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Abstract

Are humans intuitively cooperative, or do we need to deliberate in order to be generous to others? The Social Heuristics Hypothesis (SHH) proposes that fast instinctive decision making promotes cooperation in social dilemmas. In this paper, we conduct a novel time-pressure experiment to shed light on the cognitive underpinnings of cooperation. Although we find no evidence for a time-pressure effect when considering all subjects, our results, together with a re-analysis of independent data, indicate that a single factor – payoff comprehension – accounts for some studies failure to replicate the finding that fast and intuitive decision making promotes cooperation. Given payoff comprehension, the SHH predicts behavior well. We believe this finding provides a unifying interpretation of the conflicting results in the literature.

JEL-Codes: C720, C910, C920, D030.

Keywords: cooperation, intuition, dual-process, public goods game.

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1 Introduction

Are humans instinctively selfish, or is it in our nature to help others? The Social Heuristics Hypothesis (SHH), inspired by dual-process theories (Sloman, 1996; Kahneman, 2011) and theories of cultural evolution (Chudek & Heinrich, 2011), proposes that fast instinctive decision making promotes cooperation in social dilemma situations. The SHH suggests that people internalize cooperation as a default strategy that they intuitively employ in unfamiliar situations, while deliberation draws attention to the strategic setting at hand and increases selfishness.[2] The main prediction of the theory is that a decision setting that induces intuitive decision making (system 1), rather than deliberation and hard thinking (system 2), increases cooperation and never lowers it (Rand et al., 2014).

Experimental tests of the SHH offer mixed levels of support. Some find an intuitive cooperation effect (Rand, 2012; Rand, 2014), whereas others do not (Tinghög et al., 2013; Verkoeijen & Bouwmeester, 2014).[3] Most experiments dealing with intuitive cooperation use time-pressure manipulations or cognitive load in a one-shot Public Goods Game to encourage individuals to make quick non-deliberative decisions.[4] Such treatments obviously cannot guarantee that all subjects make intuitive decisions, understood as non-conscious choices. Rather, they serve to construct a counterfactual in which some subjects who would prefer to deliberate regarding the decision are pushed to make a less reflective (i.e., more intuitive) decision.

[2] Very similar ideas have previously been discussed by some game theorists. For instance, Binmore (2005) argues that pro-social behavior in one-shot games reflects a heuristic or automatic response derived from the indefinitely repeated "game of life" where the folk theorem (e.g. Friedman 1971) applies. The main difference is that the SHH explicitly takes the dual-process perspective from cognitive psychology into account.

[3] Peysakovich and Rand (2015) find that a history of cooperation leads to pro-social behavior in subsequent and unrelated situations. This seems to provide direct evidence of overgeneralization. However, this does not represent a strict test of the SHH, because the sole prediction of the SHH is that the use of intuition should never lower cooperation. Testing the theory therefore requires the explicit manipulation of intuitive processing.

[4] There are, however, other ways to induce deliberative decision making. For instance, Torsvik et al. (2011) use a treatment in which participants are informed that they will discuss the game following the treatment. Under neutral framing conditions, announcing post-game discussion increases selfishness, which is in line with the SHH.

An important problem in the original time-pressure study by Rand et al. (2012) was that nearly 50 percent of the subjects in the time-pressure treatment spent more time on the decision problem than they were allowed and 22.6 percent used at least twice the allowed time. As pointed out by Tinghög et al. (2013), this creates a selection problem when the analysis includes only those subjects who comply with the treatment. Tinghög et al. ran a Public Goods Experiment with a simpler binary choice (cooperate or not), which reduces the rate of non-compliance. With this design, there is no significant time-pressure effect on cooperation. In response to the criticism of their original study, Rand et al. (2013; 2014) reported intention-to-treat estimates, analyzing subjects according to the treatment they were intended to get. They continue to find a time-pressure effect when aggregating various studies.

