Leading to Efficient Coordination: Individual Traits, Beliefs and Choices in the Minimum Effort Game*

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October 5, 2022

Abstract

We consider data from an experiment on the minimum-effort game, repeated over many periods. In each play of the game, each player's belief about the minimum-effort of other players in the group is elicited, in addition to the player's chosen effort level. We find that many agents choose effort levels systematically exceeding their beliefs of others' effort levels. We explain this in terms of such subjects taking the role of "leader" in an attempt to pull the group towards more efficient outcomes. We find that the propensity for leaders to emerge depends on individual traits such as trustfulness and cognitive ability. Furthermore, moving to a superior equilibrium is more likely under certain design features such as conditions relating to the cost of effort and the amount of information available to players.

Keywords: Coordination, learning in games, heterogeneity, experiments

JEL Classification: C73; C91; C92.

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1 Introduction

The minimum-effort game[1] (Van Huyck et al., 1990) provides a popular experimental setting for the investigation of the reasons for successful coordination or lack thereof, among a group of players. The essential features of the game are that an individual player's payoff is decreasing in his or her own effort level (when it is above the minimum), but increasing in the minimum effort of the players in the group.

The game is very useful because it captures an everyday coordination problem: when group output is characterized by perfect complementarity of individual inputs, groups often gravitate to inefficient outcomes. For example, a project that depends on the contributions of several people can only be completed when the last person finishes his or her part. Unilaterally increasing contributions or speeding up one's effort is costly and does not improve the overall outcome if one of the other group members is lagging behind. Such a group is likely to find itself in what is known as a "performance trap" (Brandts and Cooper, 2007).

However, when the game is played in the laboratory, we frequently observe groups moving from less efficient to more efficient outcomes or vice versa, and we note that these movements may even be from one equilibrium to another. Given that an equilibrium is self-enforcing, and it is in the self-interest of each player to follow the equilibrium strategy if other players do, a natural question is then what makes groups move between equilibria.

The focus of this paper is on the role of players' beliefs about the likely effort of other players. Clearly, such beliefs play a important role in determining own effort, since a player is unlikely to increase effort unless she believes others will do so as well. However, the central hypothesis advanced in this paper is that some agents' contributions depart from their beliefs in systematic ways, which provide an explanation for the movements between equilibria. In particular, if a player's contribution is systematically greater than their belief about others' contributions, it is likely that this player is adopting the role of a "leader",[2] in the sense that he or she is making short-term sacrifices in an attempt to induce other

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[1] Camerer (2003) uses the term "weakest-link game". The version with two effort levels is also known as the "stag hunt" game. Camerer (2003) further suggests that many prisoners dilemma games and public goods games can be transformed to minimum-effort games.

[2] In the literature on strategic teaching, these players are referred to as patient players (see the seminal paper on strategic teaching by Fudenberg and Levine, 1989) or farsighted players (see, e.g., Camerer et al., 2002, 2003).

members of the group to follow with higher contributions, ultimately leading to the superior equilibrium.

Two features of the experiment reported in this paper allow a thorough investigation of the "leadership" hypothesis. First, our subjects played many repetitions of the game, and hence had the opportunity to correct previous decisions they realise to be mistakes.[3] Persistent systematic deviations of choices from beliefs over many repetitions may therefore be interpreted as purposeful choices rather than mistakes. Second, within each repetition of the game, each subject's beliefs about the group-minimum contribution were elicited as well as their own chosen contribution. Hence discrepancies between contributions and beliefs are directly observable at the level of the individual subject, and leaders can be easily identified. To the best of our knowledge, this is the first experiment on minimum effort that systematically records both individual actions and beliefs.

In addition to identifying leaders from the sample of subjects, we also set out to identify the factors that influence the likelihood of the leadership phenomenon arising, and hence the likelihood of a shift towards more efficient equilibria. These factors are of two different types. The first is exogenous factors under our control, such as conditions relating to effort cost and agents' information. Identifying the effects of these factors leads to recommendations of design features that promote leadership. The second type of factor is exogenous factors outside our control, namely individual traits, such as trustfulness and cognitive ability. Identifying the effects of these factors enables us to predict the type of subject who is most likely to emerge as a leader. Between-subject heterogeneity necessarily leads to between-group heterogeneity, and this can be used to explain why some groups converge to more efficient outcomes while others do not.

The cost conditions referred to in the last paragraph amount to changes in the effort cost over the course of the experiment. A common finding (also found by us) is that a decrease in the cost of effort can lead to quick transition towards high coordination levels. We set out to embed this finding within the leadership hypothesis: as we shall see, some subjects increase their efforts well beyond beliefs in the periods immediately following the decrease

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[3] Choices deviating from beliefs can obviously be interpreted as simple mistakes. However, there is a sense that mistakes are unlikely to persist. As argued in Nielsen and Rehbeck (2022), agents often prefer to revise their decisions when realizing that they violate canonical axioms of decision theory.

in cost.

The leadership phenomenon has been analysed previously in settings similar to ours. For example Brandts et al. (2007) consider a setting in which costs differ between players in the same group, and consider who is most likely to emerge as a leader. Brandts et al. (2016) exogenously introduce the option for some agents to "teach" other group members how to avoid the performance trap. Our setting differs from both of these. Firstly, our game is symmetric, with all players facing equal costs, and hence we need to look elsewhere to explain the emergence of leaders. Secondly, we are interested in the type of leadership that emerges spontaneously, and not as the result of any exogenous intervention.

The paper proceeds as follows. Section 2 presents the main findings from the relevant experimental literature. Section 3 introduces our experimental design, and Section 4 presents the experimental results. Section 5 provides a discussion of the results.

2 Related Literature

Van Huyck et al. (1990) conducted the seminal experimental study on the minimum-effort game. Later experiments of the same game mainly explored different ways to avoid coordination failure. In this discussion of the literature, we focus on experimental findings that are particularly relevant to our key research questions regarding between-subject heterogeneity and leadership.[4]

(i) First-period behavior. Players typically fail to coordinate in the initial period, and minimum effort level tends to be in middle of the range of all possible effort levels (Van Huyck et al., 1990; Goeree and Holt, 2005; Engelmann and Normann, 2010). Van Huyck et al. (1990) elicit subjects' beliefs before the initial period of the game, observing dispersed beliefs, with some subjects being optimistic and others pessimistic in their predictions. They see this as inconsistent with any theory of equilibrium selection, where all players' initial beliefs must be the same, since initial beliefs can only depend on the parameters of the game, which are obviously the same for all players.

