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Who Will Do It? Volunteering to Change Cooperation Rules in a Heterogeneous Population

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Abstract

We study whether and when a second-order collective action problem, like the change of existing formal rules governing cooperation, can be resolved to ultimately solve first-order collective good dilemmas. We do so by examining the conditions under which individuals change cooperation rules when both their material incentives to cooperate and their social preferences for outcome distributions differ. Our experimental findings show that proselfs who benefit the most from cooperation are most likely to initiate a rule change to a higher minimum contribution level. Regarding prosocials, we find that their underlying motives in favour or against this rule change vary depending on their relative earnings' position. If they are 'wealthy', that is, they have a higher earnings potential, they are more concerned about equality. When they are relatively 'less wealthy', they seem to care more about enhancing collective outcomes.

Introduction

Whenever cooperation is required to produce collective goods, the possibility and the benefits of individuals' free riding bring the achievement of this production in peril (Olson, 1965; Sell and Wilson, 1999). Such a situation, where individual and collective interest conflict constitutes a so-called social dilemma (Olson, 1965). Put differently, social dilemma situations refer to cooperation problems that arise when rational self-interested behaviour of individuals, such as the tendency to free ride or maximize own utility, lead to suboptimal collective outcomes. Everyday social life is full of such dilemma situations (Merton, 1936; Coleman, 1990). Beyond the classical example of the tragedy of the commons (Hardin, 1968), think of team work in organizations, joint collaborations in academia or more generally contributions to public goods like schools, bridges, or highways. Indeed, a large body of research shows that when contributing to the collective good is voluntary, free-riding prevails (Fehr and Schmidt, 1999; Winter, Rauhut and Helbing, 2012). This is known as the first-order collective action problem (Ostrom, 1990). Much attention has been dedicated to the question of what solves this problem, that is, what mitigates the tendency to free ride and increases collective good production; see, amongst others, Albanese and Van Fleet (1985), Iannaccone (1992), Kalyvas and Kocher (2007), and Nordhaus (2015) for empirical studies on free riding in different social settings.

An important theoretical and empirical insight is that in attempting to increase cooperation and solve the first-order social dilemma, a second-order collective good problem arises. That is, finding a solution that minimizes free riding and increases cooperation requires individuals to cooperate to establish an effective mechanism. Since individuals can free ride in the hope that others will make the effort to establish and maintain such a mechanism, they will face a new and different collective action problem (Coleman, 1990; Ostrom, 1990).

A prime example concerns the establishment of social norms that stimulate cooperation (i.e., how much one *ought to* contribute to a collective good). Such norms are often considered a solution to the first-order collective action problem (e.g., Coleman, 1990). Again, however, because of the second-order problem the establishment of such a solution may be hampered. The emergence of and changes in social norms pose collective action problems in and of themselves (e.g., Brennan, Goodin and Southwood, 2013; Bicchieri, 2016). This has been widely recognized in social theory. Indeed, as theorized by Coleman (1990) and empirically tested in experimental research (e.g., Yamagishi, 1986; Fehr and Gächter, 2000; Gürerk, Irlenbusch and Rockenbach, 2006; Sefton, Shupp and Walker, 2007; Reuben and Riedl, 2013; Van Miltenburg et al., 2014), the sanctioning of social norm violations is a prototypical second-order public good problem. On the one hand, an effective sanctioning of cooperation social norms would increase collective welfare, but on the other, it would also impose costs on those doing the sanctioning. Many people might therefore prefer to wait until others do the sanctioning.

Here, we do not focus on the role of informal social norms, but on the related issue of *formal rules about cooperation*. We study how changing the formal rules governing cooperation may provide an alternative 'solution' to the first-order collective action problem. Contrary to informal social norms, formal rules (a.k.a. formal norms or legal norms; Brennan, Goodin and Southwood, 2013) are explicitly written down and are typically sanctioned by an authorized third party, like the state or a formal authority. Formal cooperation rules specify how much one is *required* to contribute to a collective good and this requirement is formally sanctioned. Our focus on cooperation rules is grounded in two main observations. First, similarly to a change of social norms, the change of formal cooperation rules can solve the first-order collective action problem but at the same time poses a second-order social dilemma. In fact, we believe that changing an explicit and formally enforced rule is harder (and thus more costly) than changing an implicit and informally enforced social norm [see Elster (1989) for a distinction between the two]. We therefore ask whether individuals are able to solve this more challenging second-order problem. Second, we recognize that individuals' interactions in social dilemmas are typically structured by pre-existing rules of the game. Hence, in order to solve social dilemma's and increase cooperation, individuals can either develop strategies that enforce cooperation norms, or change the pre-existing rules towards higher contribution levels to a collective good.

We illustrate the role of formal cooperation rules with an example of a social dilemma regarding academic collaborations. Imagine two or more scholars working on a joint interdisciplinary project. They are all interested in finalizing the project and having it published (preferably in an influential journal). However, as long as contributions to the paper are voluntary, there may be free riders among them who rather wait for the other(s) to do the job than contribute directly themselves. One way to minimize free riding and increase contributions is to punish the free riders, e.g., by damaging their reputation towards other colleagues. Another way is to challenge the collaboration 'agreement' (i.e., formal cooperation rule), which might entail a formal division of the workload among the scholars, the time that needs to be invested, or the sort and the difficulty of each task. The second-order problem arises when there are costs to challenging an existing agreement amongst collaborators, for example, because doing so makes one unpopular. Challenging such agreements is what we call 'a change of cooperation rules' and is what we are interested in.

