Ego-relevance in team production*

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October 30, 2020

Abstract

We study how individuals' contribution to a team production task varies depending on whether the task is ego relevant or not. We design and conduct an experiment to test the effect of ego-relevance in two types of team tasks: when contributions are complementary and substitutable. Ego-relevance is manipulated by calling the Raven IQ Test an "IQ Task" or a "Pattern Task". We find that the effects of ego-relevance are mediated by beliefs about the teammate's contributions. Subjects act as conditional cooperators. However, the pessimistic ones contribute even less in the Ego-relevant condition, whereas the optimistic ones contribute more in the Ego-relevant condition. We do not find the nature of team production process being complementary or substitutable moderating the effect of ego-relevance on contribution decisions.

Keywords: ego-relevance; experiment; team contribution; team production

JEL Classification Codes: C90, D91

*This research was funded by Research Project Fund of the University of Portsmouth, Faculty of Business and Law. Financial Support from the program "*Inclusión productiva y social: programas y políticas para la promoción de una economía formal, código 60185, que conforma la Alianza EFI, bajo el Contrato de Recuperación Contingente No. FP44842-220-2018.*" is also gratefully acknowledged.

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1 Introduction

Team production environments are generally prone to free-riding and shirking among teammates (Alchian and Demsetz, 1972; Büyükboyacı and Robbett, 2017). However, the literature is silent on how this may depend on the ego-relevance of tasks in a team project. A familiar example is preparing a co-authored academic project. One could easily distinguish between tasks that would affect one’s ego depending on success or failure, such as writing a mathematical proof or programming a statistical test; and tasks whose completion would not have any effect on academics’ ego, such as producing a project’s expense report.

The standard economic theory makes no distinctions concerning the ego-relevance of the team production task that individuals are required to undertake. By contrast, behavioural economics and psychology theories would prescribe two opposing predictions regarding the effect of ego-relevance on effort levels. Motivational theories of behavioural economics predict that ego-relevance will stimulate the willingness to contribute with a costly effort by raising individuals’ self-confidence and intrinsic motivation (Bénabou and Tirole, 2002, 2003; Köszegi, 2006). On the other hand, psychological theories predict that ego-relevance will demote the willingness to contribute (i.e., make a costly effort) because of ego-protection: individuals in fear of failing the task might reduce their effort (Thompson et al., 1995; Tice, 1991).

Moreover, although higher confidence about one’s abilities is related to more self-interested status-seeking behaviour (Tsai and Xie, 2017), it is not clear whether this pattern is robust to substitutable and complementary nature of team production. For instance, if the team production function greatly depends on the team’s best or worst performer, it is not clear whether the team output is enhanced by ego-motivation or suppressed by ego-protection. The former might boost effort by “pulling the team to get the job done”, whereas the latter may hinder effort by providing a self-justification to shirk (i.e., not wanting to waste effort).

We design an experiment to test the effects of ego-relevance on contribution decisions in a team task, and its association to the nature of team production. Our experiment employs a 2x2 factorial design. In one dimension, we manipulate the ego-relevance of the task by framing the 10-item Progressive Raven Matrix task either as an “IQ task” (*Ego-Relevant*) or “Pattern task” (*Non-Ego-Relevant*). In the other dimension, we manipulate the nature of the team production process by making teammates’ contributions *substitutable* or *complementary*.

We find that the effects of ego-relevance and the nature of the task are strongly intertwined with conditional cooperation, measured as the beliefs about the teammate’s contribution to the task. The role of beliefs as essential predictors of contribution decisions in social dilemmas is not new (Fischbacher et al., 2001; Mertins and Hoffeld, 2015). However, we show how ego-relevance

magnifies the effect of beliefs. Among the most pessimistic participants (i.e., those reporting a low expected contribution from their teammate), contributions are lower in the *Ego* than in the *Non-Ego* treatment. Nonetheless, the effect of ego-relevance is reverted among the optimistic participants (i.e., those reporting a high expected contribution from their teammate): contributions are higher in the *Ego* than in the *Non-Ego* treatment.

We observe a similar pattern by comparing the nature of team production. The slope capturing the response in the participant's contribution to the expected contribution from her teammate is steeper when team efforts are complementary instead of substitutable. Hence, pessimistic (resp. optimistic) participants contribute less (resp. more) when efforts are complements. Nonetheless, we do not find evidence of the expected interplay between ego-relevance and nature of the team production, even conditioning on the beliefs about the teammate's contributions.

Our results speak to two strands of the literature. First, to study how ego-relevance affects economic decisions. This strand of literature has focused on how the ego-relevance induced by a task, or by a decision-making context, affects information processing and belief updating. The conclusions from these studies are somewhat mixed, finding that people tend to either ignore positive information (Coutts, 2019; Ertac, 2011), ignore negative information (Eil and Rao, 2011; Mobius et al., 2014), or evidenced a mixed asymmetry when incorporating positive or negative information into updating their ego-relevant traits (Buser et al., 2018; Grossman and Owens, 2012). We test whether the ego-relevance of a context affects individual decisions in a strategic setup, and our findings point out to a connection between ego-relevance and conditional cooperation.