While the intention-to-treat procedure avoids the selection problem, it creates an interpretation problem. The intention-to-treat estimates do not capture the effect of *actually* being under time pressure but the effect of being *offered* such a treatment. In principle, one could retrieve the causal effect of being under time pressure, but this requires substantially stronger assumptions than the intention-to-treat procedure (Imbens & Angrist, 1994; Angrist et al., 1996).[5] Moreover, none of the previous time-pressure experiments attempt to rule out non-compliance by design. In principle, in both, it was possible to make a decision freely.

In this paper, we enforce the time-pressure constraint by stopping the subjects when the allotted time has passed. This design solves the selection problem and allows for a clean causal interpretation of the time-pressure effect. Moreover, our design allows us to keep the

[5] One must assume i) that the offer of time pressure does not induce deliberation in any subgroup (monotonicity) and ii) that the offer of treatment influences cooperation solely through its effect on intuitive processing (exclusion restriction). If any of these conditions does not hold, the instrumental variables estimation procedure does not have a causal interpretation. One could easily imagine violations of the monotonicity assumption in this type of experimental setting; For instance, some subjects may get angry when given time-pressure, which may cause some to "protest" by making a slower decision.

original continuous outcome variable used in the Public Goods Experiments by Rand et. al. (2012). To our knowledge, this has not been done before.

In addition, we consider whether a social frame suggesting a norm of cooperation would foster cooperation in the deliberative (no time pressure) treatment of the game and eliminate or mitigate the intuitive cooperation effect in a Public Goods Game. A social frame that makes a norm of cooperation more salient may increase cooperation for a number of reasons: It provides a clue for those who want to do what is expected, and it may make the beliefs of conditional cooperators more optimistic (Ellingsen et al., 2012). Thus, when acting within such a social frame, reflection may not reduce cooperation. To our knowledge, the only existing study exploring the link between social frames and a time-pressure effect is Rand et al. (2015). They find a time-pressure effect when framing the Public Goods Game as a competition. However, Torsvik et al. (2011) find that enhanced thinking before play, evoked by telling participants that they will participate in an out-group discussion of appropriate behavior in the PGG after the experiment, increases cooperation when the PGG is framed in such a way as to make the norm of cooperation salient.

In our experiment, there is no time-pressure effect when we use data from all subjects. However, if we consider subjects who understand the payoff structure of the game, we find a large time-pressure effect. To check the robustness of this finding, we obtained previous Public Goods Game data. In these experiments, we find evidence that there is a time-pressure effect on cooperation for those who understand the payoffs of the game, but not for others. This suggests that a single variable – payoff comprehension – accounts for much of the variation in findings across time-pressure studies. Given payoff comprehension, the SHH predicts behavior very well.

2 Experimental design and procedures

Our main aims were to replicate the finding that time-pressure increases cooperation and to consider whether this effect depended on the framing of the game. The idea was that in a framing that made the norm of cooperation more salient, deliberation (no time pressure) would not reduce – and would possibly increase – cooperation. In order to maintain control of the decision-making time, we conducted a paper and pencil experiment. We used a 2 x 2 factorial design, varying time pressure and the social frame.

Table 1. Experimental design with number of subjects in each condition.

	Time Pressure	
Social frame	No	Yes
Standard	**Baseline** 72 subjects	**Time Pressure** 72 subjects
Dugnad	**Dugnad** 72 subjects	**Dugnad and Time Pressure** 72 subjects

In the **Baseline** condition, subjects were randomly assigned to play a standard one-shot Public Goods Game in groups of four. The instructions and control questions closely followed Rand et al. (2012). There are two main differences between our study and theirs. One is that we enforce compliance with the time limit for those who had to make a decision fast (with time pressure). The second difference is that those who were not treated with time pressure were not forced to delay their decisions. The subjects had two minutes to decide, which we consider sufficient time to make a reflective decision.[6]

The experiment proceeded in three steps. First, all subjects were informed about the rules of the game. All faced the same payoff function, and this was made common knowledge

[6]From Rand et al. (2014), we calculate that in a physical lab, 99% of subjects used less than 40 seconds to decide. The maximum time used was 98 seconds. We used data provided on David Rand's homepage.

in the instructions. Following Tinghög et al. (2013), we excluded examples of suggested actions in order to avoid priming effects. The payoff to subject i is given by the following:

$$\pi_i = 100 - c_i + 0.5 \sum_{j=1}^{4} c_j,$$

where c_i is the contribution of subject i to the public good. The participants had the same amount of time to read the instruction sheet in all experimental sessions.