More specifically, our focus is on an existing rule that imposes the minimum extent to which individuals must cooperate. In society, such rules range from taxes at local or national level to cleaning duties in a dormitory. In these and other social situations, the existing rules vary in the degree to which they allow individuals to free ride on the cooperative behaviour of others. For instance, in trying to build a bridge in a village, a local government can decide to let people contribute voluntarily or it can impose a local tax (i.e. a minimum level of contribution).[1] As a consequence, some individuals may want to change an existing rule (i.e., local tax) to one that is more or less lenient in this way. This is what we address, namely whether individuals try to change cooperation rules in social dilemma situations and under what conditions.

When individuals receive similar benefits from a collective good and when they hold similar preferences

about cooperation, rule change towards more cooperation might be relatively straightforward (Ostrom, 1990). It is highly unrealistic, however, to assume such homogeneity in groups or working teams (Bicchieri and Funcke, 2018). Individual actors may differ in the benefits they receive from a collective good[2] as well as in their preferences for the distribution of the collective outcome. Using again the example of a joint interdisciplinary project, the benefits scholars receive from a publication differ across scientific fields and may depend on the main discipline of the publishing outlet (e.g., the benefits of publishing in a sociology journal are higher for a sociologist in the team than for an economist). Or in the case of building a bridge, the benefit of a new bridge may be higher for those villagers who live close to the bridge and are more dependent on it than for those who live further away and are less dependent. Indeed, earlier research (e.g. Noussair and Tan, 2011) has shown that inequality in benefits matters for the individual willingness to cooperate towards realizing collective goods. In this study, we elaborate on this finding and inquire into the role of *unequal benefits* from a collective good in the second-order public good problem that arises when individuals have an opportunity to change the rules governing cooperation.

Furthermore, individual actors may also differ in their *social preferences* for outcome distributions. Such preferences are a reflection of individuals' social value orientations (Dijkstra, 2013). Value orientations vary in the degree to which individuals are prosocial or proself. A prosocial individual prefers maximizing collective gains and favours equal distributions, thereby valuing cooperation within a team. Proselfs, on the other hand, pursue individual gains even if these go at the expense of collective gains or yield unequal distributions; they have no preference to cooperate to enhance team performance. Think again of our examples of villagers or scholars who care more about the collective outcome like a bridge or a nice piece of research than about the costs of contributing. Although value orientations have been considered to be quite important in understanding individual behaviour bounded by social structures (e.g., Parsons, 1966; Offerman, Sonnemans and Schram, 1996; Van Lange, 1999), to the best of our knowledge, there is only one other study (Gërxhani and van Breemen, 2019) that has looked at the relationship between individuals' value orientations and rule change. That study, however, maintains the rather unrealistic assumption of equal individual benefits from cooperation.

The added value of our study is precisely the simultaneous consideration of these two types of heterogeneity—differences in benefits from collective goods and differences in preferences for outcome distributions—when analysing the change of cooperation rules. Hence, our research question is *whether and under what conditions individuals change the rules governing cooperation when both their material incentives to cooperate and their social preferences for outcome distributions differ.* Addressing such a question is of great relevance because it will increase our understanding of whether and when a second-order collective action problem, like the change of existing cooperation rules, can be resolved to ultimately solve first-order collective good dilemmas.

We study our research question using laboratory experiments. In particular, we implement a public goods game, because it comprises the key elements of a social dilemma in a simple environment and it has been widely used to study cooperation and free riding (Fehr and Gächter, 1999). In a public goods game, cooperation is measured by an individual's contributions to a collective good. Applying this in a laboratory gives us a high level of control that allows us to disentangle the effects of different cooperation rules from differences in social preferences and in unequal benefits from cooperation. Moreover, laboratory control helps us to rule out many confounding factors that are typically present in observational studies (Jackson and Cox, 2013).

Finally, we implement a majority voting procedure as the main mechanism of rule change. This procedure aims to capture a democratic environment where all individuals have equal rights to participate in rule making (Jacob, 2015) and directly challenge an existing rule via voting (Walker et al., 2000). Moreover, previous studies have shown that the presence of a minimum coalition in favour of change is necessary for a rule change (DiMaggio, 1988; Ostrom, 1990). Majority rule assures a minimum coalition of 50 per cent if a proposal to change a rule is accepted. 'When binding for all involved, voting on rule change may provide a successful way to establish socially optimal outcomes' (Hauser et al., 2014: p. 220). We reflect further on the choice of this mechanism of change in the concluding discussion.

Change of Cooperation Rules

Differences in Benefits from Cooperation: Earnings

Previous research relates individuals' contribution to collective goods to both heterogeneity in endowments and heterogeneity in rewards and finds that inequality in endowments yields higher cooperation while unequal rewards negatively affect it (Hopkins and Kornienko, 2010). Because we are interested in studying whether a

rule change is attempted to increase cooperation, we focus on heterogeneity in the rewards from cooperation (e.g., different benefits from an interdisciplinary publication), since such heterogeneity seems to impede cooperation the most. In particular, we consider situations where individuals receive different benefits from the same contribution in a collective good [as studied, for example, by Reuben and Riedl (2009, 2013) and Nikiforakis, Noussair and Wilkening (2012)]. It has already been shown that individuals contribute proportionally to their anticipated benefits from cooperation (Reuben and Riedl, 2013). More specifically, high earners contribute more to a collective good than low earners, presumably because they benefit more.[3]