Second, we contribute to the literature exploring how the nature of team production tasks affects contributions. Decision environments typically embed these team tasks within contexts. In minimum effort games with two-player teams, as in our experiment, participants are typically highly successful at coordinating. Moreover, weak players do not free-ride in perfect-substitute contests, as the theory predicts, and the most likely explanation is that participants come to bond with their teammates (Sheremeta, 2011). Another critical question in this literature is how to sort heterogeneous agents into teams, aiming to increase individual efforts (Brookins et al., 2015, 2018; Büyükboyacı and Robbett, 2017). This mechanism is blocked in our experimental setting, since we match participants with the closer scores in a similar task individually. Since this matching procedure was known by participants beforehand, our results emphasize the importance of conditional cooperation in the contribution decisions.

2 Experimental Setup

2.1 Experimental paradigm

Our experimental paradigm has two parts described below, plus a final questionnaire. See the Online Supplementary Materials for the full instructions.

Part 1

Participants were asked to complete a 10 Raven Progressive Matrices test within two minutes (Raven and Raven, 2003). We announced that this test was not directly incentivised, but their performance would affect the quality of their teammate in Part 2 (i.e., they knew that the more matrices they correctly solved, the better their future teammate). We did not provide any other information about Part 2 during Part 1. Thus, we eliminated any possibility of hedging and intentional under-performance related to the teammate matching.

After completing Part 1, we elicited the participants' beliefs about (i) their own score, as an incentivised measure of *absolute* confidence (receiving a bonus of £0.20 if their guess was correct); as well as their beliefs about scoring in the top half and top quarter of participants, a couple of non-incentivised measures of *relative* confidence.

Part 2

Participants were asked to complete another 10 Raven Progressive Matrices test within two minutes, but this time as part of a team production task. Participants were matched with another subject whose score was the closest to theirs, out of a group of 20 other participants, to form a team.

We designed a team production task giving room to ego-based mechanisms to operate by separating *intended* from *effective* contributions to the team's performance. At the beginning of Part 2, participant i had to choose how many matrices they wanted to contribute to their team ($\#Contributed_i$), at a cost £0.10 per contributed matrix out of a £1.00 endowment.¹ This is an *intended* contribution since it defines how many matrices, out of ten, will be randomly selected as part of the scoring subset from the participant i . The *effective* contribution from participant i will be the number of correctly solved matrices within the scoring subset ($Score_i$). In the computation of $Score_i$, each correctly solved matrix within the scoring subset counted as one additional point.

¹Previous experiments have investigated whether the "realness" of the effort affect on contribution decisions in team production. Dutcher et al. (2015) show that contribution to a public good is similar whether the effort is induced, trivial or useful.

If the time ran out, the unsolved matrices were also eligible to be part of the scoring subset, but their contribution to the score was null.

Note that the subjects' intended contribution involved how many matrices, but not which ones, will enter the scoring subset. Hence, subjects could not hedge between their contribution decision and their performance in the task: as long as a subject paid to contribute with at least one matrix, she had an incentive to correctly complete as many matrices as possible. This feature in our design ensured that subjects had a financially costly contribution decision, yet the subjects' performance in the task acts as a "real" component. This is similar to Gächter et al. (2016), who also advocate for the use of induced effort combined with real effort to measure effort decisions in experiments.

Subject's payoffs in Part 2 were thus as follows:

$$\pi_i = 1.00 - 0.10 \times \#Contributed_i + 0.25 \times TeamScore_{ij} \quad (1)$$

where

$$TeamScore_{ij} = \begin{cases} \max(Score_i, Score_j) & \text{if Substitutable} \\ \min(Score_i, Score_j) & \text{if Complementary} \end{cases} \quad (2)$$

Subjects knew that they would be informed about their final payment, but that they would not receive information either on their individual score or on their teammate's contribution. This ensured sufficient uncertainty to allow the ego-protection and the ego-motivation mechanisms to operate: subjects can successfully self-deceive regarding the random selection of matrices that would be counted in the scoring; and whether it is their or their teammate's scores that determine the team score. Subjects had to correctly respond to a control quiz checking their understanding of the instructions and the payoff mechanism. Then, they were allowed to proceed with the contribution decisions.

On the same page where participants make their intended contribution decision, we elicited beliefs regarding their teammate's contribution using a simple incentivised procedure (receiving a bonus of £0.20 if their guess was correct). We then proceeded with the second Raven test.

Final questionnaire

Subjects had to fill out a questionnaire on demographics, their previous knowledge about Raven Matrices, how close they felt to their teammate by eliciting an Oneness Scale (Gächter et al., 2015), and open-ended questions regarding their thoughts about the experiment.

As a manipulation check for ego-relevance, we also asked whether they would like to pay for being informed about their task scores from Part 1 and Part 2. Each piece of information would cost £0.10 to be subtracted from their final payments.