(ii) Factors affecting coordination failure. Due to the multiplicity of equilibria,

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[4] The surveys by Camerer (2003) and Devetag and Ortmann (2007) as well as Engelmann and Normann (2010) provide detailed overviews of the literature.

even rational decision makers are uncertain over which equilibrium strategy other agents will use, and they may conclude that it is too risky to choose the payoff dominant action. Coordination failure results from this strategic uncertainty (Van Huyck et al., 1990) and has been shown to increase with the number of players (Knez and Camerer, 1994; Goeree and Holt, 2005), with the relative cost of effort[5] (Goeree and Holt, 2005; Brandts and Cooper, 2006a), and with the cost of local exploration (Berninghaus and Ehrhart, 1998).[6] One design feature that has been shown to *improve* coordination is the amount of information agents receive about the behavior of others.[7]

(iii) Response to payoff changes. Brandts and Cooper (2006a) and Hamman et al. (2007) change payoff parameters during the game and find that people respond quickly and permanently to payoff changes under full information.[8] Initially, coordination is very costly due to a low bonus rate b, and convergence to the lowest effort level is observed. In Brandts and Cooper (2006a), after an increase in the bonus rate, high effort levels are achieved and sustained even when incentives are removed. By contrast, in Hamman et al. (2007), where the bonus is increased only if the minimum effort exceeds a threshold, high effort levels are obtained only as long as incentives last. Brandts and Cooper (2006b) find that when information about others' choices is limited to the group minimum effort, higher effort levels cannot be sustained, even in periods with a high bonus rate.

(iv) Heterogeneity. Engelmann and Normann (2010) conduct experiments in Denmark and find that coordination on high effort levels is possible even if there are many players and high effort levels are very risky. They found that the probability of achieving coordination on high effort levels in a game increases with the proportion of players in the

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[5] In a typical minimum-effort game, player i's payoff function is $\pi_i = a + b\min\{e_1, \ldots, e_I\} - ce_i$. Parameters b and c are referred to as "bonus rate" and "cost of effort" respectively. In our experiment, we set $b = 1$ and vary c. In this brief survey of the literature, we are referring to the ratio c/b as "relative cost of effort". Hence when we refer to a decrease in the relative cost of effort, it might be due either to a decrease in c or to an increase in b.

[6] The authors vary the cost of exploration by increasing the number of periods and simultaneously decreasing the payoffs per period.

[7] Experiments by Van Huyck et al. (1990) and Berninghaus and Ehrhart (2001) compare the partial information and the full information condition of the minimum-effort game and find significantly higher average effort levels in the latter setting. However, as outlined below, Engelmann and Normann (2010) find no significant differences between the two information conditions and suggest that socio-economic factors might outweigh the impact of information.

[8] That is, a payoff change induces a structural break and subjects converge towards a new effort level within 1-5 periods.

group who are Danish - Danes appear to act as if they have more optimistic beliefs than subjects of other nationalities. This is attributed to the homogeneity of the Danish population, and the high levels of trust in Danish institutions and society.

(v) Learning and Leadership. Several learning models have been used to successfully explain the findings on strategic uncertainty, for example the belief-based models in Crawford (1995) and Broseta (2000), as well as Goeree and Holt (2005). Attempts to explain quick reactions to payoff changes have, however, been less successful. Brandts and Cooper (2006a) use modified versions of the experience-weighted attraction (EWA) learning model (Camerer and Ho, 1999; Camerer et al., 2002) to explain their subjects' quick response to an increase of the bonus rate with a quick transition towards higher effort levels. In their data, they identify two subject types: leaders and laggards. The latter eventually become responsive followers. In their simulations, however, it is difficult to obtain such responsive followers. Brandts et al. (2016) introduce exogenous help by allowing high-ability agents to help their low-ability partners to move to better outcomes. Their structural model includes sophisticated learners who are forward-looking and unsophisticated learners that follow a simple Cournot-type learning rule. Only when they include overoptimism for sophisticated learners regarding their effect on others' beliefs can they track the data and reproduce the result that help is abandoned too soon.

This paper has many of the features covered above, such as varying cost and information conditions. The crucial way in which our paper differs from those surveyed above is our elicitation of beliefs at every stage, enabling us to identify leaders, and to explain leadership in terms of subjects' individual characteristics. Successful coordination can then be explained by the presence of leaders, and by design features such as cost and information.

3 Experimental Design

3.1 The game

In our experiment a group consists of four subjects playing a minimum effort game for 30 periods. Since the main focus of our study is on learning and behavior over time, we have subjects playing all 30 periods within the same group.[9] Each group member i chooses an effort level e_i from the set $\{110, 111, 112, ..., 170\}$.[10] Subject i's payoff function is $\pi_i = a + \min\{e_1, ..., e_4\} - ce_i$.[11]

3.2 Main Treatments

Cost. In order to study individual responses to payoff changes, we vary the cost factor of one's own effort level *within* subjects. In the high-cost condition we set $c = 0.5$, while in the low-cost condition $c = 0.1$. Each subject plays a blocks of 10 rounds under a given cost condition, then the cost changes (from low to high or vice versa) in the second and third block. To control for order effects, we distinguish between treatment HLH, where play starts in the high-cost condition, and treatment LHL, where play starts in the low-cost condition. Subjects were not informed about the cost sequence and the corresponding cost levels throughout the 30 rounds; they only knew the relevant cost for the current block of 10 rounds. With these treatments we can test whether we can replicate the previous results that subjects quickly learn to adjust when the cost structure is more favorable, and that coordination on a high-effort equilibrium can be maintained even if conditions become worse (see Brandts and Cooper, 2006a). Our collection of data on beliefs can then extend these results by providing insight into the role of beliefs for the observed effort choices and their heterogenity among subjects.

Information. Information is our treatment variable *across* subjects. In the *full info* treatment, agents are informed about the distribution of effort choices in the past period (without knowing the identity of the players), thus attempts of players to achieve a more efficient equilibrium are visible and may be followed. In the *partial info* treatment, agents only receive information about the minimum effort level in the previous period. This implies that an agent who has chosen the minimum effort level cannot know how many others have

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[9] A fixed matching protocol has the advantage of yielding more observations and the results will be cleaner to estimate. Furthermore, given our particular interest in learning within a given context and learning to predict others' choices, a fixed matching seems to be an adequate choice.

[10] This set of effort levels was also used in Goeree and Holt (2005), who also considered the effect of different cost levels on chosen effort.

[11] To help subjects understand payoffs, we provide - in addition to the payoff function - an extensive table showing the respective payoffs for each level of effort subjects would like to try out before they make a decision.

also chosen the minimum and how many have chosen higher levels. For an agent who has chosen an effort above the minimum, it remains unknown how many of the others chose effort levels lower than his. Learning to coordinate on a higher effort level is then expected to be more difficult in this treatment.

Our treatment variations largely follow Brandts and Cooper (2006a,b), using different cost sequences and information conditions. This allows for a replication of their results, adding new insight by our extension regarding the role of beliefs on agents' decision making. However, we use a much larger set of strategies for two reasons: First, following the arguments of Goeree and Holt (2005), most real-world effort decisions have a continuous nature, while most coordination experiments involve only a small number of possible effort choices. Second, given our focus on heterogeneity in adjustments of beliefs and choices, a larger set of admissible effort levels allows us to detect also smaller changes in the adjustment of behavior over time.