Second, we removed the instruction sheets. Then, we instructed the participants to turn over the decision sheet and make their choice. Third, immediately after the subjects' decisions, we measured their comprehension of the game. This was done because pre-game comprehension questions would allow subjects to deliberate extensively prior to making a decision. This could push all subjects into a reflective mode of reasoning, undermining the time-pressure effect (Rand et al., 2012).

The **Time Pressure** condition was identical to the baseline, except that subjects were informed on the decision sheet that they would have to make a decision within ten seconds. When ten seconds expired, the subjects were instructed to turn their decision sheets over. These were immediately collected. This was done in order to ensure that the subjects complied with the treatment assignment. We preferred a pencil-and-paper experiment to a computerized experiment because we believed the former would create a greater sense of time pressure. Participants view the research assistants directly and may feel that they will lose the chance to make a decision if the time expires. Making a computerized decision may not involve the same psychological pressure to make a quick decision.[7]

The **Dugnad** condition was identical to the baseline, except that on top of subjects' decision sheets, we labeled the game "The Dugnad." This is a Norwegian word commonly

[7] While this is ultimately an empirical question, note that this procedure was successful according to our stated intentions.

used to describe the activity of engaging in voluntary community work. It derives from an Old Norse word meaning "help, do a good deed." Thus, this word should suggest strong norms of cooperation from everyday life; you are expected to participate in a Dugnad. Finally, the **Dugnad and Time Pressure** condition is identical to the Dugnad condition, except that subjects received the time constraint, in addition to the label on top of the decision sheet.

The pencil-and-paper experiment was conducted in a lab at the University of Bergen, Norway. We recruited from all disciplines at the University of Bergen and the Norwegian School of Economics in order to reduce social ties among participants. The experiment and payment to subjects were double-blinded. In total, 288 students participated in the experiment. On average, subjects earned 170 NOK (19.7 USD), and the experiment lasted about 15 minutes on average. This amounts to an hourly wage for 15 minutes work, so the experiment was properly incentivized. All subjects were randomly assigned to an experimental condition.[8] In total, we conducted 18 sessions, each with 16 subjects.

Four sessions were conducted prior to the main experiment in order to verify that the procedure solved the noncompliance problem. These four sessions are included in the data in the main analysis because there are no significant behavioral changes between them and the other sessions. We used the same research assistants, rooms, and experimental procedures in all sessions.

[8] The social frame was randomized at an individual level, whereas to avoid behavioral spillovers in the time-pressure condition, for each pair of participation times closest to one another, we drew randomly to determine whether the earlier or later session would have time pressure. This means that early birds had a one-half probability of receiving the treatment, so one should not expect within-session correlation in responses to arise from participation times.

3 Results: Payoff comprehension moderates the time-pressure effect

The procedure of maintaining physical control over decision times resulted in treatment compliance. Importantly, our design reflects the effect of actually being under time pressure rather than an intention-to-treat estimate, as reported in the original study by Rand et al. (2012). In this treatment, only 2.4% of responses are missing.[9]

The SHH predicts a positive time-pressure effect only for inexperienced subjects because experienced subjects may employ heuristics adapted to the laboratory game. Our subject pool is largely inexperienced with economic experiments because 59% reported no previous experience with experiments and 21.4% reported one previous experiment.[10] However, as Table 2 shows, there are no significant differences between any treatment groups. The time-pressure effect is estimated to be positive but is not statistically significant (1.9 percentage points, $p = 0.73$, OLS regression with controls). Moreover, even for subjects with no prior experience, the time-pressure effect is very small and not statistically significant (1.2 percentage points, $p = 0.83$, OLS with controls, regression Table A.1 in Appendix A.