2.2 Treatment arms and predictions

Our experiment employs a 2x2 between-subjects design. We manipulated the ego-relevance of the task and the nature of individual efforts in the team production function.

We employed a novel ego-relevance manipulation where we kept the task at hand constant, but we changed the framing of the task description. In the *Non-Ego* treatment, the instructions told subjects that they would be shown 10 patterns with a missing element, and their task was to select the option that completes the pattern. In the *Ego* treatment, we raised the ego-relevance of the task by additionally telling subjects that the task was taken from an Intelligence Quotient (IQ) test, and referred them to a published paper that showed a significant relationship between IQ and life outcomes (Bergman et al., 2015). Throughout the experiment, we referred to the task as the “Pattern Task” in the *Non-Ego* treatment and the “IQ task” in the *Ego* treatment.

The variation in the nature of the team production function is detailed in Equation 2. When individual efforts are substitutes, the team’s score is computed with the maximum individual score between team members. By contrast, when individual efforts are complements, the team’s score is governed by the minimum individual score.

Our first-order predictions, corresponding to comparisons within each treatment arm, are the following. First, if ego-protection dominates ego-motivation, then we would expect a negative effect of the *Ego* treatment in intended contribution. By contrast, a positive effect of the *Ego* treatment on contributions would reveal that ego-motivation dominates ego-protection. Second, following a model of individual rationality within a team production framework, the average effect of *Substitutable* treatment will be negative because a larger teammate’s contribution provides incentives to decrease one’s contribution.

We now describe our second-order predictions, related to the interplay between ego-relevance and nature of the team task.² When the team production is *Substitutable*, and the task is *Ego-Relevant*, individuals’ effort will go in the opposite direction of the expected teammate’s effort. Hence, ego-motivation will increase the subject own’s effort in the ego-relevant task when the expected teammate’s effort is low, and ego-protection will decrease the subject own’s effort in the ego-relevant task when the expected teammate’s effort is high. On the other hand, when the team production is *Complementary*, the individuals’ effort will not depend on the expected teammate’s

²The second-order predictions were pre-registered in <http://aspredicted.org/blind.php?x=nf6ba4>.

effort. The ego-protection mechanism may result in self-handicapping and shift the contribution downwards, regardless of the expected teammate’s actions.

2.3 Data collection procedure

We recruited subjects in April 2019 using the online platform www.prolific.ac with a fixed payment of £2.00 per subject, plus a bonus payment determined by subjects’ decisions. The bonus was on average £1.52 (± 0.56 std. dev.). Since the experiment lasted 15 minutes on average, the payment was equivalent to a £14 hourly rate. We pre-selected subjects to be students within an age range of 18-25, and to be residing in the United Kingdom. The purpose was to have a homogeneous subject pool and a relatively homogeneous performance in the task. This sample targeting was common knowledge. The experiment was conducted in oTree (Chen et al., 2016).

We calculated the sample size given an error probability of 5%, power of 80%, allocation ratio of 1-to-1 and predicted effect sizes of Cohen’s $d=0.25$. The resulting sample size is 416. In a pilot with 100 subjects, we observed that the effect size was smaller than predicted. We proceeded to recalculate the sample size using a linear multiple regression model R^2 deviation from zero with small effect sizes ($f^2 = 0.02$), the error probability of 0.05, 80% power and three main predictors (ego-relevance, complementarity/substitutability of contributions and their interactions). The required sample size was 550. We collected 590 observations to account for possible outliers, failures in the control quiz and incomplete observations. Our random assignment to the four treatments yielded 140 participants in the *Substitutable Ego*, 154 in the *Substitutable Non-Ego*, 148 in the *Complementary Ego* and 148 in the *Complementary Non-Ego* treatments.

3 Results

3.1 Descriptive statistics

Table 1 presents the descriptive statistics of our key variables of interest in Parts 1 and 2, as well as demographic characteristics, by treatment condition. The non-parametric Mann-Whitney tests reveal that, before controlling for other covariates, there is no difference between the treatments in subjects’ contribution decisions ($p > 0.100$). The distributions of contributions are graphed, by treatment, in Figure A.1 (see Appendix).

We do not find any difference between treatments in the other elicited demographic characteristics, nor in the performance in Parts 1 and 2, with one exception: participants were more likely to pay for learning their scores from Part 1 or 2 in the *Ego* treatment (35%), compared to the *Non-Ego* treatment (20%). This difference is statistically significant (Fisher exact test with $p < 0.001$).