Here, we consider the implications of differences in benefits from cooperation (i.e., high earners vs. low earners) for a cooperation rule change. In our example, 'high earners' would be scholars who benefit more from an interdisciplinary publication, whereas 'low earners'—scholars who benefit less from an interdisciplinary publication. If given the opportunity to change a cooperation rule to a higher minimum contribution level, both high and low earners will potentially benefit from the change, as the collective good will be larger and everyone receives more benefits. Nevertheless, challenging the existing formal rules may be costly; think, for example, of sanctions such as a fine or a reprimand[4] (e.g., Yamagishi, 1986; Morrison, 2006). There is thus an incentive to free ride on others in initiating the rule change. The risk of attempting a rule change is also confirmed by research on social norms. Those individuals who stick their necks out to change norms are known as norm 'trendsetters'. 'When engaging in counter-normative actions, one must believe that such actions will carry weight and lead to some personal benefit or some broader societal change before being willing to engage in them' (Bicchieri and Funcke, 2018: p. 5). As mentioned above, we are interested in an environment where the personal benefits of both high and low earners would increase if they attempt a rule change to higher contribution levels. However, the incentive to free ride will be stronger for low earners than for high earners, since the net increase in personal benefits for the latter would be larger than for the former (Barber and Simmering, 2002). This argument is confirmed by findings from case studies where individuals who are entitled to a higher income from a cooperative effort, are more willing to provide this effort (White and Ford Runge, 1995; Gaspart *et al.*, 1998). In line with the above, we assume that—other things being equal—high earners will be the trendsetters, that is, they will be more inclined than low earners to change a rule to higher contribution levels.

Differences in Preferences for Outcome Distributions: Social Value Orientations

We consider two relevant types of social values: one where an individual's social value orientation is categorized as proself—corresponding to the pursuit of maximizing own outcomes; and the other where an individual's social value orientation is categorized as prosocial—corresponding to maximizing both joint outcomes and equality of outcomes (Van Lange, 1999). A detailed theoretical and empirical analysis by Gërxhani and van Breemen (2019) shows that under equal benefits from cooperation, prosocial individuals are more likely than the proselfs to change a rule from low to high minimum contribution levels. The underlying argument is that, when rule change is costly, proself individuals are more likely to free ride on others initiating the change. In fact, proselfs may not even favour the change altogether, if that change—from low to high contribution levels—would limit their possibility to free ride on others' contributions in a collective good, and hence to maximize their own outcomes. Prosocial individuals, on the other hand, care more about the enhancement of collective outcomes and equality and will therefore be more likely to initiate change to cooperation rules that impose higher minimum contribution levels for all.

Cooperation Benefits and Value Orientations

The question that remains is whether and how the interaction between heterogeneous benefits from cooperation and heterogeneous value orientations will affect who will initiate a change of cooperation rules. When considering such an interaction, our previous argument that proselfs will be inclined to free ride on others' initiation of rule change can be refined. Imagine again the group of equally capable scholars, teamed up to work on an interdisciplinary joint project. They come to an agreement on how much each has to contribute to the research project in order to successfully reach the publication target. Moreover, they do not know each other's value orientations, nor the distribution of benefits from cooperation (i.e., the benefit from the interdisciplinary publication). In this case, some proself scholars might initiate a change of the existing agreement to a higher minimum contribution to the project if they expect that by doing so their benefits would be higher than the costs and at the same time do not expect others to initiate the change.

Initiating a rule change is a volunteers' dilemma. If there are distinct payoff consequences to volunteering in a volunteers' dilemma, the standard mixed strategy equilibrium (Diekmann, 1985, 1986) may not hold. In Supplementary Appendix SB, we extend the volunteers' dilemma to allow for heterogeneity (i.e., two player types). We show that in a mixed strategy equilibrium where players of the same type play the same strategy, the type that benefits more from someone volunteering is more likely to volunteer. We use this to formulate our next hypotheses.

Since high-earning proselfs will benefit more than low-earning proselfs from cooperation in a setting where all members are required to make high contributions to the collective good, we expect that:

H1: If individuals are proself oriented, high earners will be more likely than low earners to attempt a change of rules towards more contribution.

For prosocial individuals, the situation is different and more complex. Prosocial value orientations are directed towards two desired outcomes: maximal collective outcomes and equality in outcomes (Van Lange, 1999). Hence, prosocial individuals—irrespective of the benefits they receive from cooperation—might feel uncomfortable when collective outcomes are not maximized (i.e., no interdisciplinary publication), or if inequality in outcomes is large (i.e., some end up benefiting more than others). This implies that prosocial individuals—no matter whether they are high or low earners—have to choose between: (i) a setting with a low minimum contribution level and hence the risk of low collective outcomes; and (ii) a setting with a high minimum contribution level—and thus a larger collective outcome as a result of higher contributions—but with a larger gap in earnings across individuals, i.e. higher inequality.

Thus, both high- and low-earning prosocials have to choose between minimizing inequality at the cost of low collective outcomes versus maximizing collective outcomes at the cost of equality.[5] Because of this dilemma, we expect that earning prospects have no effect on rule change attempts if an individual has a prosocial value orientation. Hence:

H2: If individuals are prosocially oriented, the likelihood to attempt a change of rules towards more contribution does not depend on whether individuals are low or high earners.

When comparing prosocial low earners with proself low earners, both expect the same financial benefits from a rule change to higher contribution levels and face the same costs if they attempt to change the rule. However, because of their low earnings, both rather avoid bearing the costs of changing the cooperation rule. Since proselfs care primarily about maximizing their own profit, they will thus unlikely attempt a rule change. The material burden is as high for prosocial low earners, but contrary to proselfs, they care beyond the financial benefits. In particular, prosocials care about the collective benefit and the equality of outcome distributions. By initiating a rule change to higher contribution levels, prosocial low earners can increase the overall collective welfare, but at the cost of equality. We do not know a priori which of these two outcomes they value more, but argue that by not initiating a rule change at all, prosocial low earners would not satisfy either of their desired social outcomes. Whereas if they do initiate a change, they would achieve a higher collective welfare, benefiting all, albeit some more than others (i.e. inequality increases). We assume that the fact that all benefit makes the increased inequality acceptable to the prosocials and that the advantages of higher collective benefits are therefore more important than the increased inequality.[6] We therefore hypothesize that:

H3: If individuals are low earners, those with prosocial value orientations will be more likely than those with proself value orientations to attempt a change of rules towards more contribution.