One possible explanation of our null finding is that other background factors influenced the time-pressure effect. The SHH predicts that intuition promotes cooperation and that reflection promotes selfish responses. Clearly, a selfish choice requires a firm understanding of the payoff structure of the game. Furthermore, a recent theoretical paper (Bear & Rand, 2016) finds that agents who do not understand that the game they are playing has a dominant strategy should experience no cognitive conflict between intuition and deliberation. Hence, the SHH predicts a time-pressure effect for payoff-comprehending subjects only.

[9] These are not significantly different between the time-pressure and baseline conditions or between the Dugnad and combined conditions ($p > 0.10$, t-test and Fisher's exact test). Thus, we do not find evidence for differential attrition because of our design.

[10] The rest indicated participation in two (11.6%) or more (6.4%) experiments.

For the above reasons, we estimate the treatment effects given payoff comprehension and interact with a dummy for failed comprehension to test whether the treatment effect is significantly different for subjects who understood versus subjects who did not understand the payoff structure. We classified subjects as failing to comprehend if they failed one of two comprehension questions (see Appendix B for details). Overall, only 40% of the 288 subjects were classified as understanding the payoff structure. Table 2 displays the regression results.

Table 2

OLS regressions, individual contribution in percentages of endowment (100 NOK)
Reference group: Payoff-comprehending subjects

	(1)	(2)	(3)	(4)
Time Pressure	0.321	1.855	21.33**	22.96**
	(5.667)	(5.828)	(10.83)	(10.62)
Dugnad	-3.805	-3.487	8.614	9.621
	(6.165)	(6.004)	(11.36)	(11.06)
Dugnad*Time Pressure	-1.031	-1.744	-14.14	-12.59
	(8.179)	(8.214)	(14.88)	(14.45)
Failed Comprehension			37.44***	37.08***
			(8.841)	(8.749)
Failed Comprehension*Time Pressure			-33.61***	-33.95***
			(11.94)	(11.81)
Failed Comprehension*Dugnad			-18.50	-19.77
			(12.73)	(12.41)
Failed Comprehension*Dugnad*Time Pressure			19.27	15.89
			(17.11)	(16.95)
Demographic controls				
Female		11.89***		11.18**
		(4.507)		(4.473)
Experience		-4.229		-3.862
		(4.240)		(4.075)
Age		1.058		0.963
		(0.795)		(0.746)
Constant	73.94***	44.47**	50.74***	23.91
	(4.296)	(19.13)	(8.197)	(19.19)
N	281	280	281	280

Robust standard errors in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
(1) No controls, (2) with controls, (3) with interaction, no controls, (4) with interaction, with controls

Given payoff comprehension, there is a large, positive, and statistically significant time-pressure effect ($p < 0.05$, with and without demographic controls).[11] Moreover, the interaction term between time pressure and failed comprehension is negative and significant ($p < 0.01$, with and without controls). This means that intuition promotes cooperation for payoff-comprehending subjects, but not for those who do not pass this test.[12] The interaction term between the Dugnad and Time Pressure condition is negative, but not statistically significant ($p > 0.10$). Overall, this suggests that the SHH successfully predicts individual contributions if subjects have understood the payoff structure.

In order to capture intuitive decision making, we had to ask comprehension questions after they made their choices. This makes it possible that our comprehension measure is affected by our time-pressure treatment. However, there are no significant differences in comprehension between the treatment groups. Specifically, there is no difference in comprehension between the baseline and time-pressure conditions (coefficient = 0.019, $p = 0.82$, N = 286, Appendix A, Table A.3). We also address this issue for subsequent re-analysis.