Table 1: Descriptive statistics by treatment

	Ego-relevant				Non Ego-relevant			
	Complementary		Substitutable		Complementary		Substitutable	
Part 1: Initial Raven Matrices Test								
Score	8.24	(1.50)	8.00	(1.72)	8.20	(1.51)	7.88	(1.59)
Belief about own score	7.80	(1.57)	7.55	(1.80)	7.93	(1.49)	7.80	(1.52)
Confidence top half	71.08	(21.05)	70.63	(22.89)	72.84	(21.86)	70.53	(23.15)
Confidence top quarter	55.92	(28.54)	55.18	(27.83)	57.88	(28.33)	56.94	(27.33)
Part 2: Team Production								
(own) Contribution decision	6.39	(2.72)	6.13	(2.64)	6.49	(2.68)	6.40	(2.69)
(own) Score	7.33	(1.83)	7.28	(1.87)	7.39	(1.84)	7.14	(1.51)
Beliefs about teammate’s contribution	6.47	(2.12)	6.16	(2.17)	6.27	(2.49)	6.13	(2.39)
Demographics								
Female	60.5%		59.7%		54.4%		62.1%	
Age	21.26	(2.22)	21.19	(2.22)	21.59	(2.27)	21.52	(2.26)
Taken Raven test before	14.9%		16.4%		9.5%		12.3%	
Oneness scale	2.66	(1.76)	2.39	(1.65)	2.78	(1.68)	2.51	(1.53)
Paid to learn score	35.8%		34.3%		18.9%		22.1%	
Observations	148		140		148		154	

3.2 Regression analysis

The comparison of unconditional means for the contribution decisions yields no differences between treatments. By contrast, our OLS analysis reveals that the beliefs about the teammate's contribution are determinant in the understanding of treatment effects. Table 2 reports the OLS estimates supporting this statement.

Models 1 and 2 confirm that beliefs about the teammate's contribution are significant predictors of the contribution decision. When these beliefs are interacted with the treatment variables, in models 3 and 4, the variables capturing the nature of team production and the ego-relevance become statistically significant. Let us start by discussing the differences related to the nature of the team production. Whereas the coefficient for the *Substitutable* variable is positive, its interaction with beliefs is negative, and both are statistically significant. Hence, when subjects expect a low contribution from their teammates, they are more willing to contribute when efforts are substitutes rather than complements. This pattern is reversed when the expectation about the contribution from their teammate is high.

This finding is better depicted on the left panel of Figure 1. The differences between substi-

Table 2: OLS results for the determinants of the contribution decision.

VARIABLES	Contribution decision			
	(1)	(2)	(3)	(4)
Substitutable	0.0421 (0.153)	0.0674 (0.153)	1.325*** (0.494)	1.319*** (0.504)
Ego-relevant	-0.178 (0.152)	-0.117 (0.151)	-1.285*** (0.479)	-1.267*** (0.478)
Score in Part 1	0.366*** (0.0520)	0.315*** (0.0605)	0.371*** (0.0528)	0.317*** (0.0624)
Beliefs Teammate's Contribution	0.667*** (0.0398)	0.640*** (0.0410)	0.692*** (0.0606)	0.659*** (0.0604)
Substitutable $\times$ Beliefs Teammate's Contribution			-0.203*** (0.0733)	-0.199*** (0.0751)
Ego-relevant $\times$ Beliefs Teammate's Contribution			0.175** (0.0707)	0.182** (0.0712)
Constant	-2.395*** (0.406)	-3.507*** (0.831)	-2.605*** (0.509)	-3.743*** (0.854)
Additional controls	No	Yes	No	Yes
Observations	590	586	590	586
R-squared	0.468	0.475	0.483	0.489

Additional controls: guess about own score in Part 1, confidence of having a score in top half, gender, age and oneness scale. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

tutability and complementarity of efforts become negligible when participants are close to the mean expectation of their teammate's contribution, between 6 and 7 contributed questions. This result is consistent with rational behaviour: when the team output depends on the maximum of individual contributions, subjects are willing to substitute the (expected) low teammate effort with their own higher effort, and *vice versa*.

Let us describe now the effects of ego-relevance on the contribution decision. In models (3) and (4), the coefficient for the *Ego-Relevant* variable is negative, its interaction with beliefs is positive, and both are statistically significant. Hence, when subjects expect a low contribution from their teammates, they are less willing to contribute when the task is framed as ego-relevant (i.e., an "IQ task") compared to the non-ego-relevant framing (i.e., a "Pattern task"). This pattern is reversed for high expectations regarding the teammate's contribution. The right panel from Figure 1 depicts this finding. As a general conclusion, the differences in the slopes suggests that the ego-relevance of the task reinforces conditional cooperation.

Figure 1: Subjects' contribution decision as a function of the beliefs about teammate's contribution. Error bars show 95% confidence intervals.

Since we are interested in the interplay between the nature of the team production and ego-relevance, the natural extension is to determine whether the beliefs about teammate's contributions also affect the interaction between treatments. A tractable strategy to check whether the cross-treatment effects are mediated by beliefs about teammate's contributions is a Wald-like (or Chow-like) test.³ We conduct separate regressions for the subsamples of *Ego-Relevant* and *Non-Ego-Relevant* treatments. We then compare the coefficients for the *Substitutable* variable, and its interaction with beliefs, between the two regressions. Similarly, we conduct separate regressions for the subsamples of *Complementary* and *Substitutable* treatments, and we then compare the coefficients for the *Ego-Relevant* variable, and its interaction with beliefs, between the two regressions.