The situation differs when comparing prosocial high earners with proself high earners. Also, they would both benefit from a rule change to higher contribution levels. However, the balance between the material and the social preference 'burden' might shift. Proselfs would still prefer to free ride on a rule change to higher contribution levels, unless they expect the benefits of this rule change to surpass the costs. For prosocials, on the other hand, the prospects of such a rule change would again create the dilemma of choosing between maximizing collective outcomes and achieving equality. As long as prosocial high earners have the 'burden' of caring for equality and proself high earners expect to benefit more (see *H1*), we assume that the negative effect for prosocials is stronger than the free-riding incentive for proselfs. This leads to:

H4: If individuals are high earners, those with proself value orientations will be more likely than those with prosocial value orientations to attempt a change of rules towards more contribution.[7]

Figure 1 below displays a graphical illustration of our hypotheses.

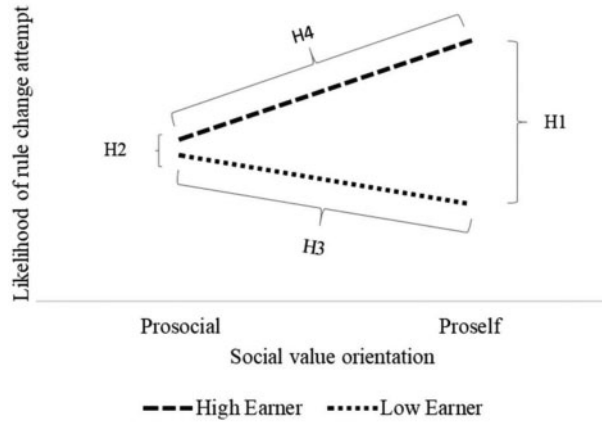

Figure 1. Summary of hypotheses on rule change attempts

Methods

Sample

We conducted laboratory experiments in June 2015 at the CREED Laboratory of the University of Amsterdam. Participants were recruited on a voluntary basis from the CREED student participant pool, consisting of approximately 2,000 individuals. All Dutch-speaking students received an invitation to sign up and participation was on a first-come, first-serve basis. There were 20 sessions with a total of 28 groups of five members each, for a total of 140 participants (70 men and 70 women, $M_{age} = 21.50$, SD = 2.86).[8] No participant took part in more than one session.

A session lasted approximately 60 minutes. At the end of each session, participants were paid their earnings in private. Earnings in the experiment were in 'points' and were exchanged for euros at a rate of 1 euro per 100 points; they were based on their decisions on several tasks (described below); participants earned on average €21.40, including a €7 show-up fee.

Experimental Design, Measurements, and Procedure

Each session followed the same protocol. Upon arrival, participants were randomly seated at separate computer cubicles. The experimenter made clear that making contact with other participants through conversation or other means was prohibited during the session. This was done to minimize the possibility that participants could identify their team members or could communicate during the experiment.

All participants receive the same general instructions; before they can proceed, participants have to indicate that they have understood these instructions.[9] The experiment proceeds according to the following stages:

- First, we measure participants' risk attitudes as they may positively influence the likelihood of a rule change (Morrison, 2006). Participants were asked to answer the following question 'How willing are you to take risks, in general?' on an 11-point Likert scale, ranging from 0 (not at all) to 10 (very much). As shown in Dohmen *et al.* (2011: p. 522), this question 'generates the best all-round predictor of risky behaviour'. The risk measure is used as a control in our empirical analysis below.
- Second, participants were randomly and anonymously paired to measure their social value orientations. We do this before the main part of the experiment starts, because this is a stable individual trait unrelated to the rest of the experiment. We assess participants' social value orientations via the Triple Dominance Measure (TDM; Van Lange, 1999). This is an established method for this purpose, in particular known for its ecological validity (Bem and Lord, 1979). The TDM has a high reliability and is in particular used in social psychology to assess individual value orientations (e.g., Messick and McClintock, 1968; Balliet, Parks and Joireman, 2009). The measure consists of nine items, each containing three distinct outcome distributions with points for oneself and for an anonymous paired other.[10] Specifically, participants are asked to make a choice, nine times, between three outcome distributions across own and other's earnings (for more details, see instructions in Supplementary Appendix SA). Participants are informed that one of their choices will be randomly chosen for payment. According to the choices made,

the TDM categorizes individuals into the two categories of interest: self-interested (maximizing own outcomes); competitive (maximizing the difference between own and other's outcomes); or prosocial (pursuing an equal distribution of outcomes) (Van den Bergh, Dewitte and Cremer, 2006), if at least six out of nine choices can be consistently attributed to one of these values, otherwise they remain uncategorized.

- Third, after an incentivized measure of the prevailing social norm,[11] participants are randomly assigned to a team of five to participate in the main experiment. This consists of two consecutive public goods games with anonymous matching. Participants remain in the same team for both games. They are unaware during the first game that a second game will follow. Instead, they are informed that the experimental session consists of multiple tasks and rounds. Each public goods game consists of 10 rounds, which the participants are informed about.[12] In every round, each participant receives an endowment of 10 points that they can split (in integers) between an amount to keep for themselves and an amount to contribute to the public good. We will discuss the payoff consequences of this choice below. In deciding on this split, participants are constrained by the existing cooperation rule (which is one of the treatments, as described below). In each of the 10 rounds of each game, the total contribution to the team collective is made public to the members, while individual contributions are not visible to other team members.
- Fourth, after the 10 rounds of the first game, the second game is announced, and participants are given the opportunity to change the existing cooperation rule before this starts. More specifically, each team member is given the opportunity to call for a vote to replace the existing rule with a new one. This initiation of a vote costs 10 points for each member calling it. This reflects possible costs outside the laboratory of attempting to change an existing rule. If no one calls for a vote, the cooperation rule that was in place during the first game also applies to the second game. If at least one member indicates 'yes' on the call to vote, then the voting procedure for that team starts. For an actual rule change, a majority vote (three out of five members) is required. If a majority of the team votes in favour of a change, then the cooperation rule changes for that team. This setup allows us to measure our dependent variable of interest: a *rule change attempt*, which occurs whenever a respondent says yes to a 'call to vote'.
- Fifth, the second public goods game starts, under either a new cooperation rule or under the same rule as in the first game.
- Finally, each session concludes with a short questionnaire on the participants' socio-demographic characteristics.

