Social value orientation and conditional cooperation in the online one-shot public goods game

Social Value Orientation and Conditional Cooperation in the Online One-Shot Public Goods Game

Ennio Bilancini* Leonardo Boncinelli† Tatiana Celadin‡

Abstract

We report two studies on the role of altruism and reciprocity in the online one-shot Public Goods Game (PGG). In study 1 we run an experiment to see whether the disposition to donate (altruistic/prosocial disposition according to the Social Value Orientation scale (SVO), Murphy et al., 2011) and the disposition to reciprocate (disposition to be a conditional cooperator measured with the strategy method (dCC), Fischbacher et al., 2012) explain contribution in the PGG. In study 2 we run a similar experiment where we add the manipulation of cognition by means of two treatments: time pressure (to induce less deliberative decisions) and motivated delay (to induce more deliberative decisions). Overall, we find that: (i) a higher SVO score goes with higher contributions; (ii) higher beliefs go with higher contributions; (iii) dCC does not appreciably account for contributions; (iv) conditional contributions elicited with the strategy method predict actual contribution for the stated belief; (v) while (i)-(iv) are unaffected by treatments, contributions under motivated delay are about 10% higher than under time pressure. Our experimental evidence suggests that altruism, beliefs and predicted contributions account for contributions regardless of the extent of deliberation, which however seems to impact positively and independently contributions.

JEL classification codes: C99; D01; D91; H41.

Keywords: Social Value Orientation; Altruism; Cognition; Reciprocity; Intuition; Deliberation.

Funding sources: This was supported by the Italian Ministry of University and Research (MIUR) through the PRIN project Co.S.Mo.Pro.Be."Cognition, Social Motives and Prosocial Behavior" (grant n.20178293XT) and by the IMT School for Advanced Studies Lucca through the PAI project Pro.Co.P.E. "Prosociality, Cognition, and Peer Effects".

*IMT School for Advanced Studies, Piazza S. Francesco 19, 55100 Lucca, Italy. Tel.: +39 0583 4326 737, email: ennio.bilancini@imtlucca.it.

†Department of Economics and Management, University of Florence, Via delle Pandette 9, 50127 Firenze, Italy. Tel.: +39 055 2759578, fax: +39 055 2759910, email: leonardo.boncinelli@unifi.it.

‡Department of Economics, University of Bologna, Piazza Scaravilli 2, 40126 Bologna, Italy. Email: tatiana.celadin@unibo.it.

1 Introduction

Humans live and are organized in large societies, where cooperation plays a central role. What may have led humans to evolve into potential cooperators has been widely investigated (Nowak, 2006). However, what determines why some individuals cooperate and some others do not, or why some individuals cooperate in some circumstances and do not in some others, is still heavily debated (see Capraro, 2019, for a review) especially for what concerns one-shot anonymous interactions. Leading explanations posit that individuals have *other-regarding preferences* (Fehr and Schmidt, 1999; Camerer and Fehr, 2004; Falk and Fischbacher, 2006) but the shape of such preferences and their distribution in the population is still a matter of investigation (Bruhin et al., 2018).

In this paper, we explore the role of altruism and reciprocity, which are two potential drivers of cooperation, in an online setting. Moreover, we study their dependency on the modes of cognition. To the best of our knowledge, we are the first who address this issue by means of an online experiment.

Reciprocity embodies the idea that one's decision to cooperate is conditional on expected cooperation by others. Available experimental evidence on cooperation in social dilemmas suggests that individuals respond to expected kindness and unkindness with like behavior (Fischbacher et al., 2001; Kurzban and Houser, 2005; Falk and Fischbacher, 2006; Boosey, 2017; Weber et al., 2018), possibly forming expectations on observed past behavior. In particular, models of reciprocity postulate that the beliefs about others' likelihood to cooperate is the key determinant of the extent of one's willingness to cooperate. Also, it has been observed that individuals are typically heterogeneous in both their disposition to be conditional cooperators (Fischbacher et al., 2001) and their beliefs about others' likelihood to cooperate (Fischbacher et al., 2012).

Altruism embodies the idea that one's decision to cooperate is a pure donation, unconditional on expected cooperation by others. The Social Value Orientation score (SVO) is often used as a measure of such disposition (Van Lange et al., 1997; Murphy et al., 2011; Murphy and Ackermann, 2014; Dolton et al., 2019). Available experimental evidence suggests that SVO provides information on the extent to which behavior is cooperative (Pletzer et al., 2018; Bogaert et al., 2008; Balliet et al., 2009; Emonds et al., 2014; Kuss et al., 2015; Bieleke et al., 2017; Alós-Ferrer and Garagnani, 2020).

Although many studies have investigated the role of either altruism or reciprocity, most have considered them separately. An important exception is the approach proposed by Kurzban and Houser (2005) to classify altruists (unconditional cooperators) and reciprocators (conditional cooperators) using actual cooperative behavior in a social dilemma. Kurzban and Houser (2005) provide experimental evidence of a substantial role of both conditional and unconditional cooperators. This kind of classification, which aims at identifying a stable set of behavioral types, implies that reciprocal and altruistic behaviors are mutually exclusive. Here instead we try to consider their joint role for explaining cooperation in a social dilemma. For this reason we use one source of information for measuring the disposition to donate (SVO) and another source of information for measuring the disposition to conditionally cooperate (referred to as dCC hereafter), both distinct from actual behavior in the social dilemma.

To the best of our knowledge only Ackermann and Murphy (2019) have tried so far to shed light on

the joint role of the disposition to donate and the disposition to reciprocate, and they do so in a laboratory setting. Their findings point to the fact that SVO and dCC can be two separable predictors of cooperation in the Public Goods Game (PGG), but their interplay with cognition is not explored.

In this paper, we ran two studies, implemented using the software oTree (Chen et al., 2016), based on incentivized online experiments where individuals play a one-shot anonymous PGG. The PGG is widely used to measure cooperation (Bogaert et al., 2008; Dolton et al., 2019; Kocher et al., 2017; Vives and FeldmanHall, 2018) with the one-shot anonymous version allowing to minimize strategic considerations. The existing literature studying behavior in the one-shot PGG has focused on the following determinants of contributions: internal and external returns to contributions (Goeree et al., 2002), rewards and sanctions (Walker and Halloran, 2004), reciprocity (Fischbacher and Gächter, 2010), public disclosure of contributions (Filiz-Ozbay and Ozbay, 2014), group size (Barcelo and Capraro, 2015), and social uncertainty and SVO (Alós-Ferrer and Garagnani, 2020). We differentiate from these by jointly considering SVO and reciprocity. Moreover, while this literature has typically run lab experiments (with the exception of Barcelo and Capraro, 2015), our studies are conducted online.

In a first study, we ran an online experiment measuring dCC, beliefs about others' contributions and SVO, to see whether dCC and SVO are distinct sources of explanation for the contributions to the one-shot PGG. We found that a higher level of SVO predicts a greater contribution in the PGG, in line with the results of Alós-Ferrer and Garagnani (2020). The same result holds for the beliefs about the average level of contribution of the other members of the PGG, while dCC seems not to play a substantial role. Results hold even when we use the finer classifications for reciprocity proposed by Fischbacher et al. (2012) and Thöni and Volk (2018). The explanation of this result cannot be scarce reliability of the conditional contributions elicited since, for the stated beliefs, they do predict actual contributions. The scarce predictive power of dCC might suggest a reduced role for reciprocity with respect to previous findings obtained in laboratory experiments on PGGs which measure conditional cooperation using the method of Fischbacher et al. (2001) or some related algorithm (Fischbacher et al., 2012; Weber et al., 2018; Fallucchi et al., 2019). However, our finding regarding dCC is directly comparable only with those contributions that regress actual contributions on a dCC variable and beliefs. To the best of our knowledge, the only study in this literature which employs dCC in a similar way is Gächter et al. (2017), where dCC is found to predict larger contributions.

In a second study, we ran another experiment, almost identical to the one in the first study, where the only difference is that we manipulated cognition by means of two conditions: a time pressure treatment (TP) to induce less deliberative decisions (following Alós-Ferrer and Garagnani, 2020), and a motivated delay treatment (MD) to induce more deliberative decisions (following Bilancini et al., 2020). We found that contributions are higher under MD than TP. The role of SVO is basically unaffected by the TP and MD treatments, and, as in the first study, it accounts for contributions. Beliefs are also good predictors of the level of contribution per se, while dCC does not help predict the level of contribution in the PGG, under either treatment, and results hold even when we use the finer classifications for reciprocity proposed by Fischbacher et al. (2012) and Thöni and Volk (2018). Also in this case the elicited conditional contributions appear to be reliable as they do predict actual contributions for the stated beliefs. The lack of treatment effects on the role of SVO roughly replicates, in an online setting, the finding in Alós-Ferrer and Garagnani

(2020) for the one-shot PGG in the lab.

In sum, our addition to the literature is the provision of experimental evidence suggesting that, in the online one-shot PGG: (i) a higher SVO score goes with higher contribution levels, irrespective of the manipulation of the cognitive manipulations; (ii) higher beliefs about others' contribution go with higher contribution levels, irrespective of the cognitive manipulations; (iii) measures of the disposition to conditionally cooperate obtained with the strategy method do not appreciably account for contributions, irrespective of the cognitive manipulations; (iv) conditional contributions elicited with the strategy method predict actual contribution for the stated beliefs, irrespective of the cognitive manipulation; (v) contributions under MD are about 10% higher than under TP. So, while altruism, expectations about others' contributions and elicited conditional contributions seem to well predict actual contributions, disposition to conditionally contribute does not seem to add much to the explanation. All this holds regardless of the extent of deliberation, which however seem to affect positively and independently contribution levels.

The paper is organized as follows: Section 2 presents the first study, Section 3 presents the second study, Section 4 explores predicted contributions in both studies, and Section 5 discusses the results. Supplementary information on collected data, experimental instructions, and alternative analyses can be found in the Appendix.

2 Study 1

In the first experiment we study how individual measures of SVO and dCC predict contributions in an online one-shot PGG, taking into account beliefs about others' contributions.

SVO (Murphy et al., 2011) is an incentivized continuous measure that captures social preferences of individuals. It consists of a series of points allocation tasks that are a variant of the dictator game (DG) (Forsythe et al., 1994), that captures how much an agent is willing to sacrifice in order to make another agent better off (or worse off).[1] Each individual gets a score that is an angle between $-16.26°$ and $61.39°$, resulting from the choices in the allocation tasks. An angle between $-12.04°$ and $22.45°$ is defined as individualistic predisposition; in particular, an angle of $0°$ is interpreted as caring for own payoff only. An angle between $22.45°$ and $57.15°$ is defined as prosocial predisposition; in particular, an angle of $45°$ gives equal weights to own and others' payoff. An angle below $-12.04°$ is defined as competitive predisposition. Finally, an angle above $57.15°$ is defined as purely altruistic predisposition.

Our measure of dCC is binary and captures the willingness to cooperate conditionally on the belief that an individual has about others' contributions. Specifically, an individual classified as dCC has a predisposition to contribute which, on average, grows in her expectation about others' contributions (as in Fischbacher et al., 2012). To elicit dCC we use a variant of the strategy method (Selten, 1967; Fischbacher et al., 2001). Given our focus on reciprocity, and not on an exhaustive classification of behavioral types, we group together all individuals who are not dCC and we refer to them as nCC. More articulated classifications have been used in the literature, distinguishing among free riders, hump shaped and unconditional cooperators

[1] See (Engel, 2011) for a meta-study on dictator game experiments.

(Fischbacher et al., 2001; Thöni and Volk, 2018). We report in Appendix A the analysis employing such finer classifications, as a robustness check of our results.

2.1 Method

We recruited 250 participants using the online platform Prolific (www.prolific.co; Palan and Schitter, 2018). Our participants were mainly from UK and US (UK=46.4%, US=51.2%, Ireland=2%, unknown=0.4%; mean age=33.52, males=41.2%, females=58.8%). Participants were randomly assigned to groups of four individuals to play a one-shot anonymous PGG. Each participant was endowed with 20 points, and they had to decide how many points to contribute to a common pool. The sum of contributions to the common pool was then doubled and redistributed evenly among the group members. No feedback was provided.