The results of this exercise are reported in Table 3. We confirm that beliefs moderate the two treatment effects, as we report in Table 2. By contrast, cross-treatment effects are not moderated by beliefs. Thus, this evidence points in the direction that the two treatment effects operate inde-

³We also conducted a regression with a triple interaction. This interaction term is non-significant. Although these results are not reported in the paper, they are available upon request or they can be easily replicated with our publicly available dataset.

Table 3: OLS results for combined effects of ego-relevance, nature of team production and beliefs about teammate's contributions. p -values corresponding to tests for seemingly unrelated estimations reported in brackets next to the χ^2 estimate.

VARIABLES	Selected subsample			
	Non-ego (1)	Ego (2)	Complementary (3)	Substitutable (4)
Substitutable	1.448* (0.749)	1.085* (0.646)		
Ego-relevant			-1.250** (0.608)	-1.359* (0.752)
Beliefs Teammate's Contribution	0.662*** (0.0702)	0.827*** (0.0605)	0.678*** (0.0671)	0.433*** (0.0892)
Substitutable x Beliefs Teammate's Contribution	-0.214* (0.113)	-0.165* (0.0951)		
Ego-relevant x Beliefs Teammate's Contribution			0.179** (0.0891)	0.195* (0.113)
Constant	-3.772*** (1.109)	-4.808*** (1.241)	-3.156*** (1.126)	-3.013** (1.261)
χ^2 test: Substitutable (1) vs. (2)	0.14	[0.709]		
χ^2 test: Substitutable x Beliefs Contrib. (1) vs. (2)	0.12	[0.731]		
χ^2 test: Ego-relevant (3) vs. (4)			0.01	[0.909]
χ^2 test: Ego-relevant x Beliefs Contrib. (3) vs. (4)			0.01	[0.913]
Observations	300	286	294	292
R-squared	0.446	0.543	0.568	0.420

Additional controls in all models: guess about own score in Part 1, confidence of having a score in top half, gender, age and oneness scale. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

pendently. This result goes in contrast to our prediction that the effect of ego-relevance on team production will be moderated both through the nature of team production and the beliefs about teammate's contributions.

3.3 Ego-protection or ego-motivation?

Table 1 revealed that participants in the *Ego-Relevant* condition were more likely to pay and receive feedback on their scores from Part 1, 2, or both. Figure 2 confirms this finding. Moreover, it reveals that most of the additional proportion of participants paying to learn their scores paid for knowing their performance in both Parts 1 and 2. This result is useful for two purposes. First,

Figure 2: Distribution of payment decisions for learning the scores in Parts 1 and 2 at the end of the game. Each score revelation costs £0.10.

it indicates that our ego-relevance manipulation was successful. Second, it allows us to explore whether the decision to pay for this feedback is moderated by the subjects' self-esteem, a test to discern between ego-motivation and ego-protection.

Table 4 reports the marginal effects of a probit model. Here, the dependent variable is equal to 1 when the participant paid to reveal her score in Part 1, 2, or both; and zero otherwise. The estimated increase in the probability to pay for this information under the *Ego-Relevant* condition, of 13 percentage points, is aligned with ego-motivation. The three models differ in the variable used as a proxy for initial confidence levels about task performance. It includes guesses of the participant's score, and their confidence in scoring in the top half and the top quarter among all subjects (Tice, 1991). The negative coefficients suggest that more confident subjects are less likely to pay and learn their scores. This result is partly aligned with Tice's (1991) hypothesis that prior self-esteem affects self-handicapping behaviour.

The marginal effects from Table 4 are computed from a model including the interaction between ego-relevance and our measures of self-confidence. Figure 3 depicts a comparison analogous to a difference-in-differences estimation. In one dimension, we have the difference between *Ego* and *Non-Ego* treatments. In the other one, we have the difference between subjects located

Table 4: Marginal effects from probit model for the decision to pay and learn at least one score

VARIABLES	Paid to reveal at least one score		
	(1)	(2)	(3)
Ego-Relevant	0.133*** (0.0362)	0.132*** (0.0363)	0.132*** (0.0364)
Above median: Guess correct response	-0.0795** (0.0402)		
Above median: Belief Top 50%		-0.0814** (0.0381)	
Above median: Belief Top 25%			-0.0468 (0.0379)
Observations	586	586	586
Additional controls: Performance in Part 1, gender, age and oneness scale. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.			

above and below the median for the three measures of confidence in their own performance. The parallel lines in the left and central panel, and the large confidence intervals in the right panel, suggest the lack of an interaction between the ego-relevance of the task and prior confidence. Hence, even if we have evidence of ego-protection, it was not moderated by the participant's relative confidence levels.

4 Concluding discussion

We find that the ego-relevance of a team production task can influence individual contributions. Nonetheless, the subjects' response depends on their beliefs regarding the teammate's contribution. Pessimistic subjects contribute less when the task is framed as ego-relevant.