The experiment implements a full-factorial 2 × 2 between-subject design. In the environment of our experiment, cooperation rules impose a minimum level of contribution to the public good. We refer to such minimum requirements as 'contribution rules'. The first treatment to which participants are randomly assigned is the *Contribution rule*. We introduce a rule for the mandatory minimum contribution in each round in the first public goods game; this is either *Rule low2*, which imposes a low contribution (two points, out of a possible 10) or *Rule high8*, which imposes a high contribution (eight points).[13] Because our focus is on the rules themselves, and not on their enforcement, we enforce any such minimum across all participants; they are unable to contribute less than the rule calls for.

The second experimental treatment concerns the *Allocation of benefits* to which participants are randomly assigned. In each round of both games, the individual earnings from the collective good are:

- In the *low-benefit* treatment, a participant earns 0.3 points for every token invested (by anyone) in the public good. The total earnings are then (10 points—points contributed to the collective good) + 0.3*(total team contributions).
- In the *high-benefit* treatment, a participant earns 0.5 points for every token invested (by anyone) in the public good. The total earnings are then: (10 points—points contributed to the collective good) + 0.5*(total team contributions).

We thus create *low earners* and *high earners* by implementing a different marginal per capita return (MPCR) for each type (0.3 versus 0.5, respectively); this MPCR yields different personal benefits from the collective good. This differentiation of benefits is common knowledge among all five team members, while the individual benefits remain private information. Each team consists of three members with one benefit type (0.3/0.5) and two with the other (0.3/0.5). In half of the teams, three individuals have high benefits and two have low benefits; the reverse holds for the remaining teams. Participants do not know how many low- or high-benefit team members (i.e., low or high earners) are in their team. The main reason for not revealing this

information is to prevent rule change attempts based on the existence of a majority of like-minded team members, because this could be a possible confound for our variables of interest.

Results

Descriptive Findings

Social value orientations

We pool the self-interested and competitive categories into a single category ('proselfs'), since only one respondent has been classified as 'competitive'. Using the TDM (e.g., Van Lange, 1999), we categorize participants into proselfs and prosocials if at least six out of nine choices a participant made is consistent with one of these values. If otherwise, participants are classified as 'uncategorized' and are not considered in our analyses. Of the 140 participants, 19 participants remained unclassified in this way. Of the remaining 121 participants, 65 (54 per cent) are classified as having a proself value orientation and 56 (46 per cent) as having a prosocial value orientation.[14]

Unequal allocation of benefits: majority and minority group composition

Recall that—unknown to the participants—some teams had three participants with high benefits and two with low benefits, while the other teams had the reverse. We tested whether this difference in group composition influenced our main variable of interest but found no significant differences for mean social value orientation, contributions in the two public goods games, and rule change attempts. From here onwards, we therefore pool the observations from the two team compositions.

Cooperation

We examine the degree of cooperation as measured by the amount of contributions to the collective good in the first public goods game (i.e., before a possible rule change) and in the second game (i.e., after a possible rule change). Under *Rule low2*, the mean contributions of the 14 teams (across 10 rounds) range from 2 to 8.9 points (out of 10), with an average of 4.87 (SD = 1.65). Under *Rule high8*, the range is between 8 and 9.9 points with an average of 8.47 (SD = 4.57). There is a difference on a 10 per cent significance level between the contribution of high and low earners in both games (Mann–Whitney test, $z = -0.680$ and -1.772; $P = 0.49$ and 0.08, respectively). More generally, both games show the typical declining contribution pattern that has been observed in many previous public goods experiments (Ledyard, 1995). Figure 2 below shows the average contributions for all 10 rounds of the first and the second public goods game, for the low as well as for the high contribution rules, and for the different earner types and social value orientations.

Earnings in the two public goods games when a rule change took place

Next, we examine the aggregate individual earnings across 10 rounds for teams where a rule change took place. Comparing the earnings in the two games when the rule was changed from *low2* to *low8*, we see that in the first game (*Rule low2*), high earners earned on average 171.5 points (SD = 18.6) while low earners earned 125.2 points (SD = 7.4). This difference is statistically significant (Wilcoxon signed-rank test, $z = -4.241$, $P < 0.001$). In the second game (*Rule high8*), high earners earned on average 220.3 points (SD =24.8), while low earners earned 140.4 points (SD = 8.7). Again, the difference is statistically significant ($z = -6.389$, $P < 0.001$).[15] The change from *Rule low2* to *Rule high8* benefits both earner types. The numbers above show that both high and low earners earned more after a higher minimum contribution level had been imposed. The differences are significant (Wilcoxon, high earners: $z = -6.297$, $P < 0.001$, low earners: $z = -4.350$, $P < 0.001$, respectively). To a large extent, of course, this is driven by the 'forced' cooperation in an environment where this benefits all. Interestingly, however, the rule change increases inequality. The average difference between high and low earners in the first game was 64.74 (SD = 22.10) versus 80.97 (SD = 12.89) in the second game. This increase in inequality is significant (Wilcoxon signed-rank, $z = -2.482$, $P < 0.05$), which shows that although a rule change led to more cooperation and increased individual and collective welfare, it also increased the existing inequality.