[11] In our classification of comprehensions, there were ambiguous answers; see Appendix B. Our results are robust with regard to reclassifying ambiguous subjects as failing the comprehension questions ($p < 0.05$ in an OLS regression with controls, Appendix A, Table A.2, $p = 0.07$ in a Mann-Whitney test). The interaction term (failed comprehension*time pressure) is also significant ($p < 0.01$, OLS regression with controls). Moreover, the sizes of the estimates hardly change.

[12] This also holds in a non-parametric Mann-Whitney test ($p = 0.039$, two-sided) and a Fligner-Policello robust rank-order test ($p = 0.045$, two-sided), relaxing the assumption of the Mann-Whitney test that the two sampling distributions have identical higher-order moments (Feltovich, 2003).

4 Re-analysis of previous Public Goods Experiments on time pressure

In our Public Good experiment, we find that the time-pressure effect is conditional upon comprehension. However, in order to argue that our findings capture a robust behavioral regularity, payoff comprehension must, in general, predict the occurrence of a time-pressure effect, not only for our particular sample. Thus, as a safeguard against false positives (Simmons et al., 2011), we also analyze previous Public Goods Game data using time-pressure.

We consider all the Public Goods Games used in the meta-analysis by Rand et al. (2014) and the Public Goods Game replication study by Tinghög et al. (2013). Tables 3 and 4 display the results of the estimation procedure.

Table 3

Contribution to public good (share of endowment), re-analysis of Public Goods Games in Rand et al. (2014); Reference group: payoff-comprehending subjects

	(1)	(2)	(3)	(4)
Time Pressure	0.0364***	0.0492***	0.0490***	0.0490***
	(0.0122)	(0.0154)	(0.0152)	(0.0152)
Failed Comprehension		0.0552***	0.0533***	.0793***
		(0.0164)	(0.0164)	(0.0168)
Time Pressure*Failed Comprehension		-0.0457**	-0.0455**	-0.0374*
		(0.0230)	(0.0227)	(0.0226)
Gender			0.0194	0.0147
			(0.0137)	(0.0138)
Age			0.00251***	0.00230***
			(0.000605)	(0.000620)
Date			-0.0000518	
			(0.000142)	
India				-0.146***
				(0.0322)
Other non-US countries				-0.0189
				(0.0356)
Round				-0.0299***
				(0.00437)
Constant	0.542***	0.522***	0.441***	0.504***
	(0.0161)	(0.0181)	(0.0247)	(0.0599)
Study dummies	Yes	Yes	Yes	Yes
Education dummies	No	No	No	Yes
N	5363	5363	5363	5363

Notes: Cluster-robust standard errors in parentheses (clustered on IP address)
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
(1) Replication of Column 5, Table 2 in Rand et al. (2014), (2) with interaction, (3) with interaction, with similar controls as in our study, (4) with interaction using same controls as Rand et al. (2014)

Column (1) in Table 2 replicates Column 5, Table 2, in the meta-analysis performed by Rand. el. (2014). Our re-analysis of the Public Goods Game data provided by Rand et al. (2014) suggests that the results are qualitatively comparable to ours. There is a time-pressure effect that is conditional upon payoff comprehension, but the estimated effect is practically zero for subjects failing the comprehension questions. Moreover, the interaction term between time pressure and comprehension is statistically significant ($p < 0.05$, OLS regression without and with similar controls as we used; $p < 0.10$, OLS regression with identical controls as Rand et. al. 2014).

Similar to our experiment, we do not find evidence that time-constraint manipulation impacts payoff comprehension ($p = 0.185$, $N = 5374$, OLS regression in Appendix A). Moreover, we also consider the time pressure effect in the one experiment included in the Rand et al. (2014) meta-analysis that thoroughly assessed comprehension *prior* to the decision, a 15-round Public Goods Game with random matching. Here, the overall estimated time-pressure effect is 11.4 percentage points ($p = 0.028$, OLS regression) and 23.3 percentage points initially ($p = 0.028$, OLS regression).

Table 4

OLS regression, re-analysis of Public Goods Games in Tinghög et al. (2013), Study 5.