This result is consistent with previous findings showing that students withdraw effort in achievement situations where poor performance is likely to be attributed to low ability (Thompson et al., 1995). Since the ego-relevance has the opposite effect among optimistic subjects (i.e., larger contributions compared to the *Non-Ego-Relevant* treatment), we conjecture that tasks framed as more ego-relevant increase the reciprocity concerns in the contribution decisions.

Beliefs about the teammate's contribution will determine whether more reciprocal responses are welfare-detrimental or welfare-enhancing. We speculate that, among pessimistic participants, ego-protection might operate as a justification to decrease contributions because ego-relevance

Figure 3: Computed marginal effects

accentuates the fear of being treated like a sucker. This mechanism is similar to how a “self-serving bias” from conditional cooperators causes a decline in contributions in public good games (Fischbacher et al., 2001). On the other hand, ego-motivation among optimistic subjects increases their willingness to contribute. Probably, by increasing the ego-utility associated with “shining” in a good team. Further research should test the exact mechanism behind this result, possibly by inducing different types of beliefs about the teammate’s willingness to contribute.

The main implication of this result is that managers should be aware of the link between task performance and workers’ ego when designing and describing team production tasks, preventing the crowding-out of individual contributions. For example, in the case of ego-relevant tasks, managers can give selective feedback/information to employees to regulate their beliefs about the teammate’s contributions to team projects. Managers should avoid giving negative information about teammate’s contributions and should try to lift the expectations (and actual contribution rates) of employees about each others’ contributions.

We also find that subjects’ willingness to pay to learn about their performance is larger in the *Ego-Relevant* than in the *Non-Ego-Relevant* treatment. Whereas previous studies exploring this question report mixed results (Köszegi, 2006; Burks et al., 2013), our findings are aligned with the empirical evidence suggesting that ego-relevance increases the willingness to receive feedback (Burks et al., 2013).

Our exogenous manipulation regarding the nature of team production, by making individual efforts complements or substitutes, served as a check for rationality. Pessimistic subjects were more willing to contribute when the maximum of individual contributions dictated the team output. Among optimistic subjects, the opposite patterns emerge. Nonetheless, we do not find supporting evidence for the hypothesized crossed-effects between ego-relevance and the nature of team production.

From a methodological perspective, we show that the ego-relevance of a simple task could be raised by framing the task as an “IQ Task” and referring participants to a study revealing a relationship between IQ and life outcomes (Bergman et al., 2015). Besides, we made a distinction between intended and effective contributions to a team production task. This feature was particularly useful to conceal information from participants in a natural manner, giving more room to the interplay between ego-relevance and beliefs.

We close with a brief discussion on the implications of using an online sample in our study. It offers an advantage in terms of validity given the increasing popularity of remote work. Nonetheless, we acknowledge that it encompasses a limitation by losing experimental control. This is not an issue for testing treatments effects since the limited experimental control affects all treatments equally. However, we might have obtained smaller effect sizes compared to what would have been observed in a laboratory or a field study.

Further research in the lab should test for the robustness of our results in settings where a greater demand for participant’s attention may translate in better measurement of conditional responses (i.e., by implementing the strategy-method). On the other hand, educational contexts might be appropriate for field studies where the ego-relevance of the tasks can be exogenously altered. Nonetheless, experimental designs need to pay special attention to intrinsic and extrinsic motivation as potential confounds in these contexts.

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Appendix

A Additional Figures and Tables

Figure A.1: Distribution of contribution (i.e., activation) decisions by the nature of the team production task (left panel) and ego-relevance (right panel). The dashed vertical lines correspond to the average contribution per treatment variation.

B Protocol

Consent form

Please read the consent form below and press the continue button if you agree to each bullet point.

- I voluntarily agree to take part in this study.
- I have been given a full instruction by the investigators of the nature, purpose, location and likely duration of the study, and of what I will be expected to do.
- I consent to my data that I provide in this experiment being used for this study. I understand that all personal data relating to volunteers is anonymised and held and processed in the

strictest confidence. I understand that the research data will be used for producing a research article to be published in scientific journals. The anonymised data may be published as an open-access data source.

- I understand that I am free to withdraw from the study at any time during the experiment without needing to justify my decision and without prejudice. I also understand that if I withdraw from the study once the study is finalised I can ask for my data to be deleted by providing my Prolific ID.
- I acknowledge that in consideration for completing the study I shall receive earnings at the end of the study. I recognise that I will receive £2 plus additional payment that will depend on my and other participants' decisions as explained in the instructions for the experiment.
- I confirm that I have read and understood the above and freely consent to participating in this study. I have been given adequate time to consider my participation and agree to comply with the instructions and restrictions of the study.

Instructions [treatment variations are highlighted]

Welcome to our study! You will receive £2 for participating in this study. Plus you can earn additional money depending on your decisions during the study. Please read and follow the instructions carefully. They contain everything you need to know.