Rule Change Attempts

Under the *Rule low2*—the low contribution rule—52 per cent of the participants attempted a change by calling for a vote after the first public goods game and the rule was changed in all but one team. Under *Rule high8*—the high contribution rule—15.7 per cent called for a vote, but the rule was never changed. We estimate the likelihood for a rule change attempt from *Rule low2* to *Rule high8*. Given our binary outcome variable—calling for a vote to change the existing rule from a low to high contribution level *versus* not calling for a vote—we estimate logistic regression models. First, we apply a

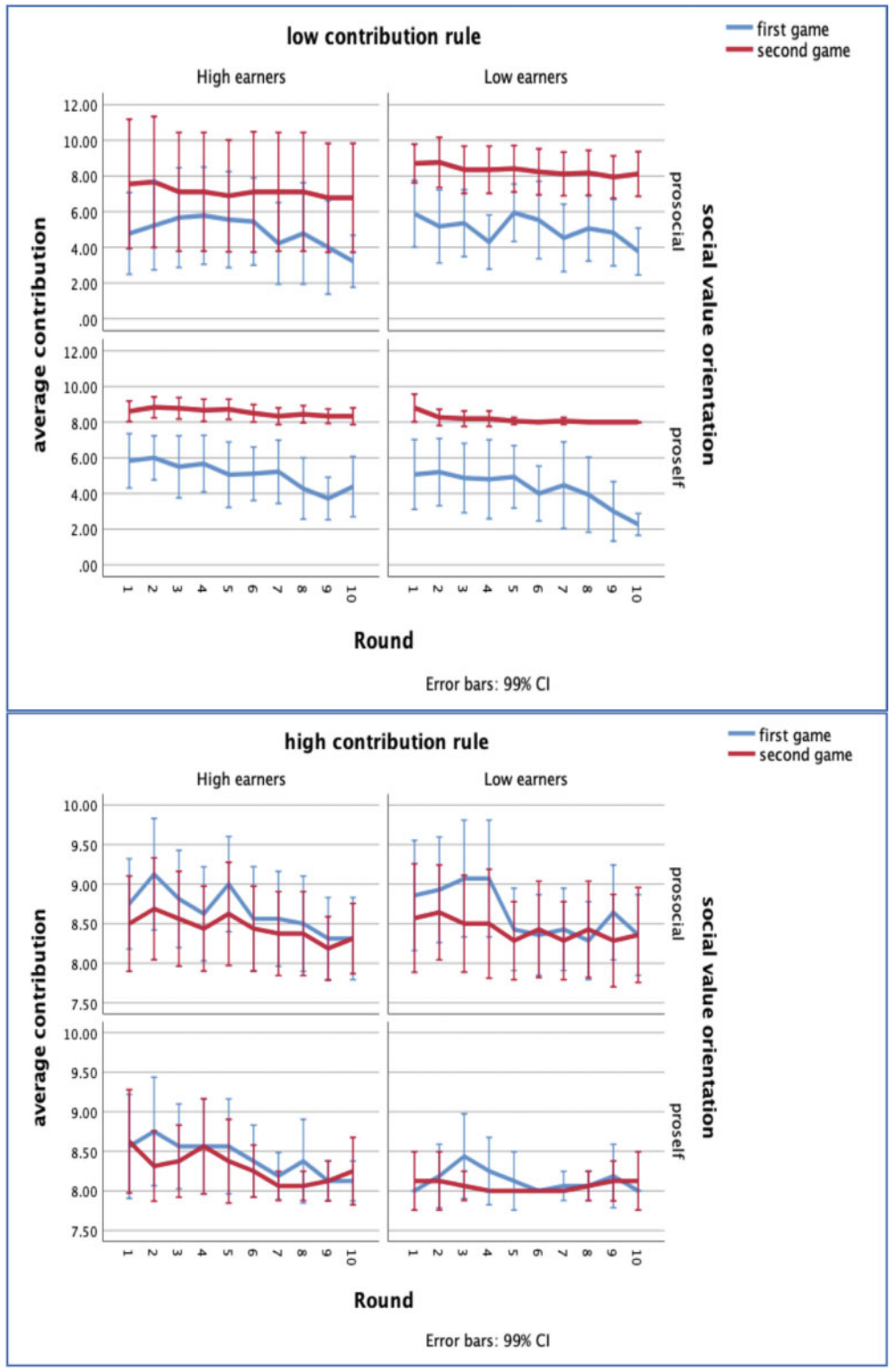

Figure 2. Average contributions per round and game, for different earner types and different social value orientations

logistic regression with robust standard errors of a rule change attempt (i.e., call to vote yes/no), on value orientation type, earner type, and the interaction between these two, while controlling for risk taking, gender, and age. We find a statistically significant interaction between the two main independent variables (i.e., value orientation and earner type) predicting support for rule change (Odds ratio = 0.05, $P = 0.016$). Second, we again estimate models for a rule change attempt (i.e., call to vote yes/no), with the same control variables. Now, however, we split the analyses across value orientations and earner types, respectively, and ran separate regressions. We do so because our hypotheses focus on differences between high and low earners and on differences between prosocial and proself individuals. The results are reported in Table 1 below.

Model 1 provides a test of hypothesis 1, i.e. that among proself individuals, high earners are more likely to attempt a rule change than low earners. The analysis confirms this hypothesis. In fact, amongst the proselfs, high earners are more than 11 times more likely to call for a vote than low earners. Model 2 tests hypothesis 2, which predicts a null effect, namely that there is no difference between earner types among prosocial individuals. The logit regression in model 2, however, only shows that we cannot reject a null effect. This in itself does not provide evidence in favour of hypothesis 2. To test this hypothesis, we therefore resort to a Bayesian analysis.[16] Doing so requires an assumption about the prior distribution of the high-earner coefficient in the logit regression.[17] To formulate a null hypothesis, we use the results for proselfs and apply a normal distribution with mean and standard deviation determined by the corresponding logit. Essentially, this assumes that the effect of earnings for prosocials has the same distribution as for proselfs. The alternative hypothesis we use assumes that the effect for prosocials centres around 0 (no effect). We use a normal prior distribution with standard deviation 1 (our conclusions are robust to choosing standard deviation 0.1 instead). In both cases, all other odds ratios are assumed to have a normal prior with mean 0 and standard deviation 1. Specifying the model in this way allows us to calculate the posterior odds ratio of the alternative hypothesis being correct to the null hypothesis being correct. Under the assumption that both models are equally likely a priori, this posterior ratio is 10.1. We conclude that for prosocials, a model where high and low earners follow the same pattern as the proselfs is strongly rejected in favour of one where there is no difference between high and low earners.