3.3 Belief elicitation

The formation of beliefs regarding the minimum effort of the other group members is a decisive part of the decision process leading to successful coordination or its failure. An important feature of our experiment is thus systematic belief elicitation.[12] We ask subjects in each period what they expect the minimum effort level chosen by any of the other group members to be.[13] In Nash equilibrium, one's own choice should match this belief.

There is some debate in the experimental literature about the available techniques to elicit beliefs in an incentive compatible manner.[14] We adopt the commonly used quadratic scoring rule for elicitation of beliefs in our experiment. While it is a proper rule, i.e. it gives a risk neutral decision maker the incentive to report truthfully, risk-averse decision makers

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[12] While we do not know of any minimum-effort experiments in which beliefs are systematically elicited in each round, there are some in which subjects' beliefs are elicited in some periods, e.g. Chaudhuri et al. (2009) ask for beliefs before the first and last of 10 rounds of play; Van Huyck et al. (1990) occasionally ask for beliefs.

[13] In a survey on various laboratory techniques on belief elicitation and their effects on behavior, Schotter and Trevino (2014) conclude that belief elicitation is meaningful and not too intrusive; that is, beliefs are indeed consistent with observed behavior in the experiment, and subjects' behavior is not altered in a significant way by asking them about their beliefs.

[14] Note that the consideration whether to elicit beliefs before or after subjects' decision becomes irrelevant in our design due to the repeated scenario.

may have an incentive to underreport beliefs. We argue in Appendix A (6.1) that we do not find systematic underreporting in our experiment. Following this rule, a subject in our experiment is paid $100 - (\min\{e_{-i}^{realized}\} - \min\{e_{-i}^{predicted}\})^2$, where e_{-i} denotes the effort of all other group members.[15] In order to avoid a hedging problem when both beliefs and game outcomes are paid out, we randomly select some rounds for which belief reports are actually paid out, while in the remaining rounds the actual outcome of the minimum effort game in those rounds was paid out. Note that subjects do not obtain any information from the belief elicitation, since they do not receive any additional feedback regarding the accuracy of their beliefs. The rounds in which belief reports are paid out are determined only at the end of the experiment.

3.4 Post-Experimental Questionnaire

Allowing for heterogeneity in the updating rules for beliefs and choices suggests that it may be useful to gather some information about subjects' personal traits in order to obtain insight regarding the factors that determine the use of different updating rules.

Cognitive Test. To elicit cognitive abilities, we use the cognitive reflection test (CRT) by Frederick (2005). Subjects have to answer to three questions that are incentivized and added to the overall earnings in the experiment. Note that the CRT is not only a test on cognitive ability, but also about reflection (as opposed to intuition), which should be kept in mind when using the result of this test as a proxy for cognitive skills.[16] Our hypothesis would be that a higher cognitive ability may be correlated with higher degree of sophistication in learning. Note that only subjects who had not previously been exposed to the cognitive reflection test at the Innsbruck EconLab were invited to participate in our experiment.

Risk Preference Elicitation. Since risk is an inherent part of the minimum effort game, we use two simple questions to elicit preferences between a sure gain (loss) of 100

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[15] Charness et al. (2021) argue that the quadratic scoring rule is complex, and it is not trivial for subjects to understand why this method works. We use a simplified version of this method. Instead of presenting long payoff tables we explain in the instructions that the farther away a guess is from group minimum, the smaller earnings from guessing are; in the worst case, earnings are zero, and in the best case they are 100 points. We also provide some numerical examples for subjects to understand the application of the quadratic scoring rule, which just requires a point belief.

[16] As shown by Frederick (2005), this test yields very good results when the goal is to separate subjects into cognitive groups, as its predictive validity is at least as good as that of other, more extensive and more involved cognitive tests.

and a lottery offering a 75% chance of winning (losing) 200 and a 25% chance of receiving 0. We can thus identify two main classes of subjects: one with strongly risk averse subjects, and one that contains those with low degrees of risk aversion as well as those who are risk neutral and risk loving. If risk aversion is an important for behavior in the minimum effort game, one would expect to see differences in the behavior of strongly risk averse subjects compared to those who are less risk averse, even though we use only a coarse measure for risk preference.

Trust Questions. We ask questions concerning a subject's general trust in other people, trust toward either a known or unknown person as well as trust in various institutions. These questions closely follow the World Value Survey formulations.

The post-experimental questionnaire and the experimental instructions can be found in Appendix B.

3.5 Experimental procedure

The experimental sessions were conducted at the Innsbruck EconLab using the software z-Tree (Fischbacher, 2007) and ORSEE (Greiner, 2015) for recruitment of subjects. A total of 248 undergraduate and graduate students from all majors participated, using random assignment to treatment groups. Sessions lasted for approximately 90 minutes and included some control questions to ensure subjects' understanding of the game. Average earnings were 20.21 Euro per subject. Table 1 displays the treatments, the corresponding number of subjects participating, and the number of groups used as independent observations for non-parametrics tests below.

Cost Sequence	Information	# subjects	# groups
Low-**H**igh-**L**ow (LHL)	*full info*	64	16
High-**L**ow-**H**igh (HLH)	*full info*	60	15
Low-**H**igh-**L**ow (LHL)	*partial info*	64	16
High-**L**ow-**H**igh (HLH)	*partial info*	60	15
	total subjects	248	

Table 1. Experimental treatments and number of observations

4 Experimental Results

In the following, we report the main aggregate findings, then we focus on individual behavior and relate it to personal characteristics.

4.1 Aggregate behavior

Overall Effect of Cost and Information on Contribution. Our experimental design allows us to check whether we can replicate the existing results in the literature. For results regarding comparisons under given cost levels and information conditions we consider only observations in the first block (first 10 periods), and for results regarding a change in the payoff structure, we consider observations in all three blocks (30 periods). Figure 1 shows the observed path of the average minimum effort (left panel) and the proportion of full contributors (right panel) by treatment throughout all three blocks. In the first block, LHL-*full info* displays a steeply increasing path of average minimum effort. Comparing means of the minimum effort in the first five and last five periods (in the following, we refer to them as 'early' and 'late' periods of a block) of this first block shows a significant increase in the late periods (paired t-test: $p < 0.01$, Wilcoxon matched-pairs signed-rank test (WMSR): $p < 0.01$).[17] An increase in the minium throughout the first block is also observed in LHL-*partial info* (paired t-test and WMSR: $p < 0.10$). However, while the increase is over 12.0 points in LHL-*full info*, it is only 3.7 in LHL-*partial info*.