Part 1: IQ Task/ Pattern Task

The Part 1 tasks are taken from an Intelligence Quotient (IQ) test that is commonly used to measure people's intelligence levels. Previous research has shown that people scoring high in IQ tests have been found to get higher salaries, obtain better job position and report higher satisfaction with their lives.

You will be shown 10 patterns with a missing element. Your task is to select the option that completes the pattern from several options given at the bottom of the screen. An example pattern is provided below, where option 4 is the correct answer.

You will have 2 minutes to complete a set of 10 patterns. Each correct answer will add 1 point to your score and wrong answers will not affect your score.

Your score does not increase your payment in Part 1, but in Part 2 you will be matched to a teammate with the closest score to yours. This may determine your payments in Part 2 of the Study. So it is in your interest to score as high as you can.

Everyone else will complete the same set of **IQ/Pattern** tasks.

Please click Continue to start the **IQ/Pattern** Task.

Execution of Part 1's Raven Task

Belief elicitation after completing Part 1's Task

Thanks for completing the **IQ/Pattern** Task.

1. Please tell us how many tasks out of 10 you think you got right?
2. Please tell us how confident you are that your score is in the top half of all other scores of all participants in this study by moving the slider below. That is, if we ranked all scores from highest to lowest, how confident are you that your rank would be in the top 50% of all scores?

(If you are completely sure your score is in the top half, choose 100% confident. If you are completely sure your score is not in the top half, then choose 0% confident. Choose intermediary values if you are uncertain whether your score is in the top or bottom half of all scores. Please try to express your confidence in scoring in the top half as accurately as you can.)

3. Also tell us how confident you are that your score is in the top quarter of all other scores by moving the slider below. That is if we ranked all scores from highest to lowest, how confident are you that your rank would be in the top 25% of all scores.

(If you are completely sure your score is in the top quarter, choose 100% confident. If you are completely sure your score is not in the top quarter, then choose 0% confident. Choose intermediary values if you are uncertain whether your score is in the top quarter of all scores. Please try to express your confidence of scoring in the top quarter as accurately as you can.)

Team Decision: **[Complementary/Substitutable Team Production Manipulation]**

Your scores in previous **IQ/Pattern** Task were calculated. We will rank all 20 participants (including you) depending on the scores in the Task. Depending on your score and your rank, you will be matched with another person as shown below to form a Team. We will know your scores, but unfortunately, you will not learn what score you or your teammate achieved or who your teammate is at any point of the study.

In this part of the experiment, you will have to complete a new set of 10 **IQ/Pattern** Tasks in 2 minutes. Your earnings will depend on your and your teammate's decisions and scores.

You are about to answer a new set of 10 **IQ/Pattern** Tasks. You have to decide how many, but not which ones, of the Tasks will be used to compute your payment. We call them the ACTIVATED answers.

You are now given an additional £1.00 that you can spend to activate your answers from the **IQ/Pattern** Task. Activating each answer costs £0.10.

The software will randomly select the number of ACTIVATED answers out of the 10 **IQ/Pattern** Tasks to calculate your ACTIVATED score.

YOUR ACTIVATED SCORE, TEAMMATE ACTIVATED SCORE and TEAMSCORE

Your additional earnings from this study depend on your TEAMSCORE.

The TEAMSCORE will be the **MINIMUM/MAXIMUM** between your own and your teammate's ACTIVATED score. That is, your TEAMSCORE depends on the **MINIMUM/MAXIMUM** number of correct answers you and your teammate got among the ACTIVATED answers.

TEAMSCORE = **Minimum/Maximum** (Your Activated Score; Teammate Activated Score)

You and your teammate will simultaneously decide how many answers to activate. It means that both you and your teammate will earn the same amount from working on IQ/Pattern task, but your total activation costs may differ depending on how many questions each of you decided to activate. We will subtract your activation cost from the additional £1.00 that you are given in this part.

Your earnings

To calculate your earnings, we will multiply your TEAMSCORE by £0.25 and subtract your cost of activating the questions. Your additional earnings will be equal to £1 that we give you to activate answers minus the £0.10 multiplied with the number you choose to activate plus your TEAMSCORE multiplied with £0.25. The formula for this is as below:

$$\text{Additional Earnings} = £1.00 - £0.10 \times \text{ACTIVATED ANSWERS} + £0.25 \times \text{TEAMSCORE}$$

At the end of the study, you will learn about your additional earnings, but you will not learn what your and your teammate's scores were or how many answers your teammate activated.

Let's look at an example to better understand how your earning will be calculated.

Example 1

You and your teammate decide to activate all 10 of the answers. Since you have both activated all 10 answers, the software will look at the correctness of all your answers. Suppose YOUR ACTIVATED SCORE was 9 questions right and your TEAMMATE's ACTIVATED SCORE was 7 questions right. Then the TEAMSCORE will be **9/7**, since **9/7** was the **MAXIMUM/MINIMUM** score between you and your teammate ACTIVATED score. Your and your teammate's earnings will thus be: $£1.00 - £0.10 \times 10 + £0.25 \times \mathbf{9/7} = \mathbf{£2.25/1.75}$.