Furthermore, model 3 tests hypothesis 3 that among the low earners, prosocial individuals are more likely to attempt a rule change towards more contribution than proself individuals. The table shows that proself individuals are indeed significantly less likely to attempt a rule change than prosocials, given low earnings. The odds ratio of 0.16 implies that proselfs are more than six times less likely to call for a vote. Finally, model 4 tests hypothesis 4 that among the high earners, proself individuals are more inclined to attempt a change of the contribution rule than prosocial individuals. We do observe

Table 1. Rule change attempts from a low contribution rule (*Rule low2*) to a high contribution rule (*Rule high8*)

	M1: Proself individuals (n = 33)	**M2: Prosocial individuals (n = 26)**
	Odds ratio (robust SE)	Odds ratio (robust SE)
High earner	11.27 (11.73)**	0.39 (0.34)
Female	0.90 (0.73)	1.28 (1.24)
Risk attitude	0.57 (0.17)*	0.76 (0.23)
Age	0.97 (0.14)	0.68 (0.18)
Intercept	22.45	32,326.54
Pseudo R^2	0.19	0.10
	M3: Low earners ($n = 32$)	M4: High earners ($n = 27$)
	Odds ratio (robust SE)	Odds ratio (robust SE)
Proself	0.16 (0.14)**	3.88 (3.56)
Female	0.34 (0.30)	1.78 (1.57)
Risk attitude	0.50 (0.15)**	0.99 (0.25)
Age	1.02 (0.20)	0.78 (0.18)
Intercept	124.80	134.10
Pseudo R^2	0.20	0.13

Notes: Logit regression with robust standard errors of call to vote on the independent variables in the first column. */** indicates that the odds ratio is significantly different from 1 at the 10/5/1 per cent level.

that proselfs are almost four times as likely to call for a vote, but this is not significantly different than equal probability. Thus, this last hypothesis is not confirmed.

Of the control variables, risk attitude shows some interesting effects: amongst the proself individuals (model 1) and the low earners (model 3), risk takers attempt to change the rule significantly less often than risk avoiders. Recall that our risk variable takes values between 0 (strongly avoiding risks) and 10 (strongly taking risks). An estimated odds ratio of 0.5 means that each unitary step upward on the risk attitude scale reduces the likelihood of calling for a vote by a factor 2. A change from *Rule low2* to *Rule high8* indeed reduces the risks involved in the public goods game. Our result thus implies that the higher the risk aversion an individual has, the more likely that (s)he will call for a vote to change the contribution rule.

Conclusions

In this study, we examine whether and under what conditions individuals change the formal rules that govern cooperation when both their material incentives to cooperate and their social preferences for outcome distributions differ. There is a large body of experimental and non-experimental literature focusing on the question of what mitigates the tendency to free ride and increases cooperation. Ours complements the existing research by, first, studying the second-order collective action problem of changing cooperation rules as an alternative 'solution' to increase cooperation. Much of the literature on second-order collective action problem has focused on changing informal social norms. Instead, our interest lies in changing formal rules; specifically, on rules that impose a minimum extent to which individuals must cooperate. As illustrated above, such rules can be applicable in various social dilemma situations, ranging from team work in organizations to joint collaborations in academia, or more generally contributions to public goods like schools, bridges, or highways. Our second contribution lies in relaxing the assumption of homogeneity within groups. We simultaneously consider the role of differences in benefits from collective goods and of differences in preferences for outcome distributions in the change of cooperation rules. Our analysis shows that the interaction between their value orientation and the extent to which they benefit from the collective good matters in the way individuals address the second-order collective action problem of changing cooperation rules.

We find evidence that the effect of material incentives on an attempt to change a rule towards more mandatory cooperation depends on one's social preferences. Proselfs who benefit the most from more cooperation are most likely to initiate a rule change to a higher minimum contribution level. It seems that high-earning proselfs, who benefit more than low-earning proselfs from cooperation, expect that their benefits surpass the costs in case of a rule change. To understand prosocials' behaviour, recall that they face a dilemma between higher collective outcomes and equality in their decision to attempt a rule change. Indeed, our data show that a rule change from low to high contribution levels yields both, increased total welfare and higher inequality.

For prosocials, thus, the decision about whether to initiate a rule change strongly depends on how they weigh these two outcomes. Interestingly, we find that although the same dilemma holds for all prosocials, the combined effect on their behaviour relative to proselfs depends on how much they materially benefit from cooperation. When comparing prosocial low earners with proself low earners, the former are much more likely to attempt a rule change towards more contribution than the latter. Instead, prosocial and proself high earners do not significantly differ in their likelihood of attempting a rule change to higher contribution levels. These findings suggest that under conditions of 'poverty' (i.e. lower earnings potential), prosocials are more keen than proselfs on a rule change. In this case, maximization of collective outcomes appears to outweigh the equality motive. In other words, when their earnings are low, prosocials seem to 'solve' the above-mentioned dilemma by satisfying at least one of their desired outcomes. Under conditions of 'wealth' (i.e. higher earnings potential), the fact that we do not observe differences between proselfs and prosocials could be related to the following. Proselfs seem satisfied with their earnings and do not appear to find the benefits from change higher than the costs; prosocials, on the other hand, seem to care more about equality than about maximizing collective outcomes. In the example of scholars collaborating to have a joint publication, these findings mean that those scholars—who benefit less than others from an interdisciplinary joint publication, but at the same time care more about the collective outcome (i.e., a nice piece of research) than about the collaboration costs—will more likely change the existing collaboration agreement in order to increase each scholar's contribution levels to the joint publication. For those scholars whose benefits from an interdisciplinary joint publication are higher than the rest, the underlying motives do not seem to matter as long as changing the existing collaboration agreement would lead to a valuable joint publication.