These results confirm (i) an increase in minimum effort over time in a low-cost schedule as observed in Goeree and Holt (2005), and (ii) the dampening effect of the partial information condition on the minimum effort under a given payoff structure, as found in Van Huyck et al. (1990) or Berninghaus and Ehrhart (2001). When play starts in the high-cost condition, we observe a constant minimum effort in HLH-*partial info*. In HLH-*full info*, we find a moderate increase during the first block (starting from a lower initial level than under low cost), while Goeree and Holt (2005) report a decreasing path (starting from the same initial level as in the low-cost condition). Note, however, that we have fixed groups throughout all periods, while they re-match groups, which may be a reason for the difference in the trend under

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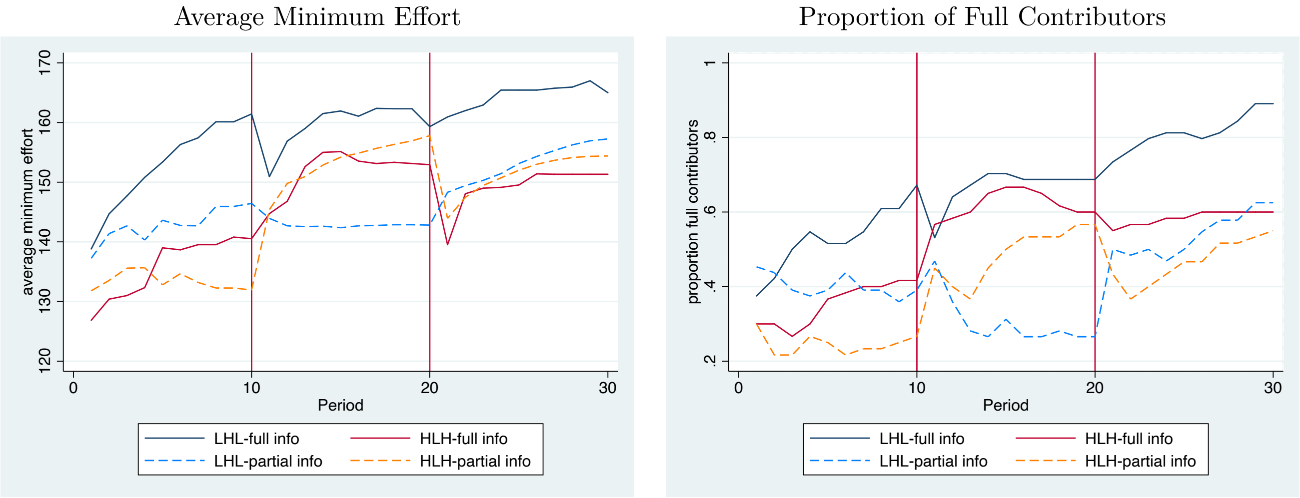
[17] All tests in this subsection on aggregate behavior are two-tailed and use means over 15 or 16 groups in each treatment as independent observations.



Average Minimum Effort

Proportion of Full Contributors

Note: Graphs display means of minimum effort and full contributors in each treatment

Figure 1. Minimum effort and full contributions

the high-cost condition. Furthermore, as can be seen in Figure 1, both treatments starting with the low-cost schedule have higher minimum efforts than those starting with high cost throughout the first block, but differences in means over treatments are significant only for *full info* treatments (t-test and Wilcoxon rank sum test (WRS) $p < 0.05$ for LHL-*full info* vs HLH-*full info*).

Now we focus on the adjustment after a change in the cost. Treatments LHL-*full info* and HLH-*full info* are directly comparable to the results of Brandts and Cooper (2006a,b). After the first cost change in period 11, we observe a dip in LHL-*full info*, but minimum effort recovers quickly, maintaining the high level of coordination achieved in the low cost block (see Figure 1, left panel). For groups starting in the high-cost condition, the favorable cost change in the second block has a significant positive impact on the minimum: The mean group minimum in late periods of block 1 is 139.8, compared to 150.9 in early periods of block 2 for HLH-*full info* (t-test: $p < 0.05$, WMSR: $p < 0.01$), and similarly, it increases from 132.9 to 150.6 for HLH-*partial info* after the cost decrease (t-test: $p < 0.01$; WMSR: $p < 0.01$). Even when incentives are removed again in the third block, the effect of the once achieved coordination under low-cost condition is regained after a quick adjustment (late periods of block 2 vs block 3 for HLH-*full info*: 153.1 vs. 151.2, t-test: $p = 0.11$; WMSR $p = 0.25$; for HLH-*partial info*: 156.3 vs 153.9, t-test: $p = 0.43$, WMSR $p = 0.77$).

These observations show that we can replicate the main effects of payoff changes by Brandts and Cooper (2006a,b) with our much larger set of possible effort choices, thus adding to the robustness of the results on how to "engineer coordination". With linear incentives that allow for stepwise adjustment, the positive effect is observed not only while incentives are present, but has a lasting effect (after a quick adjustment), when higher cooperation levels have been obtained before.[18]

The aggregate results only allow for an overall impression of behavior. Looking at group level, most groups are found to converge to maximum effort towards the end of the experiment (see Figure 4 in the appendix). In treatments starting with low cost, we have more groups that converge to the maximum, and they converge faster under full information compared to partial information. When play starts in the high cost schedule, full information fosters only the speed of convergence, but the number of groups reaching the maximum is similar between the two information regimes.

Regarding the proportion of full contributors, the right panel of Figure 1 illustrates the impact of information when the cost schedule changes. While in LHL-*full info* the proportion of full contributors quickly recovers after the change towards the high cost, a quick recovery is not observed in the *partial info* treatment; the proportion of full contributors decreases from 34% to 27% (t-test: $p < 0.05$, WMSR: $p < 0.01$) from early to late periods throughout the high-cost block in LHL-*partial info*. This is in accordance with the idea of convergence to a Nash equilibrium: Since a player's effort choice should be equal to what he believes the minimum of all other players' efforts will be, and players have more information about others' past choices in the *full info* treatment, it is easier to have the entire group move upwards with efforts here, as beliefs are more likely to increase when most group members visibly contribute more than the minimum. Finally, regarding the impact of experience and lasting effects of incentives, we consider the high-cost block after both cost regimes have already been experienced (i.e. third block in HLH). Here, the rate of full contributors in late periods increases close to the levels recorded in the late periods of the second block (in both treatments we observe a difference of 0.03, which is not significant according to both t-test and WMSR). We conclude that experience must play an important role for the

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[18] This lasting effect is not observed in Hamman et al. (2007), who use all-or-none incentives.

adjustments of groups under different cost conditions, and a closer look into the relation between subjects' beliefs and contribution choices will provide further insight into these adjustments.