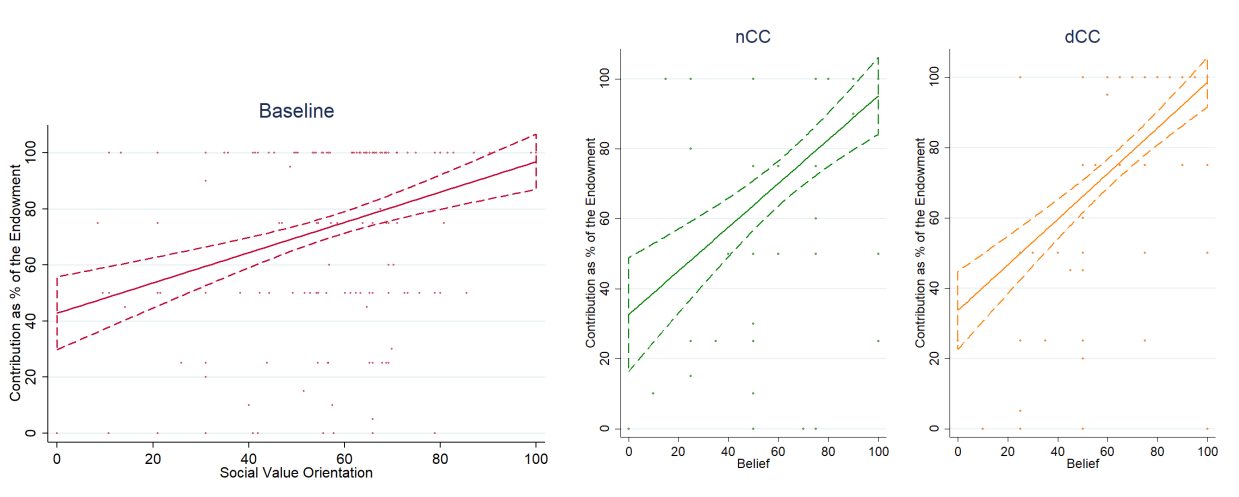
After the one-shot PGG, we elicited an incentivized measure of participants' beliefs about the average contribution of the other three group members. Participants obtained a bonus of 10 points if they guessed correctly the average level of contribution (rounded to the closest integer) by the other group members. Subsequently, we elicited, using the strategy method, an incentivized measure of the disposition to conditionally cooperate: participants had to indicate how much they wanted to contribute to the public good conditionally on different (integer) values of average contribution by the other group members. More precisely, participants had to choose a contribution level for 21 different values of the average contribution by the other group members (from 0 to 20). We incentivized the strategy method following Fischbacher et al. (2001): for each group, a member was randomly selected and her payoff calculated using the choice she made under the strategy method for the average contribution value that matched the actual one in her group (rounded to the closest integer), whereas for the other three group members the payoff was computed according to the decisions made in the one-shot PGG. This method allows assessing how individuals would like to condition their decision on the behavior of the other group members (in Appendix A we report the maps of conditional cooperation strategies at the individual level obtained from actual choices). Individuals are classified as dCC either if they show a monotonic pattern of contributions, with at least one increase, or if they have a positive Spearman rank correlation that is significant at the 1%-level (see Fischbacher et al., 2012, for the details of this definition); otherwise, individuals are classified as non-conditional cooperators (nCC). In this part of the experiment 10 points corresponded to 0.10 GBP.

Subsequently, we elicited an incentivized measure of SVO using the task in the version of the six primary items by Murphy et al. (2011). Participants were randomly assigned to interact with a new participant (different from those with whom they were playing the PGG). All the participants completed the SVO task. Payments were determined by randomly assigning participants to the role of decision-maker or receiver, and one of the decision-maker's choices was randomly selected to determine the payoffs of both participants involved. In this part of the experiment 10 points corresponded to 0.05 GBP.

We opted to pay for all tasks, in particular both the one-shot PGG and the belief elicitation. Admittedly, this increases the room for potential biases due to hedging motives. However, as pointed out by Blanco et al. (2010), in order for such biases to be a major issue the hedging problem should be fairly transparent and the gains from hedging substantial. In our setup it is quite difficult to figure out what is the guess that

optimally insures against the risk of low contributions by others and, moreover, the payment for a correct guess is rather small. Randomizing payments across tasks would have helped in reducing hedging motives, but it could have also generated some confusion about the payment mechanism, especially in the online setting where participants tend to spend little time on screens and they cannot ask for clarifications during the experiment.

The average earnings in this study were 1.14 GPB including 0.40 GPB of show-up fee.



(a) (b)

Figure 1: (a) Linear prediction of the level of contribution in the PGG as a function of SVO. (b) Linear prediction of the level of contribution in the PGG as a function of the individual belief about others' average contribution, distinguishing between participants classified as conditional cooperators (dCC) and non-conditional cooperators (nCC). Scatter plots identify the relative frequencies of the observations in the sample. Confidence intervals are at 95%.

2.2 Results

Our analysis focuses on how much SVO, beliefs and dCC can account for actual contributions in the one-shot PGG (average contribution is 14.8 Points).

In Table 1, we report the fraction of participants that we classified as dCC and nCC, together with the fractions for the finer classifications by Fischbacher et al. (2001) and Thöni and Volk (2018) (see Appendix A for details on the classification rules). Notably, slightly less than two-thirds of participants are classified as dCC. Overall, our coarser classification does not depart very much from the one obtained following Fischbacher et al. (2001) (only about 7% of participants are not classified as either dCC or Other), while the difference with the classification obtained following Thöni and Volk (2018) is more pronounced (about 22% of participants are not classified as either dCC or Other).

Classification	Fischbacher et al., 2001	Thöni and Volk, 2018	This paper
Conditional Cooperators	64.4%	63.2%	64.4%
Free Riders	2%	2%	–
Hump Shaped	5.2%	6%	–
Unconditional Cooperators	–	14.4%	–
Other	28.4%	14.4%	35.6%

Table 1: Classification of behavioral types in Study 1 following Fischbacher et al. (2001), Thöni and Volk (2018), and our classification.

In Figure 1a contributions are plotted against the SVO score, which turns out to be a good predictor: participants with a higher SVO score contributed more to the PGG. This finding is confirmed by the Tobit regression reported in Table 2 (Model 1); the result holds even when controls for nationality, gender, familiarity with the task and comprehension of the task are included as regressors (Model 2), suggesting that SVO positively affects contributions to the PGG.

Beliefs are good predictors, indeed they positively affect contributions to the PGG. This finding is confirmed by the Tobit regression reported in Table 2 (Model 2); the result holds even when controls for nationality, gender, familiarity with the task and comprehension of the task are included as regressors (Model 3).

To investigate the role of the disposition to conditionally cooperate, we look at how being classified as dCC, as opposed to nCC, affects the relation between beliefs and contributions (Figure 1b). Comparing the relation in the two cases we see that beliefs seem to matter in the same way for participants classified as dCC and participants classified as nCC. This insight is confirmed by the Tobit regressions reported in Table 2 (Models 3 and 4), even when we examine the impact of SVO and dCC simultaneously (Models 5 and 6). Such evidence may be reconciled with the estimates provided by Fischbacher et al. (2012, Table 4) by considering the fact that applying their finer classification of types we have only less than 1% of Free Riders (Table 1), who are the only types for which beliefs seem to matter substantially less.

For completeness and as robustness checks for our results, in Appendix A we report alternative regressions using the finer classification of types applied in Fischbacher et al. (2001) and the one in Thöni and Volk (2018). We find that results obtained under these alternative specifications are very similar to those presented here.

In sum, our results confirm that a higher SVO predicts higher contributions. Instead, being a dCC is not predictive of contributions being more reactive to beliefs about others' contributions. However, beliefs seem to matter *per se*. This fact is not straightforward to interpret. For instance, it could be because of the "false consensus effect" (Ross et al., 1977), or it could be because other kinds of other-regarding preferences matter (we refer the reader to the discussion in Section 5 on this point).

To investigate a possible explanation of our results we conducted a second study where we attempt to manipulate the cognitive mode of participants playing the PGG, following the idea that SVO and dCC might

play a different role under different cognitive modes.

Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
SVO	1.196***	1.127***			0.912***	0.851***
	(0.263)	(0.265)			(0.244)	(0.243)
Belief			1.370***	1.393***	1.222***	1.244***
			(0.290)	(0.282)	(0.291)	(0.279)
dCC			-5.008	-1.721	-10.91	-7.510
			(22.29)	(22.18)	(22.29)	(21.88)
Belief×dCC			0.173	0.129	0.264	0.236
			(0.377)	(0.366)	(0.369)	(0.357)
Controls:						
UK		5.099		10.18		5.249
		(9.241)		(7.786)		(7.753)
Female		5.943		12.37		11.61
		(9.181)		(8.191)		(7.863)
Familiarity		17.74**		17.95**		14.14*
		(8.820)		(7.751)		(7.238)
Understood		-9.552		-7.208		-10.62
		(11.18)		(9.967)		(9.688)
Constant	32.34**	5.209	10.66	-29.43	-32.72	-60.48**
	(15.11)	(19.64)	(17.58)	(22.37)	(21.78)	(24.24)
N	250	250	250	250	250	250
pseudo R^2	0.016	0.019	0.056	0.063	0.069	0.074

Table 2: Tobit regressions on the level of endowment contributed in the one-shot PGG. *SVO* is individuals' social value orientation; *Belief* is the individuals' belief about others contributions; *dCC*=1 if an individuals is considered as a conditional cooperator, 0 otherwise; *dCC*×*Belief* is the interaction between being and conditional cooperator and the level of beliefs about others' contributions; *UK*=1 if nationality is United Kingdom (46.4%), 0 otherwise; *Female*=1 if female (58,8%), 0 otherwise; *Familiarity* = 1 if individuals have seen "nothing like this scenario" before, 2 if they have seen "somewhat this scenario" and 3 if they have seen "exactly this scenario" (1=46%, 2=53.2%); *Understood*=1 if individuals answered correctly to all the control questions, 0 otherwise (1=24.8%). Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

3 Study 2

This second study is similar to Study 1, with the only difference that we randomly assign experimental subjects to two distinct treatments: a time pressure treatment (TP) and a motivated delay treatment (MD). We aim to see if the treatments alter how SVO, beliefs and dCC predict contributions in the one-shot PGG. As in Study 1, we do so by contrasting dCC with nCC (see Appendix A for an analysis with finer classifications according to Fischbacher et al., 2001, and Thöni and Volk, 2018).

3.1 Method

In this second experiment we recruited 504 participants using the online platform Prolific (www.prolific.co). Our participants are mainly from UK and US (UK=43.45%, US=52.58%, Ireland=3.57%, unknown=0.40%; mean age=31.67; males=41.87%, females=58.13%). Individuals were randomly assigned to one of the two conditions, 257 participants to the TP treatment and 247 participants to the MD treatment. In the TP treatment material incentives were provided to answer in a short amount of time. Specifically, we applied costly waiting as introduced by Alós-Ferrer and Garagnani (2020): participants were endowed with 15 additional points and 1.5 points were detracted from this amount for each second taken by the subject to make the decision. After 10 seconds participants could still make their decisions, though they earned no bonus in this case. In the MD treatment, following Bilancini et al. (2020), participants had to write a motivation for their level of contribution before they actually inserted how much they wanted to contribute; they were rewarded with 5 additional points if they gave a meaningful motivation of at least 40 characters.[2]

The average earnings in this study were 1.19 GPB including 0.40 GPB of show-up fee.

3.2 Results

In the TP treatment 92.61% of the participants (238 out of 257) complied with the time incentive structure (compliance means that the response time did not exceed the threshold after which zero extra points are obtained). In the MD treatment, all participants, except for 2, complied with the request to provide a meaningful motivation for their choice (99.19%). We included all participants in the analysis (we checked that results do not change if we exclude participants that did not comply with the time incentive structure). In Table 3, we report the fraction of participants that we classified as dCC and nCC in each treatment, together with the fractions for the finer classifications by Fischbacher et al. (2001) and Thöni and Volk (2018) (see Appendix A for details on the classification rules). As in Study 1, slightly less than two-thirds of participants are classified as dCC. Overall, our coarser classification is close to the one obtained following Fischbacher et al. (2001) (only about 10% of participants are not classified as either dCC or Other), while

[2]In order to minimize potential demand effects, in the instructions – rather than asking for a meaningful motivation, which could in principle generate the expectation of a high contribution – we exemplify what we mean by *non-meaningful* as follows: "If you give a non-meaningful motivation (e.g., "aaaaaaaaa...") you will not obtain the bonus" (see Appendix B, Screenshots of Study 2).