Example 2

You have chosen to activate 7 answers and your teammate have chosen to activate 4 answers. The software randomly activates 7 out of the 10 answers from the set of 10 **IQ/Pattern** tasks, and then checks how many are correct. The software randomly activates 4 out of the 10 answers of your

teammate from the set of 10 **IQ/Pattern** tasks, and then checks how many are correct. Suppose your ACTIVATED SCORE is 6 of 7 answers. Suppose your TEAMMATES' ACTIVATED SCORE is 2 of 4 answers.

Then the TEAMSCORE will be **6/2**, since **6/2** was the MAXIMUM/MINIMUM number of correct answers between you and your teammate. Your final earnings will be $\pounds 1.00 + \pounds 0.25 \times \frac{6}{2} - \pounds 0.10 \times 7 = \pounds 1.80 / 0.80$ and your teammate's earnings will be $\pounds 1.00 + \pounds 0.25 \times \frac{6}{2} - \pounds 0.10 \times 4 = \pounds 2.10 / 1.10$.

You will only learn about your final earnings, but not about your or your teammate's correct answers.

Quiz [Correct answers in bold]

To make sure you understood how your earnings will be calculated, please answer the following quiz on your screen. You will not be able to proceed to the study unless you can answer all questions.

Q1: You activated 4 answers and your teammate activated 0 answers. You answered correctly 3 out of the 4 randomly selected questions.

Select the correct answer:

- Your activated score will be: **a) 3** b) 4 c) 5 d) 0
- Your teammate activated score will be: a) 3 b) 4 c) 5 **d) 0**
- Your team score will be: **a) 3**, b) 4, c) 5, **d) 0**
- Your earnings will be: **a) less than your teammate's earnings**, b) larger than your teammate earnings, c) equal to your teammate earnings.
- YOUR ACTIVATED SCORE: **[3]**
- TEAMMATE'S ACTIVATED SCORE: **[0]**
- TEAMSCORE: **[3/0]**
- Your earnings: [**£1.35/£0.60**]
- Your teammate's earnings [**£1.75/£1.00**]

Q2: You and your teammate activated 6 answers each. Suppose you have answered 5 of the 6 randomly selected questions correctly, while your teammate answered 6 out of 6 questions correctly.

Select the correct answer:

- Your activated score will be: a) 3 b) 4 **c) 5** d) 0
- Your teammate activated score will be: a) 3 b) 4 c) 5 **d) 6**
- Your team score will be: a) 3, b) 4, **c) 5, d) 6**
- Your earnings will be: **a) less than your teammate's earnings, b) larger than your teammate earnings,** c) equal to your teammate earnings.
- YOUR ACTIVATED SCORE: **[5]**
- TEAMMATE'S ACTIVATED SCORE: **[6]**
- TEAMSCORE: **[6/5]**
- Your earnings: **[£1.90/£1.65]**

Additional questions:

- Will you learn how many questions your teammate activated? Yes/**No**
- Will you learn how many questions you or your teammate answered correctly? Yes/**No**
- Will you learn your final earnings? **Yes**/No

Part 2: Activation Decisions

How many questions do you think your teammate will activate? (If you guess it right we will add £0.20 to your earnings)

Please choose how many questions you want to activate.

Bear in mind that each activated question will cost you £0.10 as explained before, so please make sure you are certain of your choice before pressing submit. You will not be able to go back to change your decision.

Execution of Part 1's Raven Task

Questionnaire

This is the end of Part 2. Before proceeding to the payment stage please fill in the following questionnaire.

- Gender
- Age
- Nationality
- Have you ever taken the **IQ Test/Pattern** Task before? Yes/No
- What are your thoughts on the task you completed? [Open Ended]
- **What do you think Pattern Task measures?** [Open ended]
- **How accurate do you think IQ task measures person's general intelligence level?** [Open ended]
- Please tell us what determined how many questions you chose to activate? [Open ended]
- Suppose your teammate is called X. Please choose the number of the picture below which best describes your relationship with your teammate X based on your experience in this study?

- Is there anything you would like us to know about your decision process during the experiment? [Open ended]

Would you like to learn what your score was in the **IQ/Pattern** Task? If yes, please choose which score you want to learn and we will show your scores in the final stage. This will cost you £0.10 each (to be subtracted from your earnings if you have positive earnings).

- ☐ Part 1: IQ/Pattern Task Score (costs £0.10)
- ☐ Part 2: IQ/Pattern Task Score (costs £0.10)
- ☐ Part 1 and 2: IQ/Pattern Task Score (costs £0.20)
- ☐ I do not want to learn my scores (costs £0.00)

Final Screen

Please provide your Prolific ID so that we can send to you results of your decisions and your final earnings amount.

You activated [] questions so your cost was [].

[If chosen to learn scores] – You answered [] and [] questions out of 10-items in your IQ/Pattern task. We will let you know of your TEAMSCORE and respectively your earnings once all participants have completed the study.