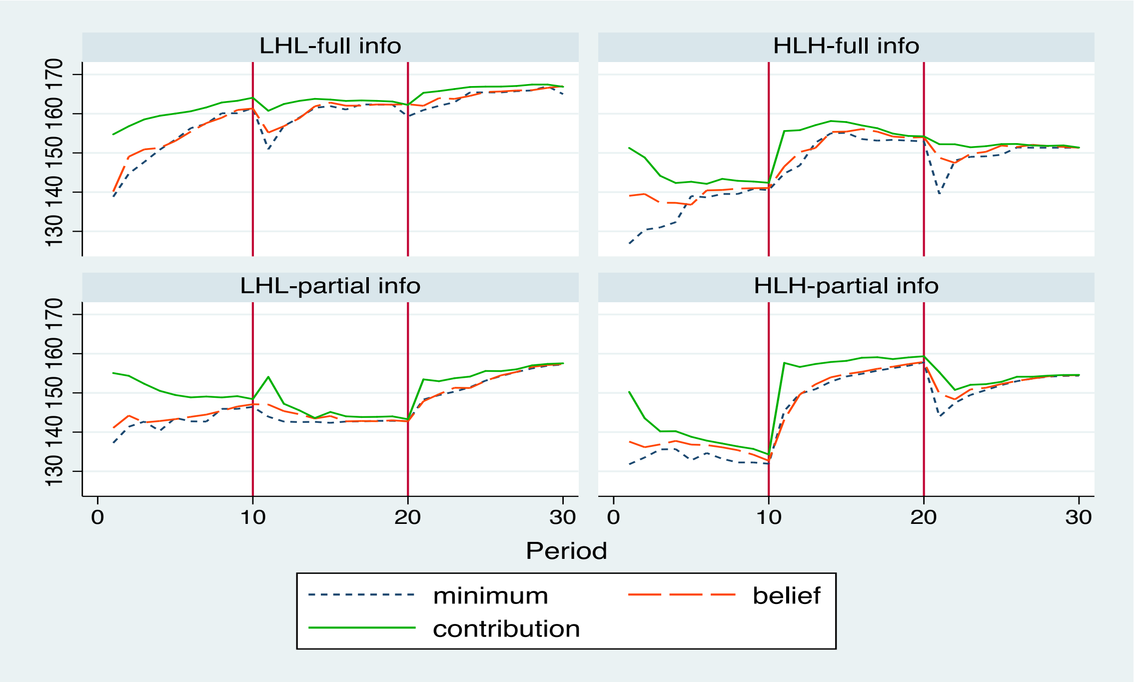

Figure 2. Average minimum effort, contribution and belief by treatment

Relation between Beliefs and Choices. Note that in one-shot games the optimal contribution of a utility-maximizing agent has to match her belief. Figure 2 displays means of minimum efforts, contributions and stated beliefs over time by treatment. Our first observation is that contributions exceed beliefs considerably, in particular in the beginning of each block, while they seem to converge towards the end of each block. This is confirmed by Table 2, where group means of *excess contributions*, i.e. the differences between contributions and beliefs, *diff(cont*$_t$*-belief*$_t$*)*, are shown to be significantly higher in early periods compared to late periods of a given block. Pooling all data further shows that the mean difference between contributions and beliefs is positive in each single period: a t-test rejects the hypothesis that the average difference is 0 in 28 periods out 30 (25 periods at 1% level, 3 periods at 5% level); for WMSR the difference is significant at 1% level in 29 periods, and the only period that fails significance is the last one. Repeating these tests by treatments we find significant differences in most of the periods. Figure 4 in the appendix shows that contributions exceed beliefs also on group level. Only towards the end of the 30 periods groups that have not converged seem to give up their attempts to bring the group towards higher effort levels, and contributions then equal beliefs.

Our second observation from Figure 2 is that, on average, beliefs largely correspond to the achieved minimum effort in each period. In the HLH-treatments, some periods of adjustment are needed initially, leading to similar correspondence as in LHL. This evidence suggests that beliefs may be quite accurate.[19] Table 2 supports this impresssion, reporting belief accuracy as the difference between a subject's belief and the minimum contribution of all others in his group, $diff(belief_t\text{-}minothers_t)$. On the aggregate level, belief accuracy is high (i.e. small differences between the group means of beliefs and realized minimum effort of the other players) in all treatments, and few differences are observed over early and late periods, indicating a fast convergence towards correct beliefs.

Table 2. Excess contributions and belief accuracy

		full information				**partial information**			
		Excess contrib.		**Belief accuracy**		**Excess contrib.**		**Belief accuracy**	
Block	Period	LHL	HLH	LHL	HLH	LHL	HLH	LHL	HLH
1	1-5	9.03^{***}	7.86^{***}	−0.08	3.20	9.57^{**}	5.57^{***}	−0.43	1.75
		(4.35)	(5.63)	(3.43)	(4.79)	(4.73)	(3.47)	(5.00)	(4.12)
	6-10	3.63	1.90	−0.85	0.71	3.39	1.22	0.08	1.78
		(3.94)	(2.99)	(1.40)	(1.58)	(4.38)	(1.70)	(1.08)	(3.74)
2	11-15	3.67^{***}	5.13^{***}	0.10	−0.18	2.22^{***}	6.79^{***}	1.45	−0.93
		(4.04)	(5.33)	(2.09)	(2.60)	(2.83)	(6.41)	(5.20)	(3.56)
	16-20	0.82	0.64	0.51	1.15	0.99	2.33	−0.05	0.15
		(2.13)	(1.17)	(1.82)	(3.46)	(1.98)	(4.69)	(0.86)	(0.75)
3	21-25	2.25^{***}	2.33^{**}	−0.02	1.55	3.36^{***}	2.10^{***}	−0.22	1.16^{**}
		(3.40)	(2.50)	(1.08)	(3.56)	(4.50)	(1.73)	(2.47)	(1.74)
	26-30	0.91	0.21	0.20	0.27	0.52	0.37	0.09	0.05
		(2.43)	(0.63)	(1.46)	(1.13)	(0.90)	(0.54)	(0.31)	(0.22)

Note: Aggregate level data. Means of early and late periods within blocks (Standard deviation in parenthesis). Sign test (two tails) of differences between means of early and late periods within the same block. Significance at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ levels.

The observations of excess contributions and high accuracy of beliefs indicate that individuals may purposefully choose contributions above their beliefs. To pursue this conjecture, we look into how contributions and beliefs are adjusted or updated from previous obser-

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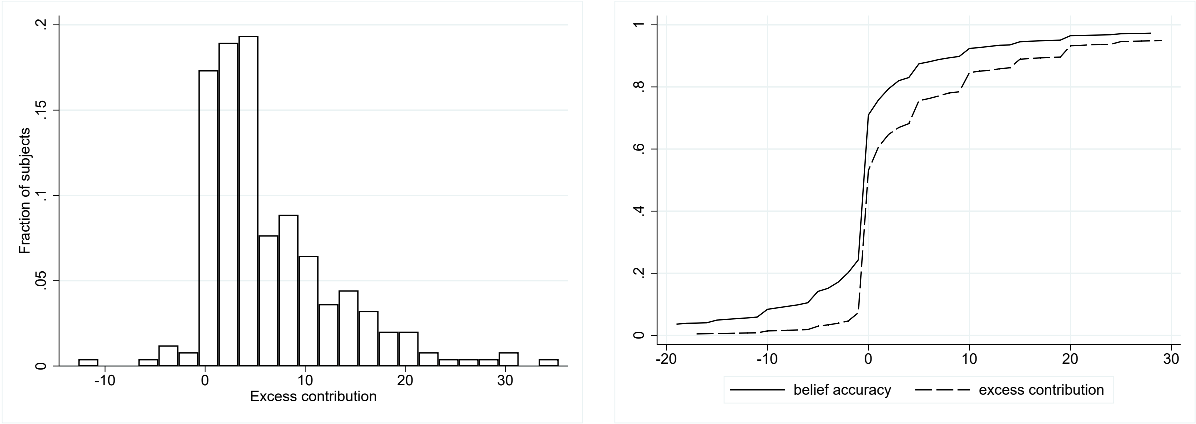
[19] Note that $belief_t$ denotes the expected minimum of an individual for the other group members' contributions in t, while $\min_t$ is the group minimum incuding one's own contribution. To measure belief accuracy, we thus use the difference between a subject's belief and the actual minimum of all others in that period. This is not observable for subjects in *partial info*-treatments.