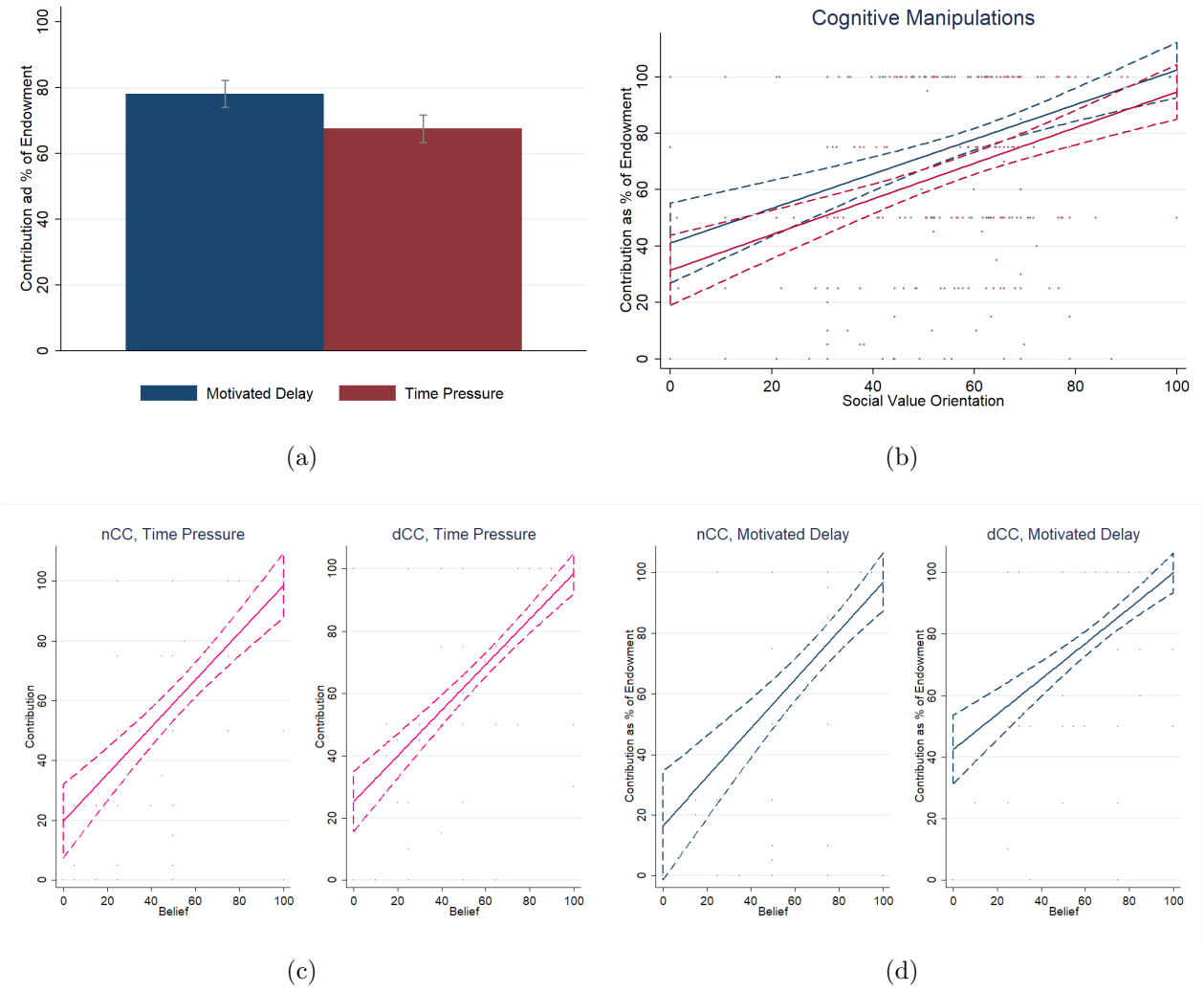


Figure 2: (a) Mean of the level of contribution between treatments in the PGG. Wilcoxon rank-sum test, N=504, z=4.054, p <0.000. Epps-Singleton test, N=504, $W2$=25.289, p <0.000. (b) Linear prediction of the level of contribution in the PGG as a function of SVO in both treatments. (c) Linear prediction of the level of contribution in the PGG as a function of the individual belief about others' average contribution, distinguishing between participants classified as conditional cooperators (dCC) and non-conditional cooperators (nCC), under the Time Pressure treatment (TP). (d) Linear prediction of the level of contribution in the PGG as a function of the individual beliefs about others' average contribution, distinguishing between participants classified as conditional cooperators (dCC) and non-conditional cooperators (nCC), under the Motivated Delay treatment (MD). Scatter plots identify the relative frequencies of the observations in the sample. Confidence intervals are at 95%.

the difference with the classification obtained following Thöni and Volk (2018) is more substantial (about 25% of participants are not classified as either dCC or Other).

	Fischbacher et al., 2001		Thöni and Volk, 2018		This paper	
	TP	MD	TP	MD	TP	MD
Conditional Cooperators	58.37%	62.35%	59.53%	61.54%	58.37%	62.35%
Free Riders	5.45%	2.83%	5.45%	2.83%	–	–
Hump Shaped	3.11%	2.83%	3.89%	3.24%	–	–
Unconditional Cooperators	–	–	13.62%	19.84%	–	–
Others	33.07%	31.99%	17.51%	12.55%	41.63%	37.65%

Table 3: Classification of behavioral types in Study 2 following Fischbacher et al. (2001), Thöni and Volk (2018), and our classification, for each treatment. For each of these classifications we cannot reject the null hypothesis that the distribution of types is equal in the TP and MD treatments (p-values for the Fischer's exact test are, $p = 0.484$, $p = 0.122$, and $p = 0.364$, respectively).

Figure 2a shows that the average contributions under MD (on average 15.6 points) are higher with respect to the TP treatment (on average 13.5 points), with the difference being statistically significant (Wilcoxon rank-sum test, N=504, z=4.054, p <0.001; Epps-Singleton test, N=504, $W2$=25.289, p <0.001). A Tobit regression (see Table 4, Model 1) confirms that the MD cognitive manipulation had a significant effect, and this holds even when controls for nationality, gender, familiarity with the task and comprehension of the task are included as regressors (see Table 4, Model 2). The effect of the treatments on cooperative behavior can be placed into a lively debate which is still to be settled (see the meta-analyses in Rand, 2016, Bouwmeester et al., 2017, Isler et al., 2021 and Kvarven et al., 2020, and also Capraro, 2019, for a recent review).

In Figure 2b contributions are plotted against the SVO score. As in Study 1, a higher SVO goes with higher contributions, on average. Specifically, this happens in both treatments with no substantial difference. These findings are confirmed by a Tobit regression (see Table 4, Model 3), also controlling for nationality, gender, familiarity with the task and comprehension of the task (Table 4, Model 4). Overall the estimated coefficients for SVO are consistent across our two studies and substantially in line with those obtained by Alós-Ferrer and Garagnani (2020). When we look at the beliefs we have that higher beliefs predict higher contributions, on average, and this happens in both treatments. These findings are confirmed by a Tobit regression (see Table 4, Model 3), also controlling for nationality, gender, familiarity with the task and comprehension of the task (Table 4, Model 4). As in Study 1, beliefs seem to matter *per se*, which remains a fact that is not straightforward to explain (a more detailed discussion on this point can be found in the following Section 5).

Figures 2c and 2d show that in the TP treatment, as well as in the MD treatment, the relationship between one's belief about others' contributions and one's contribution does not depend much on being classified as dCC or nCC, similarly to what we found in Study 1. In particular, higher beliefs go with higher contributions. The Tobit regressions in Table 4 confirm these results (Models 3 and 4). Results hold even

Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
MD	28.57***	27.92***	7.540	6.615	-23.71	-26.84
	(7.185)	(7.101)	(5.532)	(5.503)	(22.10)	(22.04)
SVO			0.831***	0.826***	0.836***	0.837***
			(0.166)	(0.167)	(0.164)	(0.164)
Belief			1.495***	1.519***	1.388***	1.393***
			(0.176)	(0.173)	(0.235)	(0.230)
dCC			6.710	8.946	-10.12	-9.663
			(13.11)	(12.92)	(16.12)	(15.71)
Belief×dCC			-0.007	-0.015	0.179	0.210
			(0.235)	(0.233)	(0.313)	(0.306)
Belief×MD					0.364	0.407
					(0.383)	(0.380)
dCC×MD					50.18*	54.42*
					(28.33)	(28.04)
Belief×dCC×MD					-0.580	-0.661
					(0.488)	(0.480)
Controls:						
UK		7.605		0.922		0.738
		(7.109)		(5.418)		(5.385)
Female		9.688		2.903		1.950
		(7.355)		(5.539)		(5.499)
Familiarity		4.570		7.060		7.184
		(6.877)		(5.066)		(5.071)
Understood		-2.580		-12.82**		-13.53**
		(8.302)		-(6.471)		(6.411)
Constant	86.90***	71.57***	-52.39***	-63.62***	-43.35***	-53.48***
	(4.960)	(12.08)	(11.95)	(13.77)	(13.89)	(14.95)
N	504	504	504	504	504	504
pseudo R^2	0.006	0.007	0.092	0.094	0.093	0.096

Table 4: Tobit regressions on the level of endowment contributed in the one-shot PGG. *MD*=1 if individuals are under the motivated delay condition, 0 otherwise; *SVO* is the individuals' social value orientation; *Belief* is the individuals' belief about others contributions; *dCC*=1 if an individuals is considered as a conditional cooperator, 0 otherwise; *dCC*×*Belief* is the interaction between being and conditional cooperator and the beliefs about others' behavior; *UK*=1 if nationality is United Kingdom (43.45%), 0 otherwise; *Female*=1 if female, 0 otherwise (1=58,13%); *Familiarity* = 1 if individuals have seen "nothing like this scenario" before, 2 if they have seen "somewhat this scenario" and 3 if they have seen "exactly this scenario" (1=49.40%, 2=49.01%, 3=1.59%); *Understood*=1 if individuals answered correctly to all the control questions, 0 otherwise (1=26.39%). Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

when we pool together all the variables (Model 5 and 6), only the interaction between dCC and the MD treatment is slightly significant. Interestingly, this result is in line with Gächter et al. (2017) who find a positive effect of being classified as dCC (see regressions in Section 3 of Supplementary Information), hinting that the MD treatment may be more likely to recreate the conditions of play in Gächter et al. (2017), e.g., the lab setting.

Finally, as done for Study 1, in Appendix A we report alternative regressions analysis using the finer classification of types applied in Fischbacher et al. (2001) and the one in Thöni and Volk (2018). Again, we find that results obtained under these alternative specifications are very similar to those presented here.

4 Predicted contributions

An alternative way to assess the role beliefs and conditional contributions is the one proposed by Fischbacher and Gächter (2010) and Fischbacher et al. (2012): calculating *predicted contributions*, i.e., the prediction obtained from reported conditional contributions and the belief actually reported, and then regressing actual contributions on predicted contributions and beliefs. In our case we add as regressor SVO (to account for altruism).

More precisely, the predicted contribution of a participant is the contribution that the participant provided when asked to contribute conditionally (with the strategy method) on the specific average contribution of the other group members that is equal to the belief about others' average contribution that the same subject actually stated.

Table 5 reports results of Tobit regressions for Study 1. Estimates show that predicted contributions alone (Model 1), together with beliefs (Model 2), and together with SVO (Model 3) predict actual contributions. At the same time, both beliefs and SVO predict contributions with comparable estimates, even when included simultaneously as regressors (Model 4). Results hold even when we control for nationality, gender, familiarity with the task, and comprehension of the task (Model 5).

Table 6 reports results of Tobit regressions for Study 2. Estimates show that predicted contributions alone (Model 1), together with beliefs (Model 2), and together with SVO (Model 3) predict actual contributions, controlling for the treatment effect of MD. Also in this case, both beliefs and SVO predict contributions with comparable estimates, when included simultaneously as regressors. These results hold even when we control for nationality, gender, familiarity with the task, and comprehension of the task (Model 5). Finally, it is worth stressing that the treatment effect of MD becomes statistically not significant when all three regressors are included (Model 4 and Model 5). Importantly, beliefs do not appear to have a stronger role in the MD treatment with respect to the TP treatment (Model 5).

In sum, these results are consistent with what we found in the analyses of Section 2 and Section 3: even controlling for predicted contributions, higher SVO and higher beliefs predict a higher level of contributions in the PGG, irrespective of the cognitive manipulation. In particular, beliefs do not appear to play a substantially different role in the MD and TP treatment.

We observe that in this setup there is no direct measure of the disposition to conditionally cooperate, so it is not straightforward to identify what should be accounting for reciprocity. If one interprets beliefs or predicted contribution as a proxy of the role of reciprocity in determining contributions, then our estimates suggest that reciprocity actually matters as much, if not more, than SVO, which is in contrast to what one can conclude from our analysis in Section 2 and Section 3. So, while the predictive role of beliefs and SVO are confirmed, one can actually conclude differently regarding the role of reciprocity depending on the interpretation of predicted contributions and beliefs, and more in general on the operationalization of reciprocity. In any case, this analysis confirms the reliability of conditional contributions elicited with the strategy method and, hence, the classifications of participants' types based on it.

Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5
Predicted Cont	1.162***	0.781***	1.072***	0.682***	0.693***
	(0.124)	(0.157)	(0.117)	(0.146)	(0.149)
Belief		0.786***		0.800***	0.808***
		(0.205)		(0.193)	(0.189)
SVO			0.682***	0.697***	0.657***
			(0.234)	(0.229)	(0.228)
Controls:					
UK					4.449
					(7.421)
Female					15.96**
					(7.652)
Familiarity					7.641
					(7.004)
Understood					-8.626
					(9.128)
Constant	37.72***	8.777	3.056	-27.10*	-47.41**
	(7.287)	(9.450)	(14.53)	(16.32)	(20.07)
N	250	250	250	250	250
pseudo R^2	0.064	0.076	0.084	0.071	0.089

Table 5: Study 1. Tobit regressions on the level of endowment contributed in the one-shot PGG. *Predicted Cont* is the predicted contribution of the participants; *SVO* is the individuals' social value orientation; *Belief* is the individuals' belief about others contributions; *UK*=1 if nationality is United Kingdom, 0 otherwise; *Female*=1 if female, 0 otherwise; *Familiarity* = 1 if individuals have seen "nothing like this scenario" before, 2 if they have seen "somewhat this scenario" and 3 if they have seen "exactly this scenario"; *Understood*=1 if individuals answered correctly to all the control questions, 0 otherwise. Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

5 Discussion

We have run two experiments to explore how altruism and reciprocity affect contributions in an online one-shot PGG, trying to understand if the manipulation of cognition can alter their role.

The experimental evidence that we collected suggests that the disposition to donate, beliefs about others'

Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
MD	16.05***	8.645*	14.89***	7.669	-3.711	-3.837
	(5.639)	(5.170)	(5.469)	(4.989)	(12.51)	(12.55)
Predicted Cont	1.302***	0.880***	1.198***	0.788***	0.798***	0.808***
	(0.0887)	(0.113)	(0.0863)	(0.109)	(0.110)	(0.109)
Belief		0.895***		0.876***	0.782***	0.799***
		(0.140)		(0.136)	(0.165)	(0.161)
SVO			0.573***	0.536***	0.539***	0.535***
			(0.155)	(0.146)	(0.145)	(0.145)
Belief×MD					0.201	0.187
					(0.218)	(0.217)
Controls:						
UK						3.203
						(4.999)
Female						2.550
						(5.096)
Familiarity						5.855
						(4.644)
Understood						-13.45**
						(5.530)
Constant	17.54***	-11.72*	-10.21	-37.04***	-32.71***	-41.95***
	(5.162)	(6.080)	(9.239)	(9.540)	(10.60)	(12.17)
N	504	504	504	504	504	504
pseudo R^2	0.093	0.112	0.098	0.118	0.118	0.121

Table 6: Study 2. Tobit regressions on the level of endowment contributed in the one-shot PGG. *MD*=1 if individuals are in the motivated delay condition, 0 otherwise; *Predicted Cont* is the predicted contribution of the participants; *SVO* is the individuals' social value orientation; *Belief* is the individuals' belief about others contributions; *UK*=1 if nationality is United Kingdom, 0 otherwise; *Female*=1 if female, 0 otherwise; *Familiarity* = 1 if individuals have seen "nothing like this scenario" before, 2 if they have seen "somewhat this scenario" and 3 if they have seen "exactly this scenario"; *Understood*=1 if individuals answered correctly to all the control questions, 0 otherwise. Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

behaviors, and elicited conditional contribution are sources of explanation of actual contributions, and they are so regardless of the cognitive manipulations. Interestingly, we found that the disposition to reciprocate does not predict contributions in any case. Importantly, we also found out that the disposition to donate and the disposition to be a conditional cooperator are two distinct behavioral dimensions, showing little or no correlation (see Table 11 and 12 in the Appendix).

In more detail, in our first experiment there was no cognitive manipulation, while in the second experiment cognition was manipulated by means of a time pressure treatment and a motivated delay treatment. Comparing the data of the two experiments we found that in the time pressure condition participants roughly behaved as in the first experiment. If one assumes that deliberation has been more likely in the motivated delay treatment than in the time pressure treatment, then our results can be interpreted as suggesting that the baseline attitude in online experiments involving PGG is closer to intuition than deliberation – which may well be different from what happens in the laboratory (Kurzban and Houser, 2005; Chaudhuri et al., 2006; Rustagi et al., 2010; Gächter et al., 2012; Cheung, 2014; Gächter et al., 2017; Ackermann and Murphy, 2019).

One may see our result regarding the little role for the disposition to conditionally cooperate as in contrast with the previous literature (Fischbacher et al., 2001, 2012). However, this may not be the case actually. One possibility is related to the online environment that may lead people to rely more on expectations and altruism rather than reciprocal attitudes. Further research on this point is needed. Another possibility is related to the classification between conditional cooperators and non-conditional cooperators. Recent work by Fallucchi et al. (2019) suggests using hierarchical clustering analysis to construct a typology of behaviour in the Public Goods Game. This is an interesting methodology to deal with the classification of behaviorial types in the Public Goods Game, which imposes less restrictions than more traditional ones (Fischbacher et al., 2001; Thöni and Volk, 2018). It seems worth exploring the application of this methodology considering both conditional cooperation strategies and altruistic choices, possibly advancing on what has been attempted by Kurzban and Houser (2005) and what we have done here. One last possibility is a different operationalization of reciprocity. Indeed, when we follow Fischbacher and Gächter (2010) and Fischbacher et al. (2012) using predicted contributions to assess the role of beliefs in predicting by controlling for reported conditional behavior we find a substantial role for beliefs. If one interprets beliefs in this setup as a proxy of reciprocity then the contrast disappears, while both the positive role of the disposition to donate and the non-dependency of results on the cognitive manipulations are confirmed. A similar argument applies if one interprets predicted contributions as a proxy of reciprocity.

Finally, one may wonder why beliefs about others' contributions apparently matter *per se* and not only in relation to the disposition to reciprocate. This could be due to the "false consensus effect" (Ross et al., 1977): participants who like to contribute more tend to have more optimistic beliefs about others' contributions (e.g., because of introspection). If the role of beliefs is entirely due to the false consensus effect and the false consensus effect is entirely driven by one's own disposition to donate, then such role should vanish when controlling for the disposition to donate. Actually, we find that the role of beliefs is reduced when controlling for the disposition to donate but it does not disappear, suggesting that the false consensus effect depends at least in part on some other preference and/or the role of beliefs is not entirely driven by the

false consensus effect. The role of beliefs can also be related to the "hot-cold empathy gap" (Loewenstein and Prelec, 1992; Loewenstein, 2005). Indeed the strategy method can be seen as the "cold" status where individuals deliberate, while actual beliefs can be seen as the "hot" status, and thus they can have a higher predictive power with respect to the disposition to reciprocate. Another possibility, which does not rest on the false consensus effect, is that contributions are conditional on beliefs due to other-regarding preferences different from the disposition to donate (e.g., positional concerns, compliance to social norms). In this case beliefs would capture the effect of such preferences when controls for them are omitted (Cooper and Kagel, 2016). Unfortunately, this is not testable with our data as we lack proper measures of such other-regarding preferences. Given the quantitative relevance of beliefs as a positive predictor of contributions, we think that further experimental research in this regard is very much needed.

References

Ackermann, K. A. and R. O. Murphy (2019). Explaining cooperative behavior in public goods games: How preferences and beliefs affect contribution levels. *Games 10*(1), 15.

Alós-Ferrer, C. and M. Garagnani (2020). The cognitive foundations of cooperation. *Journal of Economic Behavior & Organization 175*, 71–85.

Balliet, D., C. Parks, and J. Joireman (2009). Social value orientation and cooperation in social dilemmas: A meta-analysis. *Group Processes & Intergroup Relations 12*(4), 533–547.

Barcelo, H. and V. Capraro (2015). Group size effect on cooperation in one-shot social dilemmas. *Scientific Reports 5*(1), 1–8.

Bieleke, M., P. M. Gollwitzer, G. Oettingen, and U. Fischbacher (2017). Social value orientation moderates the effects of intuition versus reflection on responses to unfair ultimatum offers. *Journal of Behavioral Decision Making 30*(2), 569–581.

Bilancini, E., L. Boncinelli, and L. Luini (2020). Does focality depend on the mode of cognition? Experimental evidence on pure coordination games. *Mimeo*.

Blanco, M., D. Engelmann, A. K. Koch, and H.-T. Normann (2010). Belief elicitation in experiments: is there a hedging problem? *Experimental Economics 13*(4), 412–438.

Bogaert, S., C. Boone, and C. Declerck (2008). Social value orientation and cooperation in social dilemmas: A review and conceptual model. *British Journal of Social Psychology 47*(3), 453–480.

Boosey, L. A. (2017). Conditional cooperation in network public goods experiments. *Journal of Behavioral and Experimental Economics 69*, 108–116.

Bouwmeester, S., P. P. Verkoeijen, B. Aczel, F. Barbosa, L. Bègue, P. Brañas-Garza, T. G. Chmura, G. Cornelissen, F. S. Døssing, A. M. Espín, et al. (2017). Registered replication report: Rand, greene, and nowak (2012). *Perspectives on Psychological Science 12*(3), 527–542.

Bruhin, A., E. Fehr, and D. Schunk (2018). The many faces of human sociality: Uncovering the distribution and stability of social preferences. *Journal of the European Economic Association 17*(4), 1025–1069.

Camerer, C. F. and E. Fehr (2004). Measuring social norms and preferences using experimental games: A guide for social scientists. *Foundations of human sociality: Economic experiments and ethnographic evidence from fifteen small-scale societies 97*, 55–95.

Capraro, V. (2019). The dual-process approach to human sociality: A review. *Available at SSRN (3409146)*.

Chaudhuri, A., T. Paichayontvijit, et al. (2006). Conditional cooperation and voluntary contributions to a public good. *Economics Bulletin 3*(8), 1–14.

Chen, D. L., M. Schonger, and C. Wickens (2016). otreean open-source platform for laboratory, online, and field experiments. *Journal of Behavioral and Experimental Finance 9*, 88–97.

Cheung, S. L. (2014). New insights into conditional cooperation and punishment from a strategy method experiment. *Experimental Economics 17*(1), 129–153.

Cooper, D. J. and J. H. Kagel (2016). Other-regarding preferences. In *The handbook of experimental economics*, Volume 2. Princeton University Press.

Dolton, P., R. S. Tol, et al. (2019). Correlates of social value orientation: Evidence from a large sample of the uk population. Technical report.

Emonds, G., C. H. Declerck, C. Boone, R. Seurinck, and R. Achten (2014). Establishing cooperation in a mixed-motive social dilemma. an fmri study investigating the role of social value orientation and dispositional trust. *Social Neuroscience 9*(1), 10–22.

Engel, C. (2011). Dictator games: A meta study. *Experimental Economics 14*(4), 583–610.

Falk, A. and U. Fischbacher (2006). A theory of reciprocity. *Games and Economic Behavior 54*(2), 293–315.

Fallucchi, F., R. A. Luccasen, and T. L. Turocy (2019). Identifying discrete behavioural types: a reanalysis of public goods game contributions by hierarchical clustering. *Journal of the Economic Science Association 5*(2), 238–254.

Fehr, E. and K. M. Schmidt (1999). A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics 114*(3), 817–868.

Filiz-Ozbay, E. and E. Y. Ozbay (2014). Effect of an audience in public goods provision. *Experimental Economics 17*(2), 200–214.

Fischbacher, U. and S. Gächter (2010). Social preferences, beliefs, and the dynamics of free riding in public goods experiments. *American Economic Review 100*(1), 541–56.

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

Fischbacher, U., S. Gächter, and S. Quercia (2012). The behavioral validity of the strategy method in public good experiments. *Journal of Economic Psychology 33*(4), 897–913.

Forsythe, R., J. L. Horowitz, N. E. Savin, and M. Sefton (1994). Fairness in simple bargaining experiments. *Games and Economic Behavior 6*(3), 347–369.

Gächter, S., F. Kölle, and S. Quercia (2017). Reciprocity and the tragedies of maintaining and providing the commons. *Nature Human Behaviour 1*(9), 650–656.

Gächter, S., D. Nosenzo, E. Renner, and M. Sefton (2012). Who makes a good leader? cooperativeness, optimism, and leading-by-example. *Economic Inquiry 50*(4), 953–967.

Goeree, J. K., C. A. Holt, and S. K. Laury (2002). Private costs and public benefits: unraveling the effects of altruism and noisy behavior. *Journal of Public Economics 83*(2), 255–276.

Isler, O., S. Gächter, A. J. Maule, and C. Starmer (2021). Contextualised strong reciprocity explains selfless cooperation despite selfish intuitions and weak social heuristics. *Scientific reports 11*(1), 1–17.

Kocher, M. G., P. Martinsson, K. O. R. Myrseth, and C. E. Wollbrant (2017). Strong, bold, and kind: Self-control and cooperation in social dilemmas. *Experimental Economics 20*(1), 44–69.

Kurzban, R. and D. Houser (2005). Experiments investigating cooperative types in humans: A complement to evolutionary theory and simulations. *Proceedings of the National Academy of Sciences 102*(5), 1803–1807.