Dependent variable is binary (1 = Cooperate, 0 = Defect)

Reference group: Payoff-comprehending subjects

	(1)	(2)	(3)	(4)	(5)	(6)
Time Pressure	-0.0217	0.0262	0.0139	0.0428	-0.0393	0.000705
	(0.0446)	(0.0668)	(0.0514)	(0.0636)	(0.0486)	(0.0683)
Failed Comprehension		0.104*		-0.00807		0.0857
		(0.0629)		(0.0757)		(0.0679)
Time Pressure*Failed Comprehension		-0.0912		-0.0806		-0.0800
		(0.0896)		(0.109)		(0.0976)
Constant	0.785***	0.742***	0.614***	0.609***	0.754***	0.720***
	(0.0447)	(0.0541)	(0.0523)	(0.0572)	(0.0497)	(0.0583)
Location dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	395	395	374	374	380	380

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
(1) Early info without example, (2) Early info without example, interaction included, (3) Experiment 2 without interaction, (3) Late info with example, (4) Late info with example, interaction included, (5) Late info without example, (6) Late info without example, interaction included

In the Tinghög et al. dataset, we use their Study 5 because this seems to be the only one for which comprehension rates are reported. We find the same qualitative pattern as can be seen in Tables 2 and 3. Although there are no statistically significant differences here, we note that the estimated time-pressure effect either changes from negative to positive when we control for the interaction or the effect increases in magnitude. The interaction term between time pressure and failed compression is quite large and negative in all three studies, although it is imprecisely estimated. Overall, we believe these estimation results are consistent with what we find in our experiment.

In their Study 5, Tinghög et al. (2013) also estimate the effect of a suggestive example of possible actions (contribute zero), which was used in the original study by Rand et al. (2012). Their Studies 1-4 did not include this example and found no time-pressure effect. We followed Tinghög et al. in removing this example because they argue the example primes selfishness. However, a competing explanation is that the example increases payoff comprehension. Thus, removing it lowers payoff comprehension and undermines the possibility for a time-pressure effect. Using the data from Tinghög et al.'s (2013) Study 5, we find that removing the example decreases comprehension by 14.9 percentage points ($p < 0.01$, OLS regression, Table A.6, Appendix A). This suggests that by removing the example from the instructions, our own study, as well as the Tinghög et al. study, obtained a lower comprehension rate. This could potentially explain why we failed to find an overall time pressure effect when considering all subjects.

Similar to our experiment and Rand et al.'s experiment, there are no significant differences in comprehension in Tinghög et al.'s ($p = 0.73$, $N = 1204$) Public Goods data. Thus, we do not find any evidence that time-constraint manipulation impacts payoff comprehension.

Another Public Good study not considered in our re-analysis also reports no effect on the part of time pressure, even though their subjects reported being largely inexperienced with economic games (Verkoeijen & Boutwmeestern, 2014). However, they report a comprehension rate of only 10%. Our finding that time pressure is conditional on comprehension helps explain why this study failed to support the SHH.

5 Concluding remarks

The results of our study show that a single variable – payoff comprehension – helps organize the empirical discrepancies reported in the experimental literature on time pressure and cooperation in Public Goods Games. For those who understand the payoff structure of the game, the time-pressure effect is consistently positive across studies from different locations; our own experiment and the re-analysis of previous time-pressure experiments involving Public Goods Games overall considers data from the US, Norway, Sweden, and Austria. The fact that payoff comprehension consistently predicts the direction of the time pressure effect indicates that future studies using time constraints in Public Goods Games should take this interaction into account.

We have argued that payoff comprehension is necessary for a time-pressure effect in Public Goods Games. Although comprehension rates are identical across treatments when subjects fill out their questionnaires, comprehension rates may have been systematically different when subjects were in the decision stage. This means that the result of a time pressure effect could be interpreted as systematic differences in comprehension at the points in time at which the decisions were made. That is, time pressure influences cooperation through "delaying" payoff comprehension. While this possibility cannot be strictly ruled out, two arguments suggest that it is not very likely. First, as we noted previously, in the one study included in Rand et al. that thoroughly assessed comprehension prior to treatment, we also find a large time-pressure effect. Second, given that time pressure influences cooperation through comprehension, one should also expect a time-pressure effect in the overall sample. However, we do not observe such an effect.