vations. Using the difference between contributions in round t and the observed minimum in round $t-1$ as a coarse measure for the adjustment of contributions, and an analogous measure for beliefs, we find larger standard deviations for the adjustment of contributions compared to that of beliefs (see Table 7 in the Appendix). The larger dispersion indicates that there is more heterogeneity among subjects in the adjustment of contributions than in that of beliefs, and thus contributions and beliefs must be formed according to different rules. Together with the observed accuracy of beliefs from Table 2, the adjustment of beliefs from the previous period's minimum indicates that subjects overall correctly anticipated the current minimum by an appropriate adjustment of their beliefs from the past minimum. Therefore, they do not play myopically, but they seem to anticipate an upwards change in the minimum, expecting higher contributions of other group members. This only works if others indeed raise their contributions. If this is the case, then the excess contributions of some 'leaders' may serve as a teaching device to have everyone in the group raise their contributions. Given the observed heterogeneity in contributions, a closer look at individual behavior will give further insight into which individuals are more likely to act as leaders.

4.2 Individual behavior

To support our hypothesis that subjects' excess contributions are intended as a teaching device, we first show that on an individual level, the deviation of contributions from beliefs are not just due to subjects' errors. The left graph in Figure 3 shows a right-skewed distribution of mean differences (over all periods) between an individual's contributions and beliefs. This is evidence against the interpretation of the deviations as errors, and further illustrates individual heterogeneity in excess contributions. The right graph shows the cumulative distributions of all individual observations for belief accuracy and for excess contributions in any given period. While the differences between belief and minimum of other are small, excess contributions are large also on the individual level. These two graphs together confirm the conclusions obtained from aggregate behavior: most subjects' expectations regarding turn out to be accurate, but excess contributions are systematic and purposeful from individuals' point of view. Moreover, individuals differ in the extent to which they make such excess contribution choices.

Individual Traits: To investigate the hypothesis whether individual traits are factors that can explain the above observed individual heterogeneity in contributions, we use the three individual traits elicited in the post-experimental questionnaire. The first one is subjects' cognitive ability, elicited by the CRT, and summarized by the variable *cognitive* taking value 1 for subjects who correctly responded at least to two questions, and 0 otherwise.[20] The second trait is *trust*, a binary variable taking value 1 if the subject declares to trust an unknown person.[21] The third trait is risk attitude, represented by the binary variable *riskaverse* taking value 1 for subjects choosing the sure amount in the risk elicitation question in the gain domain (see Section 3.4).[22]



Note: Individual level data. Histogram (left graph) shows heterogeneity of excess contributions; cumulative distribution (right graph) shows systematic deviation from (accurate) beliefs.

Figure 3. Excess contributions and accurate beliefs

Regarding the impact of these three characteristics on a subject's performance in the game, we find that subjects with a higher cognitive level and those with low risk aversion earned significantly more (WMSR: $p < 0.01$ and $p < 0.01$, respectively). Trust has no significant effect on earnings in the game ($p = 0.85$).

Individual traits may also play a role for *initial* beliefs and choices, i.e. with which attitude one starts this game. Comparing subjects with different levels of cognitive skills,

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[20] We had 19% of all subjects who gave no correct answer, 23% with 1 correct answer, 29% with 2 and 29% with all 3 correct answers.

[21] While over 95% of our subjects answered that they trusted a known person, the answers to how much they trusted an unknown person was more useful for our analysis, as here only 38% said they did.

[22] The decisions from the choices in the loss domain had less explanatory power for our variables such as initial contributions and beliefs.

we find that this distinction does not affect initial beliefs in three of the four treatments (see Figure 5 in the Appendix). By contrast, initial contributions are larger (WRS: $p < 0.05$ each) for subjects with higher cognitive skills in all treatments except HLH-*partial info*. Trust has a positive effect on initial beliefs only under LHL-*full info*, WRS: $p < 0.1$) and HLH-*partial info*, WRS: $p < 0.01$); no effect is observed on initial contributions. Risk aversion finally plays no major role in explaining inital beliefs and contributions.

Regarding the effect of individual traits on subjects' overall choices, Table 3 (right column for pooled data) shows that overall, excess contributions are significantly larger for subjects with higher cognitive skills (WMSR: $p < 0.01$) and for those who have trust (WMSR: $p < 0.05$) .[23] We do no find any significant effect of risk aversion (WMSR: $p = 0.57$). Looking into separate treatments, we see that the result for trusting subjects is driven by the *partial info*-LHL treatment (WMSR: $p < 0.05$), while the result for cognitive skills is driven by both *full info*-treatments (WMSR: $p < 0.01$). This is quite intuitive, as trust is a personal feeling that does not need information, while, on the other side, a rational (i.e. cognitive) reasoning needs more detailed information, as is the case in *full info*.

Table 3. Effect of individual traits on excess contributions by treatment

		Excess contributions						
		full information			**partial information**			**Overall**
		LHL	**HLH**	**Total**	**LHL**	**HLH**	**Total**	
Trust	0	6.63	4.10	5.39	3.17^{**}	3.69	3.43^{**}	4.28^{**}
	1	8.21	7.23	7.59	7.14	5.13	6.21	6.75
Cognitive	0	4.84^{**}	3.44^{**}	4.05^{***}	4.00	3.57	3.81	3.90^{***}
	1	8.25	6.45	7.33	5.12	4.63	4.87	6.00
Risk averse	0	6.50	5.66	6.12	5.81	4.14	4.88	5.45
	1	9.96	4.41	5.82	3.10	4.17	3.49	4.28

Note: Wilcoxon matched-pairs signed-ranks test on differences between rows for a given trait. Significance at $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$ levels.

Determinants of excess contributions. Table 4 presents the results of a panel regression (separate by cost sequence) for the important determinants of excess contribution.[24]

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[23] We calculated group means over all periods, using only groups where trait values differ across members.

[24] Note that the number of observations in Table 4 is below the overall possible number due to our definition of $laggard_{t-1}$: it captures minimum contributor(s) in a group as long as the minimum is below 170. We have several groups who coordinate on the maximum of 170 before period 30, and these observations are not included here due to the missing laggard.