Kuss, K., A. Falk, P. Trautner, C. Montag, B. Weber, and K. Fliessbach (2015). Neuronal correlates of social decision making are influenced by social value orientationan fmri study. *Frontiers in Behavioral Neuroscience 9*, 40.

Kvarven, A., E. Strømland, C. Wollbrant, D. Andersson, M. Johannesson, G. Tinghög, D. Västfjäll, and K. O. R. Myrseth (2020). The intuitive cooperation hypothesis revisited: a meta-analytic examination of effect size and between-study heterogeneity. *Journal of the Economic Science Association*, 1–16.

Loewenstein, G. (2005). Health psychology. *Hot-cold Empathy Gaps and Medical Decision Making 24*(4 Suppl), S49–S56.

Loewenstein, G. and D. Prelec (1992). Anomalies in intertemporal choice: Evidence and an interpretation. *The Quarterly Journal of Economics 107*(2), 573–597.

Murphy, R. O. and K. A. Ackermann (2014). Social value orientation: Theoretical and measurement issues in the study of social preferences. *Personality and Social Psychology Review 18*(1), 13–41.

Murphy, R. O., K. A. Ackermann, and M. Handgraaf (2011). Measuring social value orientation. *Judgment and Decision Making 6*(8), 771–781.

Nowak, M. A. (2006). Five rules for the evolution of cooperation. *Science 314*(5805), 1560–1563.

Palan, S. and C. Schitter (2018). Prolific. aca subject pool for online experiments. *Journal of Behavioral and Experimental Finance 17*, 22–27.

Pletzer, J. L., D. Balliet, J. Joireman, D. M. Kuhlman, S. C. Voelpel, and P. A. Van Lange (2018). Social value orientation, expectations, and cooperation in social dilemmas: A meta-analysis. *European Journal of Personality 32*(1), 62–83.

Rand, D. G. (2016). Cooperation, fast and slow: Meta-analytic evidence for a theory of social heuristics and self-interested deliberation. *Psychological Science 27*(9), 1192–1206.

Ross, L., D. Greene, and P. House (1977). The false consensus effect: An egocentric bias in social perception and attribution processes. *Journal of Experimental Social Psychology 13*(3), 279–301.

Rustagi, D., S. Engel, and M. Kosfeld (2010). Conditional cooperation and costly monitoring explain success in forest commons management. *Science 330*(6006), 961–965.

Selten, R. (1967). Die strategiemethode zur erforschung des eingeschränkt rationalen verhaltens im rahmen eines oligopolexperiments, s. 136–168. *Tübingen: JCB Mohr (Paul Siebeck)*.

Thöni, C. and S. Volk (2018). Conditional cooperation: Review and refinement. *Economics Letters 171*, 37–40.

Van Lange, P. A., E. De Bruin, W. Otten, and J. A. Joireman (1997). Development of prosocial, individualistic, and competitive orientations: theory and preliminary evidence. *Journal of Personality and Social Psychology 73*(4), 733.

Vives, M.-L. and O. FeldmanHall (2018). Tolerance to ambiguous uncertainty predicts prosocial behavior. *Nature Communications 9*(1), 2156.

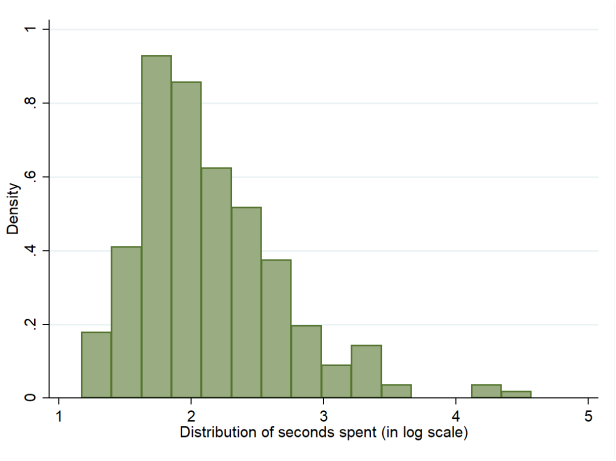
Walker, J. M. and M. A. Halloran (2004). Rewards and sanctions and the provision of public goods in one-shot settings. *Experimental Economics 7*(3), 235–247.

Weber, T. O., O. Weisel, and S. Gächter (2018). Dispositional free riders do not free ride on punishment. *Nature Communications 9*(1), 2390.

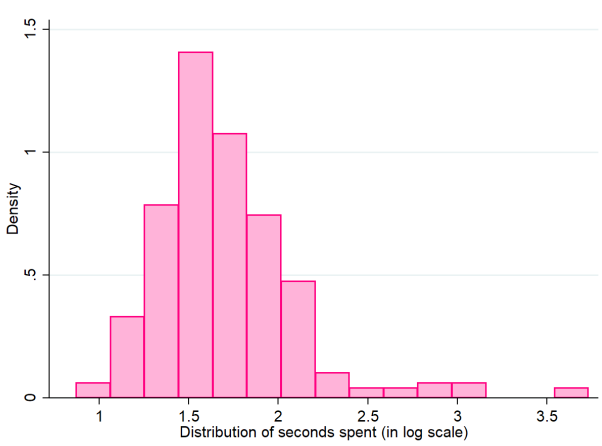
Appendix A:

Distribution of response times

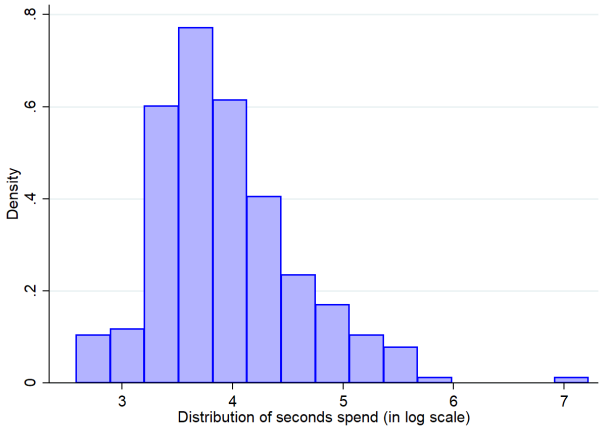
Here we report the distribution of the decision times in Study 1 and Study 2.



(a)



(b)



(c)

Figure A.1: (a) Distribution of response times in Study 1; (b) distribution of response times in Study 2, under the Time Pressure treatment; (c) distribution of response times in Study 2, under the Motivated Delay treatment.

Main analyses with finer classifications of nCC

In this section we provide replications of our main analyses in Study 1 and in Study 2 using the finer classifications of behavioral types described in Fischbacher et al. (2001) and Thöni and Volk (2018).

According to Fischbacher et al. (2001) participants are classified as Conditional Cooperator if they either show contributions that are non-decreasing in others' contributions, with at least one increase, or show a positive Spearman rank correlation (between contributions and others' contributions) that is significant at the 1%-level. Participants are classified as Free Rider if they choose to contribute zero irrespective of others' contributions. Participants are classified as Hump Shaped if they show contributions that are increasing in others' contributions up to some maximum and then contributions that are decreasing, and both trends have a Spearman rank correlation (between contributions and others' contributions) that is significant at the 1%-level. The remaining participants are classified as Other.

According to Thöni and Volk (2018) participants are classified as Conditional Cooperator if they either show contributions that are non-decreasing in others' contributions, with at least one increase, or show a Pearson correlation of least 1/2 (between contributions and others' contributions). Participants are classified as Free Rider as done in Fischbacher et al. (2001). Participants are classified as Unconditional Cooperators if they contribute a given amount irrespective of others' contributions. Participants are classified as Hump Shaped (also called Triangular cooperators) if their contributions reach a maximum at a given level (k) of others' contribution and they either show a strong positive (negative) correlation to the left (right) of k (using at least three contributions), or show contributions which are monotonically increasing (decreasing) to the left (right) of k (using at least two contributions). The remaining participants are classified as Other.

Tables 7 and 8 report the regression analysis for Study 1, while Tables 9 and 10 report the regression analyses for Study 2, respectively using the classification in Fischbacher et al. (2001) and the one in Thöni and Volk (2018). The estimates for the coefficients of the relevant variables (SVO, Cond.Coop., MD) largely confirm our main findings, both in Study 1 and in Study 2. We opted for not including a dummy for Free Riders, due to the small number of subjects classified as such (see Table 1 and Table 3). However, we do not exclude Free Raiders from the analysis, leaving them into the residual omitted category of Other.

Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
SVO	1.196***	1.127***			0.889***	0.819***
	(0.263)	(0.265)			(0.242)	(0.243)
Belief			1.376***	1.405***	1.232***	1.262***
			(0.289)	(0.277)	(0.292)	(0.277)
Cond.Coop.			-9.482	-6.471	-14.20	-11.01
			(22.63)	(22.30)	(22.48)	(21.90)
Hump Shaped			-29.26	-33.31*	-23.60	-27.18
			(19.60)	(18.60)	(17.40)	(17.08)
Cond.Coop.×Belief			0.161	0.110	0.249	0.213
			(0.374)	(0.360)	(0.368)	(0.354)
UK		5.099		10.47		5.683
		(9.241)		(7.751)		(7.754)
Female		5.943		14.10*		13.05*
		(9.181)		(8.150)		(7.898)
Familiarity		17.74**		18.37**		14.61**
		(8.820)		(7.719)		(7.240)
Understood		-9.552		-6.350		-9.792
		(11.18)		(9.853)		(9.602)
Constant	32.34**	5.209	15.32	-26.48	-28.01	-57.00**
	(15.11)	(19.64)	(18.12)	(22.07)	(22.34)	(24.25)
N	250	250	250	250	250	250
pseudo R^2	0.016	0.019	0.058	0.065	0.070	0.076

Table 7: Tobit regressions on the level of endowment contributed in the one-shot PGG following the classification in Fischbacher et al. (2001). *SVO* is individuals' social value orientation; *Belief* is the individuals' belief about others contributions; *Cond.Coop.*=1 if an individual is considered as a conditional cooperator, 0 otherwise; *Hump Shaped*=1 if an individual is considered as a triangular cooperator, 0 otherwise; Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
SVO	1.196***	1.127***			0.861***	0.799***
	(0.263)	(0.265)			(0.228)	(0.225)
Belief			1.168***	1.212***	1.028***	1.064***
			(0.292)	(0.276)	(0.292)	(0.276)
Cond.Coop.			3.623	7.403	-1.415	2.447
			(21.75)	(21.32)	(21.66)	(21.03)
Uncond.Coop.			63.55***	65.19***	60.73***	62.54***
			(16.81)	(16.76)	(16.76)	(16.50)
Hump Shaped			-7.111	-8.926	-3.634	-5.191
			(19.45)	(18.37)	(17.84)	(17.12)
Cond.Coop.×Belief			0.317	0.264	0.405	0.373
			(0.368)	(0.354)	(0.361)	(0.348)
Controls:						
UK		5.099		10.79		6.038
		(9.241)		(7.570)		(7.573)
Female		5.943		15.98**		14.80*
		(9.181)		(7.961)		(7.711)
Familiarity		17.74**		16.37**		12.84*
		(8.820)		(7.448)		(6.963)
Understood		-9.552		-8.323		-11.64
		(11.18)		(9.946)		(9.672)
Constant	32.34**	5.209	4.288	-36.76*	-37.12*	-65.82***
	(15.11)	(19.64)	(17.38)	(21.36)	(20.90)	(23.32)
N	250	250	250	250	250	250
pseudo R^2	0.016	0.019	0.070	0.078	0.082	0.089

Table 8: Tobit regressions on the level of endowment contributed in the one-shot PGG following the classification in Thöni and Volk (2018). *SVO* is individuals' social value orientation; *Belief* is the individuals' belief about others contributions; *Cond.Coop.*=1 if an individual is considered as a conditional cooperator, 0 otherwise; *Hump Shaped*=1 if an individual is considered as a triangular cooperator, 0 otherwise; *Uncond.Coop.*=1 if an individual is considered as an unconditional cooperator, 0 otherwise. Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
MD	28.57***	27.92***	7.528	6.609	-20.76	-24.34
	(7.185)	(7.101)	(5.534)	(5.505)	(22.52)	(22.56)
SVO			0.829***	0.825***	0.833***	0.835***
			(0.167)	(0.168)	(0.164)	(0.165)
Belief			1.498***	1.521***	1.398***	1.402***
			(0.176)	(0.174)	(0.235)	(0.230)
Cond.Coop.			7.055	9.179	-8.553	-8.383
			(13.28)	(13.10)	(16.30)	(15.89)
Hump Shaped			2.518	1.780	12.45	10.36
			(12.49)	(12.09)	(16.03)	(15.50)
Cond.Coop×Belief			-0.009	-0.017	0.169	0.201
			(0.235)	(0.234)	(0.313)	(0.306)
Belief×MD					0.345	0.390
					(0.383)	(0.380)
Cond.Coop.×MD					47.23*	51.89*
					(28.65)	(28.44)
Hump Shaped×MD					-22.22	-19.13
					(22.66)	(22.12)
Cond.Coop×Belief×MD					-0.560	-0.644
					(0.487)	(0.480)
Controls:						
UK		7.605		0.905		0.467
		(7.109)		(5.416)		(5.418)
Female		9.688		2.869		1.921
		(7.355)		(5.544)		(5.504)
Familiarity		4.570		7.094		7.183
		(6.877)		(5.089)		(5.088)
Understood		-2.580		-12.79**		-13.36**
		(8.302)		(6.482)		(6.425)
Constant	86.90***	71.57***	-52.64***	-63.82***	-44.69***	-54.52***
	(4.960)	(12.08)	(12.03)	(13.92)	(14.04)	(15.12)
N	504	504	504	504	504	504
pseudo R^2	0.006	0.007	0.092	0.094	0.094	0.096