There is no evidence that priming a cooperative norm by using the value-laden term Dugnad increases deliberative cooperation to such an extent that it nullifies the intuitive cooperation effect, although we believe further work remains to be done in this area.

However, our finding is consistent with an experiment by Engel and Rand (2014), who report that subjects seem to intuitively project cooperative frames onto neutrally framed games. If subjects enter into experimental games with a default cooperative frame derived from everyday experience, then perhaps priming a cultural cooperation norm may not change behavior.

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Appendix A: Supplementary regressions

Table A.1. OLS results, interaction with experience with experiments

	(1)	(2)
Time Pressure	1.181	0.756
	(5.499)	(5.425)
Experience	-4.039	-4.420
	(6.254)	(5.967)
Exp*Time Pressure	-0.500	-0.646
	(8.684)	(8.451)
Female	11.87**	9.313**
	(4.608)	(4.526)
Age	1.074	0.837
	(0.805)	(0.789)
Failed		14.65***
		(4.321)
Constant	42.27**	40.69**
	(19.33)	(19.00)
N	280	280

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.2. OLS results, re-classifying ambiguous subjects, individual contribution in percentages of endowment (100 NOK)

	(1)	(2)
Time Pressure	19.27* [(a)]	20.45**
	(9.860)	(9.719)
Dugnad	7.901	8.489
	(10.82)	(10.50)
Dugnad*Time Pressure	-10.91	-9.125
	(13.96)	(13.58)
Failed	36.53***	35.61***
	(8.010)	(7.945)
Failed*Time Pressure	-30.18***	-29.98***
	(10.43)	(10.44)
Failed*Dugnad	-16.42	-17.08
	(11.75)	(11.43)
Failed*Dugnad* Time Pressure	14.67	11.02
	(15.82)	(15.75)
Female		10.49**
		(4.457)
Experience		-3.921
		(4.059)
Age		0.962
		(0.747)
Constant	50.27***	24.32
	(7.911)	(19.08)
N	281	280

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

(a): p-value = 0.052 (two-tailed)

Table A.3. OLS regression results, testing for treatment effects on comprehension in our data (1 = Comprehension, 0 = Failed comprehension)

	(1)	(2)
Time Pressure	0.0278	-0.0190
	(0.0823)	(0.0850)
Dugnad	0.0417	0.0314
	(0.0825)	(0.0828)
D*Time Pressure	-0.0972	-0.0622
	(0.116)	(0.116)
Female		-0.177***
		(0.0604)
Age		-0.0158*
		(0.00933)
Experience		-0.0315
		(0.0590)
Constant	-0.611***	-0.126
	(0.0579)	(0.232)
N	288	286

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.4. OLS regression results, treatment effect on comprehension in all Public Goods Games included in Rand et al. (2014)

(1 = Comprehension, 0 = Failed comprehension)

	(1)	(2)	(3)
Time Pressure	-0.0160	-0.0170	-0.00707
	(0.0121)	(0.0121)	(0.0113)
Age		-0.000215	-0.000936
		(0.000698)	(0.000699)
Female		-0.0431***	-0.0605***
		(0.0125)	(0.0120)
Date		0.00000655	
		(0.000174)	
From India			-0.616***
			(0.0401)
Other Non-US countries			-0.284***
			(0.0488)
Round			-2.01e-14
			(2.30e-10)
Study dummies	Yes	Yes	Yes
Education dummies	No	No	Yes
Constant	0.557***	0.583***	0.811***
	(0.0217)	(0.0298)	(0.0603)
N	5374	5374	5374

Cluster-robust standard errors in parentheses (cluster id: IP address)
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.5. OLS regression results, Study F in Rand et al. (2014) (comprehension addressed *prior* to treatment)

	(1)	(2)
Time Pressure	0.114**	0.233**
	(0.0503)	(0.102)
Round		-0.0217***
		(0.00503)
Round*Time Pressure		-0.0144*
		(0.00823)
Constant	0.122***	0.296***
	(0.0254)	(0.0595)
N	709	709

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.6. OLS regression results, treatment effect on comprehension in Tinghog et al. (2013). All data are pooled for maximum statistical power.