We use the following explanatory variables:

- *excess contrib*$_{t-1}$: difference between own contribution and group minimum in $t-1$,
- *distance to max*: difference between maximum possible contribution of 170 and realized group minimum in $t-1$,
- *laggard*$_{t-1}$: dummy variable taking value 1 if the subject's contribution was equal to the minimum in the previous period,
- *trend*: difference between the minimum observed in $t-1$ and in $t-2$
- In addition, we use variables to control for the exogenous factors of our experimental design (different cost and information conditions): dummies for the periods of a cost change (*first cost change* and *second cost change*), for all periods with the same cost (*block 2* and *block 3*) and for the treatments under full information (*full info*). We also control for learning by including the variable *period*, and for the interaction between variables *full info* and *excess contrib*$_{t-1}$.
- Finally, we use a set of variables representing the exogenous factors that are not under our control, which may affect the difference between beliefs and choices: the variables *cognitive*, *trust* and *riskaverse* (as defined in the previous section). In particular, we use one dummy for each specific combination of these three variables using the (0, 0, 0), i.e. *cognitive*=0, *trust*=0 and *riskaverse*=0, as baseline.

Table 4 shows that the previous period's excess contribution has a significant impact on the choice of excess contributions in the current period, i.e. the behavior of subjects who chose contributions above their beliefs is persistent, and this behavior is reinforced in treatment *LHL-full info*. Full information alone does not explain excess contributions. We also find significant effects regarding *distance to max* and *laggard*$_{t-1}$ in both treatments, and *trend* in LHL. The effect of *laggard*$_{t-1}$ indicates that subjects who were laggards in the previous period try to avoid being a laggard again in the current period by choosing a larger excess contribution.

The immediate impact of a new cost schedule shows that excess contributions increase not only when cost decreases (first cost change in HLH), but also when cost increases (first cost change in LHL). This is consistent with the idea that teaching others to raise their

Table 4. Factors Affecting Excess Contributions

	Excess contrib in LHL		**Excess contrib in HLH**	
Excess contrib$_{t-1}$	0.337^{***}	(0.035)	0.379^{***}	(0.131)
Distance to max	0.028^{**}	(0.011)	0.034^{***}	(0.011)
Laggard$_{t-1}$	0.888^{**}	(0.403)	1.746^{***}	(0.581)
Trend	0.137^{***}	(0.046)	0.048	(0.039)
full info	−0.410	(0.736)	−0.432	(0.665)
full info × excess contrib$_{t-1}$	0.206^{**}	(0.095)	0.015	(0.130)
First cost change	5.798^{***}	(1.243)	12.229^{***}	(2.587)
Second cost change	4.818^{***}	(1.523)	6.314^{***}	(1.392)
Block2	−0.746	(0.906)	2.895^{**}	(1.275)
Block3	1.752	(1.740)	1.668	(2.486)
Period	-0.170^{*}	(0.090)	−0.091	(0.134)
Cognitive*Trust*Riskaverse				
(0 0 1)	−0.435	(1.024)	1.704	(1.216)
(0 1 0)	0.336	(1.553)	3.321^{***}	(1.101)
(0 1 1)	0.356	(0.760)	1.340	(1.647)
(1 0 0)	0.579	(0.592)	1.491^{*}	(0.862)
(1 0 1)	0.105	(0.828)	1.201	(0.984)
(1 1 0)	3.129^{***}	(1.086)	3.541^{***}	(1.109)
(1 1 1)	−0.431	(0.630)	1.539	(1.004)
_cons	1.874^{*}	(1.048)	-2.891^{*}	(1.728)
Marginal effects				
Cognitive	0.890^{**}	(0.445)	0.631	(0.566)
Trust	1.338^{**}	(0.575)	1.708^{*}	(0.903)
Riskaverse	−0.899	(0.707)	−0.199	(0.715)
N	2,056		2,108	

Note: Random-effects Tobit Model, Standard Errors in Parentheses. Significance at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ levels.

contributions is attempted initially when a new block starts, but may then be discontinued, as can be seen for during a high cost block (negative coefficient for *block2* in LHL), while it is more easily maintained during a low cost block (positive coefficient for *block2* in HLH).

Cognitive skills and trust have a positive effect on excess contributions, in particular trust has a significant marginal effect under both cost sequences. Risk aversion has no major effect on excess contributions.[25]

Causal effect of stated beliefs on contributions. The observed differences between beliefs and contributions reject the idea that subjects are behaving as payoff-maximizers

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[25] One may object that this is due to our rather coarse measure for risk attitude. However, given that we count only subjects with a relatively strong risk aversion to this class, we would argue that if an effect of risk aversion on choices were present, it should be visible with our measure of risk aversion. Recall that subjects are counted as risk averse if they prefer the sure payoff of 50 to an expected payoff of 75, thus subjects with a more moderate degree of risk aversion are not in this class.

of a one-shot minimum effort game. To understand which role beliefs play in determining contributions, we need to consider that estimating the effect of beliefs on contributions might give rise to endogeneity problems, as highlighted by Smith (2013) and Costa-Gomes et al. (2014). Due to the systematic elicitation of beliefs in each period, beliefs and contributions are affecting each other, and this may revert the causality of these two variables of interest. Appendix A (6.3) describes the detailed procedure and results of an instrumental variables estimation. We show that higher lags of beliefs and contributions are good instruments for beliefs. Table 5 shows the results of an IV-Arrellano Bond regression, where contributions are estimated using these instruments for beliefs in both treatments LHL and HLH. Using instrumental variables we can thus identify the causal effect of beliefs on contributions.

Table 5. Causal Effect of Beliefs on Contributions

	Cont_t in LHL		Cont_t in HLH	
Belief_t	0.756***	(0.213)	0.724***	(0.135)
Cont_{t-1}	0.469	(0.243)	0.341**	(0.108)
Period	-0.190**	(0.068)	-0.096*	(0.039)
First cost change	1.620	(1.219)	9.156***	(2.560)
Second cost change	3.815***	(0.900)	0.483	(1.208)
N	3584		3360	
AR(1)	$p = 0.003$		$p = 0.000$	
AR(2)	$p = 0.372$		$p = 0.120$	
Hansen test (overid)	0.988		1.000	

Note: Arrellano-Bond dynamic panel data estimation; beliefs are instrumented by higher lags of beliefs and contributions. Standard errors in parentheses; significance at $^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$ levels.

5 Discussion

This paper has studied how people learn to adjust their choices in a coordination problem. Since each individual response to others' choices and to changes in the environment (such as the incentive structure) can be decisive for the overall outcome, it is important to understand which individual factors affect behavior so that more effective incentives or policies can be designed in order to get coordination on more efficient equilibria.