Table 9: Tobit regressions on the level of endowment contributed in the one-shot PGG, following the classification in Fischbacher et al. (2001). *MD*=1 if individuals are in the motivated delay condition, 0 otherwise; *SVO* is the individuals' social value orientation; *Belief* is the individuals' belief about others contributions; *Cond.Coop.*=1 if an individual is considered as a conditional cooperator, 0 otherwise; *Hump Shaped*=1 if an individual is considered as a triangular cooperator, 0 otherwise. Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Perc. Contribution	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
MD	28.57***	27.92***	6.578	5.844	-31.78	-35.15
	(7.185)	(7.101)	(5.407)	(5.394)	(24.63)	(24.73)
SVO			0.691***	0.686***	0.668***	0.669***
			(0.161)	(0.163)	(0.159)	(0.160)
Belief			1.357***	1.376***	1.297***	1.311***
			(0.194)	(0.192)	(0.239)	(0.234)
Cond.Coop.			17.17	18.28	1.406	1.279
			(13.51)	(13.42)	(15.64)	(15.32)
Uncond.Coop.			49.02***	48.13***	28.49**	25.94*
			(11.27)	(11.17)	(14.21)	(14.11)
Hump Shaped			10.54	9.183	25.87*	23.53
			(15.30)	(15.40)	(14.98)	(14.71)
Cond.Coop.×Belief			0.094	0.089	0.231	0.245
			(0.245)	(0.243)	(0.312)	(0.305)
Belief×MD					0.367	0.399
					(0.432)	(0.429)
Cond.Coop.×MD					55.30*	59.07**
					(29.92)	(29.82)
Uncond.Coop.×MD					49.45**	52.40**
					(21.45)	(21.47)
Hump Shaped×					-36.56	-35.13
					(29.69)	(30.58)
Cond.Coop.×Belief×MD					-0.587	-0.644
					(0.520)	(0.512)
Controls:						
UK		7.605		2.432		0.739
		(7.109)		(5.337)		(5.353)
Female		9.688		1.779		2.643
		(7.355)		(5.475)		(5.509)
Familiarity		4.570		7.080		7.574
		(6.877)		(4.985)		(4.923)
Understood		-2.580		-10.29*		-11.59*
		(8.302)		(6.193)		(6.143)
Constant	86.90***	71.57***	-53.27***	-64.32***	-42.66***	-53.46***
	(4.960)	(12.08)	(11.94)	(14.38)	(13.11)	(14.67)
N	504	504	504	504	504	504
pseudo R^2	0.006	0.007	0.101	0.103	0.106	0.108

Table 10: Tobit regressions on the level of endowment contributed in the one-shot PGG, following the classification in Thöni and Volk (2018). *MD*=1 if individuals are under the motivated delay condition, 0 otherwise; *SVO* is the individuals' social value orientation; *Belief* is the individuals' belief about others contributions; *Cond.Coop.*=1 if an individual is considered as a conditional cooperator, 0 otherwise; *Hump Shaped*=1 if an individual is considered as a triangular cooperator, 0 otherwise; *Uncond.Coop.*=1 if an individual is considered an a unconditional cooperator, 0 otherwise. Robust standard errors in parentheses, where: * denotes $p < 0.10$, ** denotes $p < 0.05$, *** denotes $p < 0.01$.

Correlations

We explore the correlation between SVO and being a Conditional Cooperator under all the classifications for both the Studies (our classification, Fischbacher et al. (2001) and Thöni and Volk (2018)). Table 11 shows that SVO and the being a Conditional Cooperator do not correlate between themselves and this is true for all the classifications.

	Fischbacher et al., 2001	Thöni and Volk, 2018	This paper
	Social Value Orientation		
Conditional Cooperators	0.002	-0.024	0.002
Free Riders	-0.077	-0.077	–
Hump Shaped	-0.074	-0.057	–
Unconditional Cooperators	–	0.079	–
Others	0.058	0.023	-0.002

Table 11: Correlation between SVO and the classification of behavioral types in Study 1 following Fischbacher et al. (2001), Thöni and Volk (2018), and our classification.

Table 12 shows that SVO and the being a Conditional Cooperator do not correlate between themselves under MD and this is true for all the classification, while they correlate slightly under TP.

	Fischbacher et al., 2001		Thöni and Volk, 2018		This paper	
	Social Value Orientation					
	TP	MD	TP	MD	TP	MD
Conditional Cooperators	0.152**	0.092	0.158**	0.090	0.152**	0.092
Free Riders	-0.334***	-0.185***	-0.334***	-0.185***	–	–
Hump Shaped	0.026	-0.010	0.044	-0.31	–	–
Unconditional Cooperators	–	–	0.107*	0.141**	–	–
Others	-0.008	-0.026	-0.123*	-0.192***	-0.152**	0.092

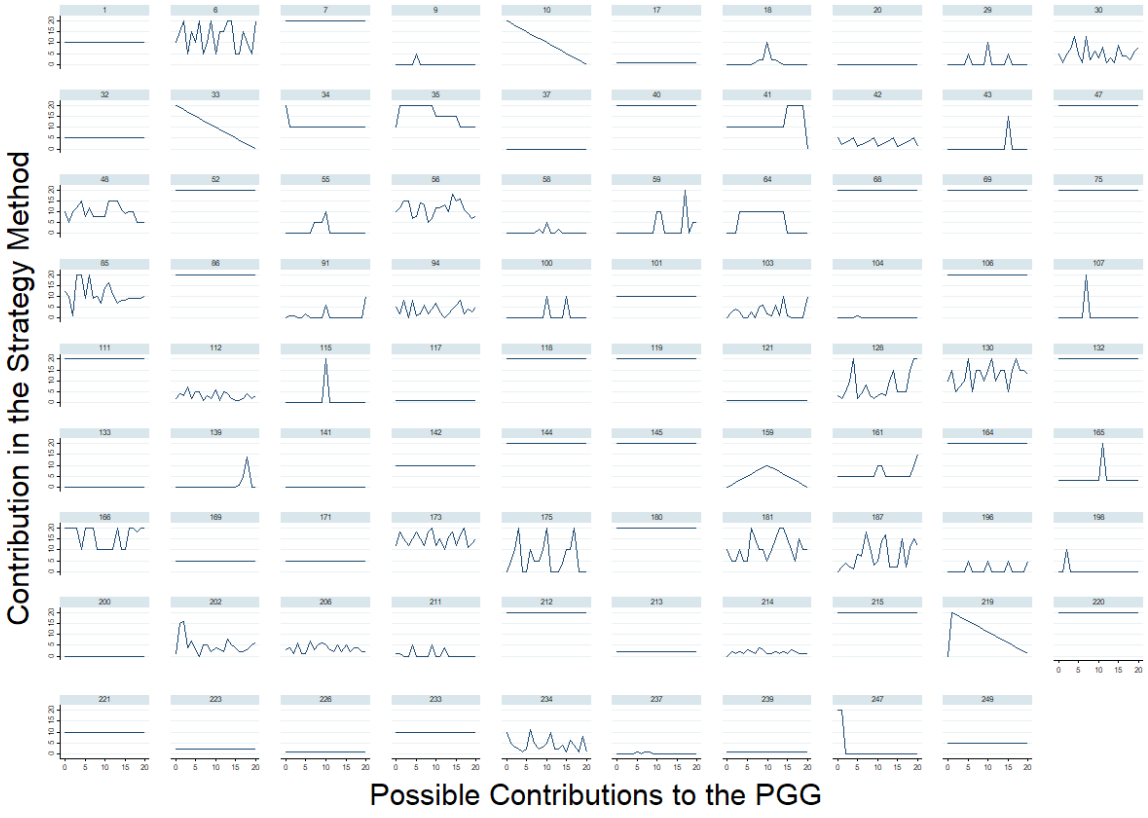
Table 12: Correlation between SVO and the classification of behavioral types in Study 2 following Fischbacher et al. (2001), Thöni and Volk (2018), and our classification.

For completeness in Table 13 we report the correlation between SVO and predicted contributions for both studies.

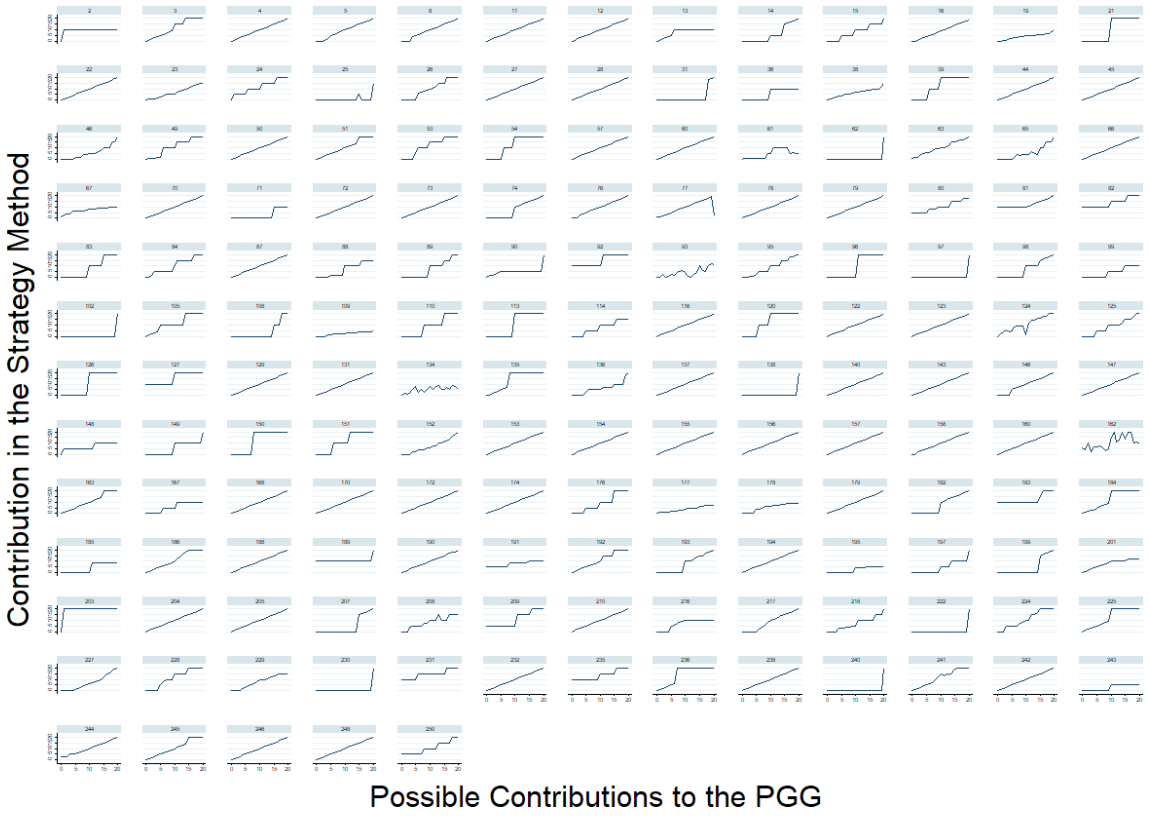
	Study 1	Study 2	
		TP	MD
	Social Value Orientation		
Predicted Contribution	0.252***	0.321***	0.298***