(1 = Comprehension, 0 = Failed comprehension)

	Comprehension
Time Pressure	0.00968
	(0.0281)
Location dummies	Yes
Constant term	0.287***
	(0.0280)
N	1204

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.7. OLS regression results, results of removing payoff example from Rand et al. (2012). Data from Tinghog et al. (2013).

(1 = Comprehension, 0 = Failed comprehension)

	Comprehension
Time Pressure	-0.0108
	(0.0487)
Example Removed	-0.149***
	(0.0483)
Time Pressure*Example Removed	0.0625
	(0.0700)
Location dummies	Yes
Constant	0.797***
	(0.0403)
N	754

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B: Experimental instructions and control questions

Stage 1: Main instructions (similar in all experimental conditions)

You are guaranteed to earn 50 NOK for your participation. Additionally, you may earn more, depending on your choices.

You have been randomly assigned to a group with three other persons. You will receive exactly the same instructions. Initially, each person will receive 100 NOK.

You, yourself, decide how many of these 100 NOK you want to give to a common group project. Whether you want to contribute or not is up to you.

The amount of money the group members contribute will be doubled and then shared equally among the group members.

Communication is not allowed.

If you have any questions, you may raise your hand, and we will come to you.

Thank you for your participation.

Stage 2: Decision stage

Decision sheet (Baseline)

Please make a choice. Take the time you need.

Put a circle around your desired contribution.

0 - 10 - 20 - 30 - 40 - 50 - 60 - 70 - 80 - 90 - 100

Decision sheet (Time Pressure)

Please make a choice within ten seconds.

Put a circle around your desired contribution.

0 - 10 - 20 - 30 - 40 - 50 - 60 - 70 - 80 - 90 - 100

Decision sheet (Dugnad)

The Dugnad

Please make a choice. Take the time you need.

Put a circle around your desired contribution.

0 - 10 - 20 - 30 - 40 - 50 - 60 - 70 - 80 - 90 - 100

Decision sheet (Dugnad and Time Pressure)

The Dugnad

Please make a choice within ten seconds.

Put a circle around your desired contribution.

0 - 10 - 20 - 30 - 40 - 50 - 60 - 70 - 80 - 90 - 100

<u>Stage 3</u>: Control questions and comprehension questions

Control questions

Age	
Gender	
Have you previously participated in an economic experiment? How many times?	
Do you think the compensation in the experiment was sufficiently large?	
Were the instructions explained in a clear way?	
What is your field of study?	

Please answer the following two questions:

1) Put a circle around the contribution that gives the group the highest payment.

   0 - 10 - 20 - 30 - 40 - 50 - 60 - 70 - 80 - 90 - 100

2) Put a circle around the contribution that gives you the highest payment.

   0 - 10 - 20 - 30 - 40 - 50 - 60 - 70 - 80 - 90 - 100

If you have further comments, you may state them here:

[Open field]

Thank you for your time!

Comments concerning the classification of comprehension

When reading the written comments below the comprehension questions, a few subjects seemed to interpret the question of what the payoff-maximizing choice was more broadly than intended and seemed to give the optimal answer for both themselves and the other group members. Because these subjects clearly understood the payoff structure (they specify the strategy profile yielding the highest individual payoff rather than just their own choice), they were not classified as failing comprehension. Subjects who gave this answer without further verbal explanations were not classified as failed comprehension either, because we believed they simply specified the optimal choice for both themselves and the other group members. However, for robustness, the latter subgroup is considered in the analysis, both as part of the treatment and as part of the control group, in order to ensure that the results are robust with regard to the classification procedure.