOL is the sum of the unselected three members' first-round contributions plus the selected member's second-round contribution given that the average contribution of the other three members is equal to that of the first round. Thus, each group member's return from the pool is:

Return from the POOL = (the selected member's second round contribution + sum of the other three members' first round contribution) * 2 * 1/4

For the selected member, his/her final payoff is the amount s/he didn't contribute in the second round plus the return from the POOL. That is:

The selected member's payoff = 20 - tokens contributed in the second round + return from the POOL

For the other three members, their final payoff is the amount of tokens they didn't contribute in the first round plus the return from the POOL. That is:

Each of the other three members' payoff = 20 - tokens contributed in the first round + return from the POOL.

Example:

Assume that you have been selected by the random mechanism. This implies that your conditional contribution is the relevant decision and other three members' unconditional contribution is the relevant decisions.

In the first round you decide to contribute 0 tokens and other three members in your group contribute 8, 10, and 12 respectively. The average contribution of the other three members is thus, (8+10+12)/3=10. And in the second round, you indicate that you want to contribute 20 if the others contribute 10 on average.

Thus, the total group contribution to the POOL is 20 + 8 + 10 + 12 = 50. The return from the POOL for each member is then 50*2/4 = 25. Your final payoff equals the amount you did not contribute in the second round, 0, plus your return from the POOL, 25, resulting in 25.

The other three members' final payoffs equal their return from the POOL, 25, plus what they did not contribute in the first round.

Therefore, for the member who contributes 8 to the POOL in the first round, the final payoff is the amount s/he did not contribute, 12, plus the return from the POOL, 25, which results in a final payoff of 37.

For the member who contributes 10 to the POOL in the first round, the final payoff is the amount s/he did not contribute, 10, plus the return from the POOL, 25, which results in a final payoff of 35. For the member who contributes 12 to the POOL in the first round, the final payoff is the amount s/he did not contribute, 8, plus the return from the POOL, 25, which results in a final payoff of 33.

Quiz for the Experiment. 1. If in the first round you decide to contribute 5 tokens and other group members contribute 10, 15, and 20 respectively. Imagine that the computer program later randomly selects the member who contributes 20, for whom the payoff-relevant decision is from the second round. And this player decides to contribute 10 when the average contribution of other members in the first round is 10. What's your final payoff?

A 25; B 30; C 35; D 40

2. If in the first round you decide to contribute 20 tokens and other group members contribute 0, 10, and 5 respectively. Imagine that the computer program later randomly selects you, for whom the payoff-relevant decision is from the second round. In the second round, you decide to contribute 13 when the average contribution of other members in the first round is 5. What's your final payoff?

A 10; B 21; C 36; D 40

Payoff Calculator. Now you can simulate this basic decision situation by **hypothetically** inputting tokens contributed to the POOL for you and your group members. Contribution could be any integer from 0 to 20. Note this is just a simulation. In the experiment you will see later, you will enter contribution just for yourself. The purpose of the simulation is to make you familiar with the calculation of the payoff that arises from different decisions about the allocation of 20 tokens.

Please enter the contribution for player 1:

Please enter the contribution for player 2:

Please enter the contribution for player 3:

Please enter the contribution for player 4:

A.2. **MAJ Treatment**

The instructions for MAJ treatment is similar to the IND treatment except that each player were matched with two other players to form a team of three. The team would play a game with three other teams. The identity of the teammates and three other teams were not revealed. Each team received 20 tokens at the beginning and must decide how many tokens to contribute to a shared POOL that would yield a return to each team. In addition, for the MAJ treatment, the decision rule within the team is as follows:

Within a team, each team member will propose a contribution level. If a majority of the members (i.e., at least two) propose the same amount, that amount becomes the team contribution level. Otherwise, team members go back to propose again until two or more team members propose the same amount. Before proposing the contribution, members within a team can communicate with each other in an anonymous chat room.

Finally, each team member's payoff equals the team's payoff

A.3. **RAND_WITHOUT Treatment**

The instructions for RAND_WITHOUT treatment is similar to the MAJ treatment except the team decision rule and that team members cannot communicate with each other. For this treatment the decision rule within the team is:

Within a team, each team member will propose a contribution level each round. A random draw will then determine which team member's proposed contribution level to be the team's contribution level.

A.4. **RAND Treatment**

The instructions for RAND treatment is similar to the RAND_WITHOUT treatment except that prior to proposing the contribution, members within a team can communicate with each other.

Appendix B. Regressions with RAND being the baseline treatment

Table 7. Average treatment effects on the conditionally cooperative behavior with RAND being the baseline treatment

	Majority		RAND_WITHOUT	
	OLS (1)	Tobit (2)	OLS (3)	Tobit (4)
Other.Contri	0.087**	0.112**	0.087**	0.115**
	(0.037)	(0.051)	(0.037)	(0.057)
MAJ	−1.078*	−0.963		
	(0.556)	(0.902)		
MAJ * Other.Contri	0.203***	0.288***		
	(0.051)	(0.071)		
RAND_WITHOUT			2.036***	3.993***
			(0.634)	(0.990)
RAND_WITHOUT * Other.Contri			−0.001	−0.032
			(0.054)	(0.079)
Constant	3.915***	1.444**	3.915***	1.108
	(0.424)	(0.647)	(0.424)	(0.719)
Observations	1,512	1,512	1,512	1,512
Log Likelihood	0.061	−3,852.748	0.034	−3,922.635

Notes: Here the baseline treatment is the RAND treatment. Standard deviations are in parentheses. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

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