Table 13: Correlation between SVO and predicted contributions for Study 1 and 2

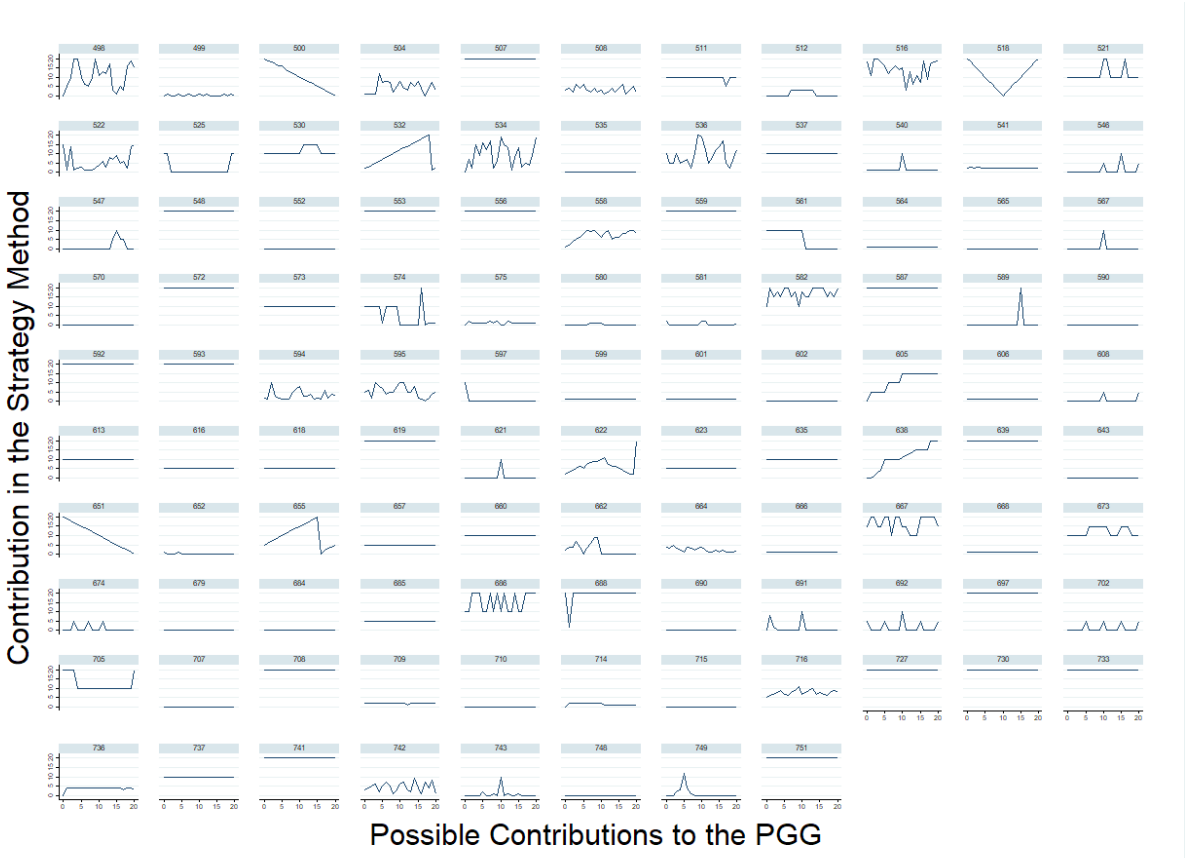
Maps of Non-Conditional Cooperation Strategies, Study 1



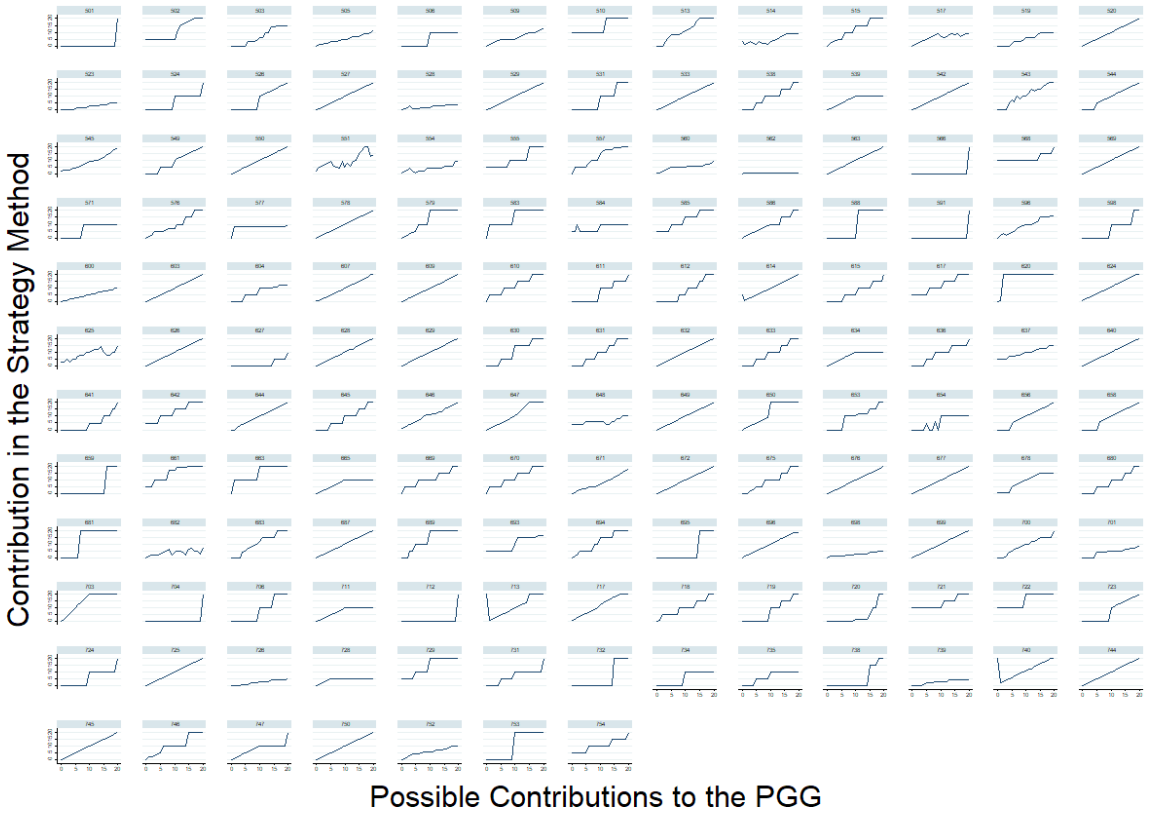
Maps of Conditional Cooperation Strategies, Study 1



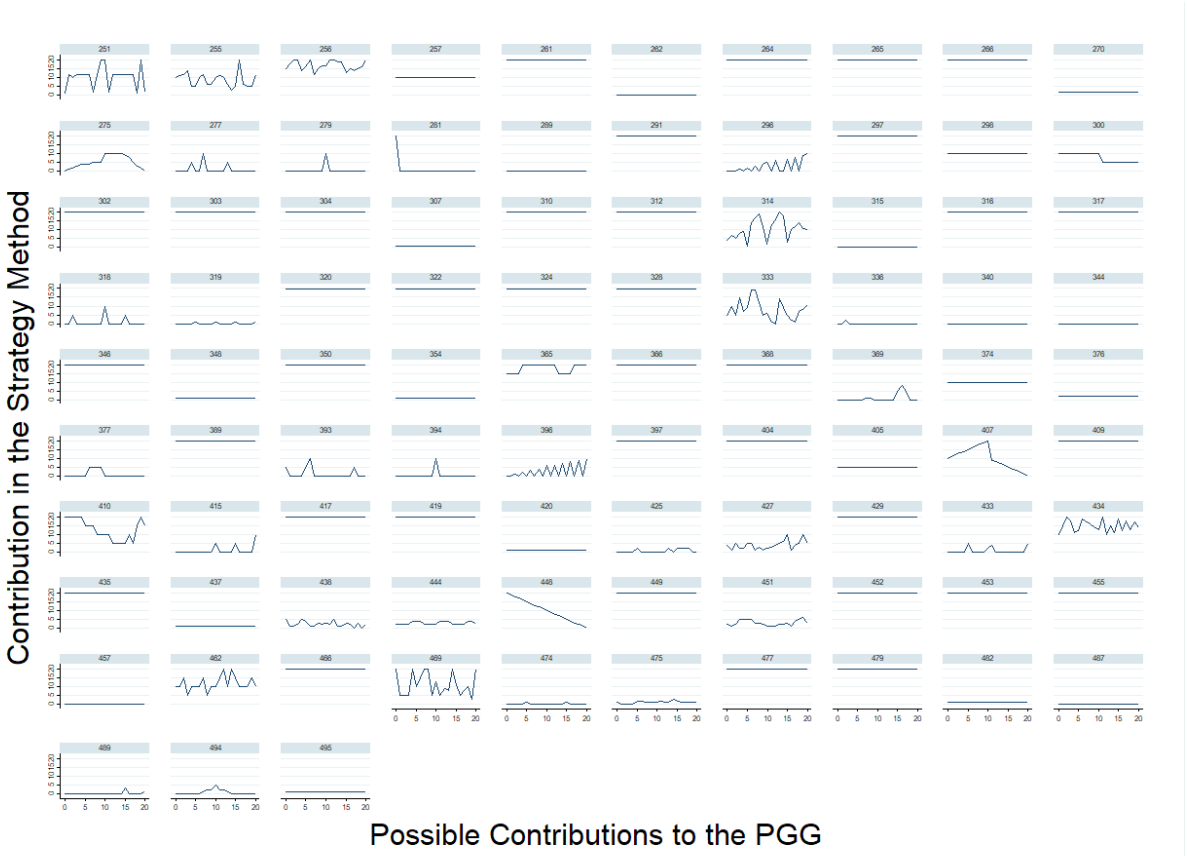
Maps of Non Conditional Cooperation Strategies, Study 2 with Time Pressure treatment



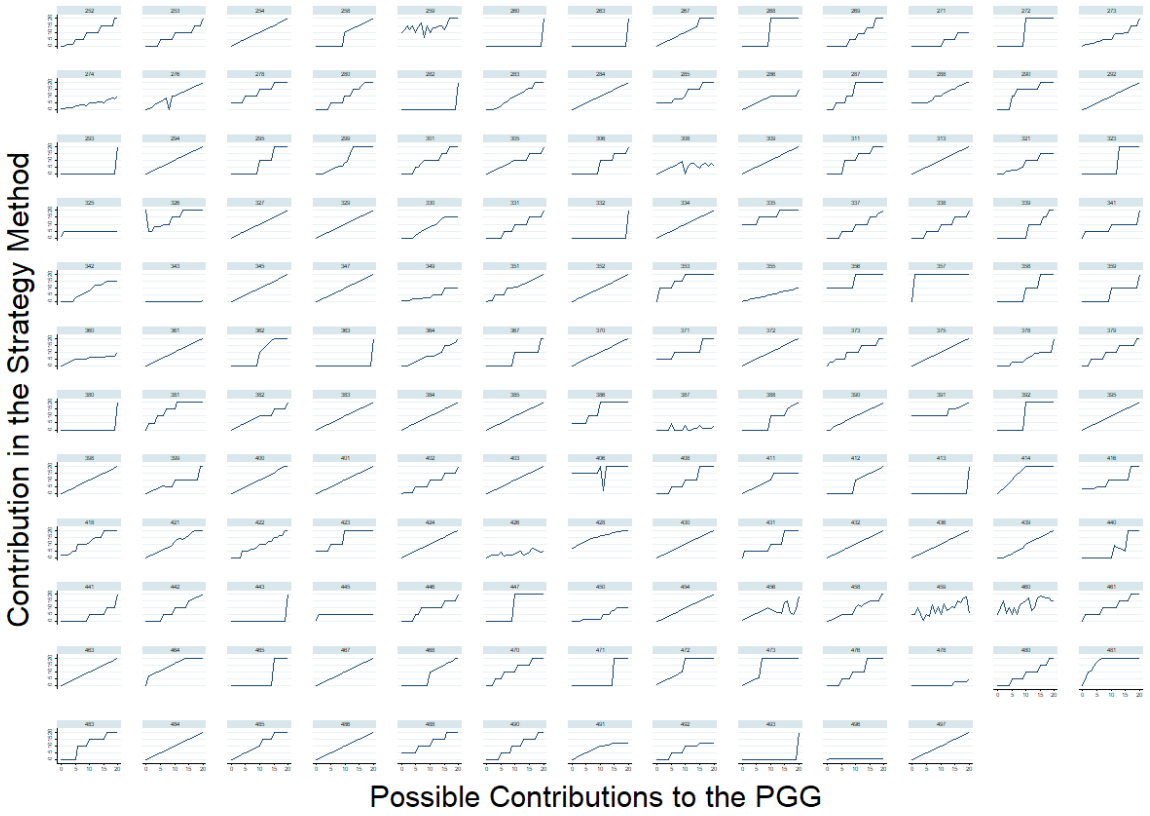
Maps of Conditional Cooperation Strategies, Study 2 with Time Pressure treatment



Maps of Non Conditional Cooperation Strategies, Study 2 with Motivated Delay treatment