Earlier work (Gërxhani and van Breemen, 2019) shows that prosocials care more than proselfs about

collective outcomes and are thus more likely to bear the cost of initiating a change of cooperation rules. There, however, the material benefits from cooperation were equally distributed among team members, which is why the motive of enhancing collective outcomes might have driven prosocials' behaviour. In the present study, where the material benefits from cooperation are not equally distributed within a team, it was a priori not obvious what prosocials would do compared to proselfs: act upon the collective outcome motive or upon the equality motive? Our results indicate that the answer to this question depends on which side of the benefits from cooperation distribution scale a prosocial is. Those on the lower end seem to care relatively more about the collective outcome, whereas those on the higher end are more concerned about equality. Prosocials are thus not homogeneous in their behaviour, when compared to proselfs. Prosocials underlying motives in favour or against rule change towards more cooperation varies depending on their relative earnings' position.

A potential limitation of our study is that our participants had only one option for a rule change: it was a choice between either an environment with a rule imposing a low contribution level or one with a rule imposing a high contribution level. In follow-up experiments, one could allow team members to debate or design an own rule to regulate the level of cooperation (Ostrom, 2008). A related limitation is that we applied a single decision-making structure, namely majority voting. Although majority voting is one of the most common formal mechanisms to enact or change a rule, voting systems come in many varieties (Walker *et al.*, 2000). Future research could for example explore the endogenous formation of a new rule by giving participants the possibility to negotiate a level of contribution without imposing a formal decision-making procedure. Finally, while our social value measure was able to categorize individuals as prosocials or proselfs, thus allowing us to address our main research question, future research could enrich and refine our finding that prosocials are not homogeneous in their behaviour when compared to proselfs. For instance, an alternative social value measure can be considered, like the SVO slider measure (social value orientation), which enables a differentiation of the two underlying motives of prosocials (Murphy, Ackermann and Handgraaf, 2011). Although these are all interesting avenues for further research, we see our study as providing a first solid analysis of how heterogeneity in social values and benefits affects individual attempts to change rules towards more mandatory cooperation.

Supplementary Data

Supplementary data are available at *ESR* online.

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Notes

1 Another example can be found in modern crowd funding, where sometimes contribution is not necessary, sometimes mandatory, but not fixed, and sometimes set at a minimum if one wants to benefit from the collective outcome. In such a setting, individuals might want to change the cooperation rules, e.g., fixing them at a minimum or enhancing them in order to generate more collective output.

2 There are various examples of inequality of collective benefits in a society. Think for instance of the disparity of benefits and rewards between temporary and tenured staff members in various organizations. With increased non-standard workplaces and more flexible contracts and fixed-term employment, these disparities might increase in the future (Kalleberg, 2000).

3 Henceforth, we use 'high earners' and 'low earners' when referring to those individuals who receive high and low benefits from the same contribution in a collective good, respectively.

4 This is why we make the initiation of rule change costly in our experiment, as will be clarified later on.

5 This dilemma is not present when benefits from cooperation do not differ, as equality is not at stake. Prosocial individuals then change rules in favour of higher minimum contribution levels to achieve higher collective outcomes (Gërxhani and van Breemen, 2019).

6 Note that we make an assumption here (as well as related to *H4*) about the trade-off prosocials make between collective welfare and equality, while we made no such assumption for *H2*. The reason is that in *H2* we compare two groups of prosocials to each other, and any trade-off they make is assumed to hold for both groups. For *H3* (and *H4*), a trade-off holds only for the prosocial low (high) earners in their comparison to proself low (high) earners.

7 *H1–H4* are logically consistent. It follows from *H2 to H4* that proself high earners will contribute more than proself low earners, which is summarized in *H1*.

8 We find no differences with respect to our participants' gender and age in relation to their social value orientations, contributions to the collective good, their rule change attempt, and their willingness to take risks.

9 See Supplementary Appendix SA for a translated version of the instructions.

10 We used anonymous RING matching, such that for participant 1 'the other' is participant 2, for 2 it is 3, and so forth. For the last participant 'the other' is participant 1.

11 Since we do not use this measure in the current study, we refrain from giving further details. For a related application, see Gërxhani and van Breemen (2019).

12 Meta-analysis shows that 10 rounds are a common number of periods applied in a public goods game (see Zelmer, 2003), and participants are able to cooperate during these rounds, even if they know that a public goods game is finite (Andreoni, 1988).

13 Note that *Rule high8* is introduced because it provides us with a benchmark to which we can compare some general descriptives to the *Rule low2* treatment. Because *Rule high8* already mandates a minimum of eight points, hence a high contribution, our empirical analysis will focus on the change from *Rule low2* to *Rule high8*, as theoretically hypothesized above.

14 Note that this distribution is quite similar to what other related studies find (see, e.g., Offerman, Sonnemans and Schram, 1996).

15 Although it is intuitive that a higher benefit yields higher earnings, it is not trivial. Earnings reflect not only the benefits from the public good, but also the extent of free riding.

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17 We use the coefficient as opposed to the odds ratio because there is no straightforward prior distribution for the latter (which is positive and possibly asymmetric around its mean).

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