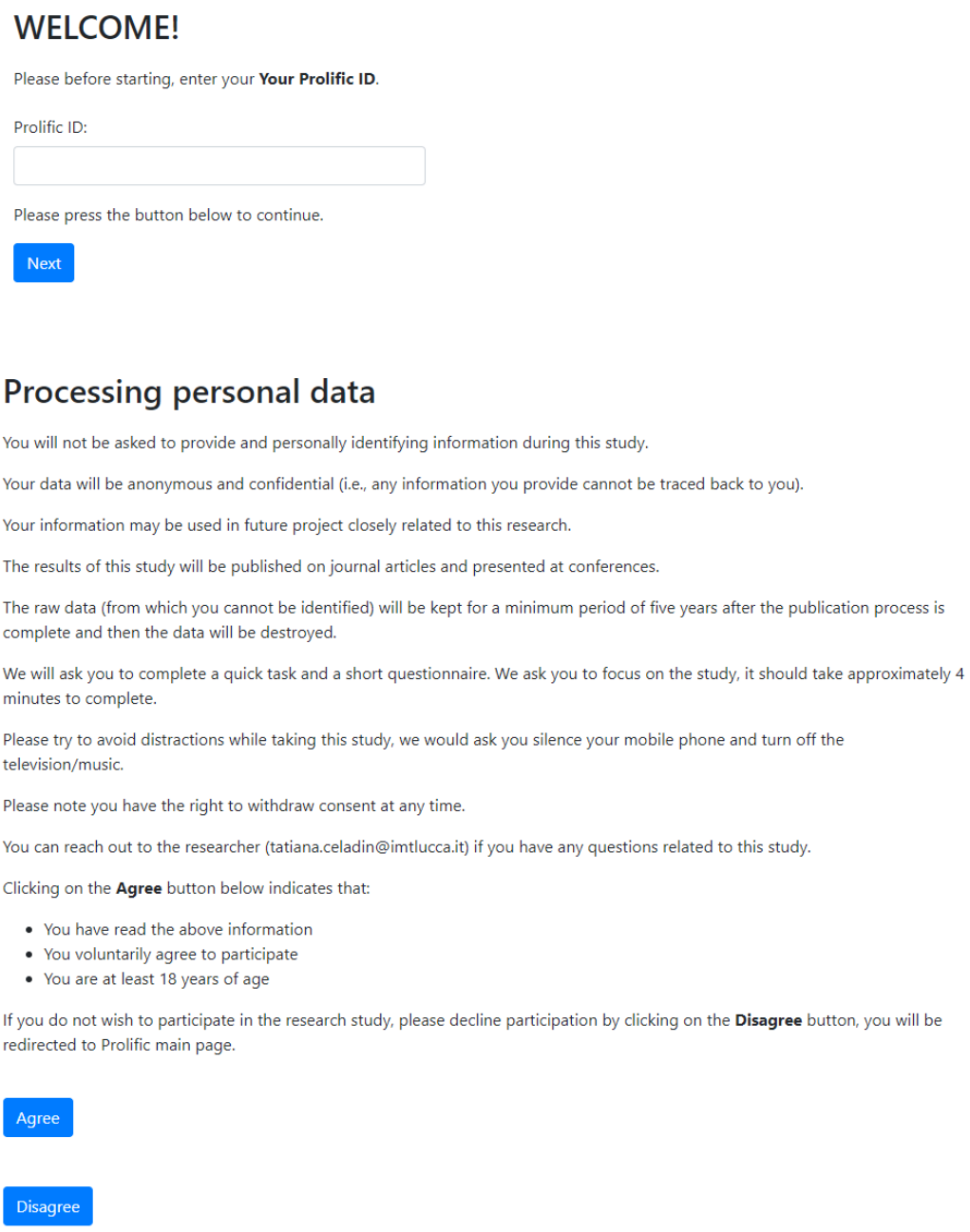


Maps of Conditional Cooperation Strategies, Study 2 with Motivated Delay treatment



Appendix B: Instructions

Screenshots of Study 1



WELCOME!

Please before starting, enter your **Your Prolific ID**.

Prolific ID:

Please press the button below to continue.

Next

Processing personal data

You will not be asked to provide and personally identifying information during this study.

Your data will be anonymous and confidential (i.e., any information you provide cannot be traced back to you).

Your information may be used in future project closely related to this research.

The results of this study will be published on journal articles and presented at conferences.

The raw data (from which you cannot be identified) will be kept for a minimum period of five years after the publication process is complete and then the data will be destroyed.

We will ask you to complete a quick task and a short questionnaire. We ask you to focus on the study, it should take approximately 4 minutes to complete.

Please try to avoid distractions while taking this study, we would ask you silence your mobile phone and turn off the television/music.

Please note you have the right to withdraw consent at any time.

You can reach out to the researcher (tatiana.celadin@imtlucca.it) if you have any questions related to this study.

Clicking on the **Agree** button below indicates that:

- You have read the above information
- You voluntarily agree to participate
- You are at least 18 years of age

If you do not wish to participate in the research study, please decline participation by clicking on the **Disagree** button, you will be redirected to Prolific main page.

Agree

Disagree

First Part

You have been randomly assigned to interact in a group with 3 of the other participants.

All of you will read the same set of instructions below.

Each person will receive 20 Points at the beginning of the interaction.

Every one of you will decide how many of your 20 Points to keep for yourself, and how many (if any) to contribute to a common pool (from 0 to 20 Points).

All Points contributed to the common pool are doubled and then split evenly among the 4 group members.

If each of you contributes **20 Points**, the total amount of the group is **80**. The common pool doubles the amount of Points and so your group gets **160 Points** that are split evenly among the 4 group members. Each of you gets **40 Points**.

If you keep your **20 Points**, while every one else contributes **20 Points**, the total amount of the group is **60**. The common pool doubles the amount of Points and so your group gets **120 Points** that are split evenly among the 4 group members. You earn **50 Points** (the **30 Points** that you earned from the common pool and the **20 Points** of your endowment that you kept for yourself) and each of the others will earn **30 Points**.

If you and the other group members keep your **20 Points**, you do not earn any additional Points and each of you remains with your initial endowment **of 20 Points**.

The other group members will be asked to make the decision too.

Each participant has to make two different types of decisions following the rules described above.
In the first type of decision you have to choose how many Points to contribute to the common pool.
In the second type of decision you have to fill a "contribution table" where you indicate how many Points you would like to contribute to the common pool for each possible average contribution of the other group members.
Actual contributions are computed as follows. At the end of this study, one out of the four participants in your group is randomly selected. For the one selected, the actual Points contributed to the common pool are obtained from the participant's contribution table, according to the average contribution of the other three participants in the first type of decision. For the other three participants who are not selected, the actual Points contributed are equal to the contributions made in the first type of decision.

No deception is allowed in this study.

50 Points are equal to 0.5 GBP.

Please press the button below to continue.

Next

First Part

Please enter the number of Points that you want to contribute.

points

Please press the button below to continue.

Next

First Part

You can now earn 10 additional Points.

Please indicate your estimate of average contribution of the other three participants (rounded to the closest integer).

If you give the right answer you will earn the 10 additional Points.

Average contribution of the other three participants:

points

Please press the button below to continue.

Next

First Part

In the table below, you can see all the possible averages of the contributions of the other three participants (rounded to the closest integer).

Please indicate how many Points you wish to contribute in each of the possible scenarios.

Your choices will be used as follows. One of the 4 participants will be randomly selected.

If you are NOT selected, your contribution will be the one you indicated previously.

If you are selected, your contribution will be the one that you will have indicated in the box corresponding to the average contribution of the other three participants (rounded to the closest integer).

Please enter the amount which you want to contribute for every possible average contribution of the other three participants:

Others' Average Contributions	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
You																					

Please press the button below to continue.

Next

First Part

Please answer the following questions:

Question 1: What level of your contribution earns the highest payoff for the group as a whole if all others contribute 20?

Answer:

Question 2: What level of your contribution earns the highest payoff for the group as a whole if all others contribute 0?

Answer:

Question 3: What level of your contribution earns the highest payoff for you personally if all others contribute 20?

Answer:

Question 4: What level of your contribution earns the highest payoff for you personally if all others contribute 0?

Answer:

Please press the button below to continue.

Next

Second Part

You will be randomly assigned to interact with another participant.

On the next pages you will decide how to allocate Points between you and the other participant. You will take six different decisions.

At the end of this second part, you and the other participant will be randomly assigned to the role of Decision Maker or Receiver and one of the six decisions will be selected randomly.

If you are the Decision Maker, the decisions you take are relevant for your and the other participant's payment.

If you are the Receiver, the other participant's decisions will be payoff relevant.

50 Points correspond to 0.25 GBP.

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 1:

You receive:	50	54	59	63	68	72	76	81	85
	○	○	○	○	○	○	○	○	○
Other receives:	100	89	79	68	58	47	36	26	15

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 2:

You receive:	85	87	89	91	93	94	96	98	100
	○	○	○	○	○	○	○	○	○
Other receives:	15	19	24	28	33	37	41	46	50

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 3:

You receive:	100	94	88	81	75	69	63	56	50
	○	○	○	○	○	○	○	○	○
Other receives:	50	56	63	69	75	81	88	94	100

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 4:

You receive:	100	98	96	94	93	91	89	87	85
	○	○	○	○	○	○	○	○	○
Other receives:	50	54	59	63	68	72	76	81	85

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 5:

You receive:	85	85	85	85	85	85	85	85	85
	○	○	○	○	○	○	○	○	○
Other receives:	85	76	68	59	50	41	33	24	15

Please press the button below to continue.

Next

Second Part

Please, decide how to allocate Points between you and the other participant.

Decision 6:

You receive:	50	54	59	63	68	72	76	81	85
	○	○	○	○	○	○	○	○	○
Other receives:	100	98	96	94	93	91	89	87	85

Please press the button below to continue.

Next

Third Part

Questionnaire

Please enter the following information.

- Your age:
- Your gender:
  - M
  - F
- Your level of education:
  - Secondary Education
  - Bachelor
  - Master
  - PhD
  - Other
- Field of study (Economics, Maths...):
- Are you a student now?
  - Yes
  - No
- Are you an employee now?
  - Yes
  - No
- To what extent have you participated in studies like this one before?
  - Nothing like this scenario
  - Somewhat like this
  - Exactly this scenario

Please press the button below to continue.

Next

Thank you!

Thank you for participating.

You will see your earnings on your Prolific profile after the experimenter has confirmed your payment.

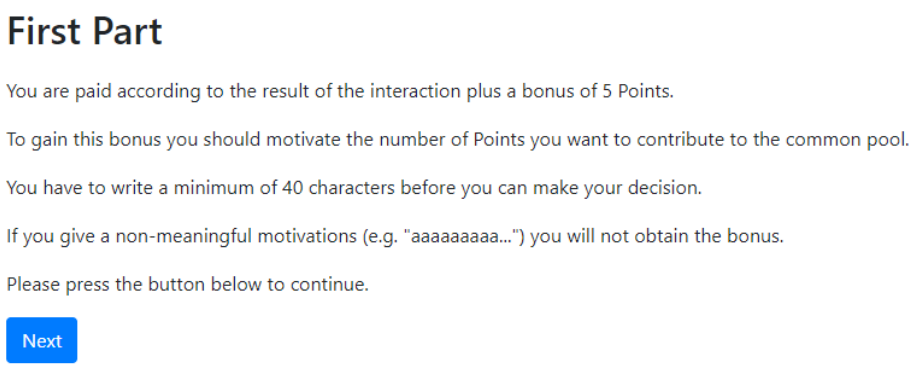
Please press the button below to conclude.

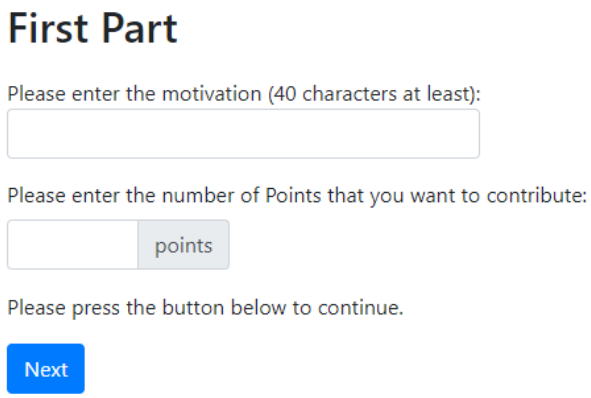
Press to Conclude

Screenshots of Study 2

Study 2 has the same instructions as Study 1 except for the part of the contribution to the PGG, of which we report below the screenshots for each treatment.

Motivated Delay





Time Pressure

First Part

You have the opportunity to earn additional Points if you make a quick decision.

You start from 15 additional Points and for each second spent in making your decision you renounce 1.5 of these Points.

For example, if you make your decision after 4 seconds, you get 9 additional Points.

You will see a timer counting down from 10 to 0 seconds.

If the timer reaches 0 you get 0 additional Point, but you can still make your decision.

Please press the button below to continue.

Next

First Part

Timer: 9 seconds

Please enter the number of Points that you want to contribute:

points

Please press the button below to continue.

Next