From the research on learning in coordination games, the idea of modeling the different behavior of leaders and laggards as in Brandts and Cooper (2006a) seems compelling. In a standard minimum-effort game, we can think of having leaders who may move the outcome upwards to a more efficient equilibrium, and laggards whose contribution lags behind. The question we ask is who is likely to emerge as leader, and how successful are attempts to lead under different conditions.

Existing data from past experiments mainly consists of observed choices, and thus beliefs and responses to beliefs cannot be disentangled. We systematically elicited subjects' beliefs and some individual traits in an experiment, and we studied their responses to changes in incentives. We found systematic discrepancies of subjects' contributions from their stated beliefs. Since beliefs are rather accurate, the systematic deviation of contributions from beliefs may serve as a teaching device. Our results indicate that leadership seems a likely explanation for the observed excess contributions. This is line with the results of Hyndman et al. (2009), where strategic teaching in a coordination game leads play to an efficient Nash equilibrium. Excess contributions work as a teaching device because subjects lagging behind with their contributions do adjust their beliefs and contributions upwards. The motivation for why someone becomes a leader would require further study, but regression results show that trust and cognitive skills positively affect excess contributions over time. When subjects do not receive detailed information about others' past choices, teaching is more difficult, in particular when subjects are not experienced with different cost conditions. Attempts at leadership may then go unnoticed by other players, and hence attempts are less likely to be followed through.

What we learn from our experiment is that people who are generally trustful in environments with unknown partners, and people who have high cognitive abilities, are more likely to act as leaders in a minimum effort context by contributing more than others. This does not result from more optimistic beliefs, but on the anticipated effect of leaders' higher contributions on raising others' beliefs. While an unfavorable cost condition can be overcome by learning, personal traits seem to be important for the advancement of a group, since leaders teach others the way how to converge towards a more efficient equilibrium.

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6 Appendix A

6.1 Quadratic Scoring Rule and Risk Aversion

We adopted the commonly used quadratic scoring rule for elicitation of beliefs in our experiment. While this rule provides incentives for risk neutral decision makers to reports truthfully, one may be concerned that risk-averse decision makers may have an incentive to underreport beliefs with this elicitation rule. We check for systematic underreporting of beliefs by risk-averse subjects by investigating whether different risk attitudes play a role in decisions and beliefs of our experiment.

Table 6 displays the results of a panel regression identifying the determinants of beliefs. We find no effect of risk aversion on beliefs. That is, the beliefs reported by subjects classified as risk averse are not significantly different from reported beliefs by subjects who are not risk averse. Now one could still object that risk averse subjects generally have higher beliefs than those who are not risk averse, and if they underreport beliefs, their reported beliefs might look similar to those reported by subjects who are not risk averse. But if this were the case, then the *choices* of risk averse subjects should go along with their true beliefs (rather than their (under)reported beliefs), and we would observe differences between excess contributions (i.e. the difference between contributions and reported beliefs) for risk averse and non-risk averse subjects. However, we so not find a significant effect of risk aversion on excess contributions, neither for initial differences between beliefs and choices (WRS: p = 0.93, t-test: p=0.89), nor for overall differences across periods, as shown in Table 3 of the main text (WMSR: p = 0.57). This result is also reflected in the panel regression of Table 4. Furthermore, belief accuracy was found to be high overall (see Table 2), which also speaks against a systematic underreporting of beliefs by risk averse subjects.

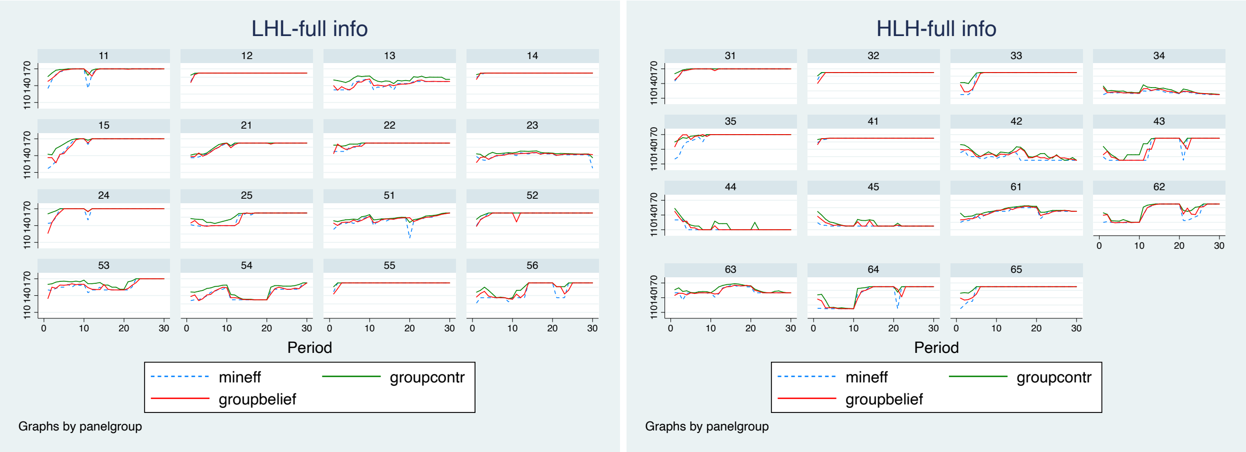
Table 6. Determinants of Beliefs in LHL and HLH

	Belief$_t$ in LHL		**Belief$_t$ in HLH**	
Min$_{t-1}$	0.843***	(0.027)	0.939***	(0.028)
Cont$_{t-1}$	0.216***	(0.025)	0.208***	(0.026)
Laggard$_{t-1}$	2.408***	(0.586)	1.891**	(0.643)
full info	5.545***	(1.046)	3.847*	(1.499)
First cost change	−5.088***	(1.271)	8.693***	(1.412)
Second cost change	4.035**	(1.297)	−12.45***	(1.687)
Block2	4.085***	(1.003)	7.825***	(1.226)
Block3	10.23***	(1.804)	15.35***	(2.149)
Period	−0.458***	(0.090)	−0.820***	(0.106)
Cognitive*Trust*Riskaverse				
(0 0 1)	2.447	(1.800)	0.245	(2.682)
(0 1 0)	2.505	(2.395)	3.382	(2.837)
(0 1 1)	4.018	(2.265)	3.822	(3.692)
(1 0 0)	1.132	(1.545)	−0.974	(2.301)
(1 0 1)	1.314	(2.159)	−1.197	(3.058)
(1 1 0)	5.249**	(1.779)	1.520	(2.460)
(1 1 1)	5.665*	(2.687)	3.069	(3.253)
Constant	−10.51**	(3.473)	−17.54***	(3.510)
N	2180		2224	
Log likelihood	-6287.85		-5908.24	
Marginal effects:				
Cognitive	0.959	(1.047)	−1.254	(1.503)
Trust	3.175**	(1.047)	3.192**	(1.516)
Riskaverse	1.137	(1.112)	0.375	(1.593)

Note: Random-effects Tobit Model, Standard Errors in Parentheses. Significance at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ levels.

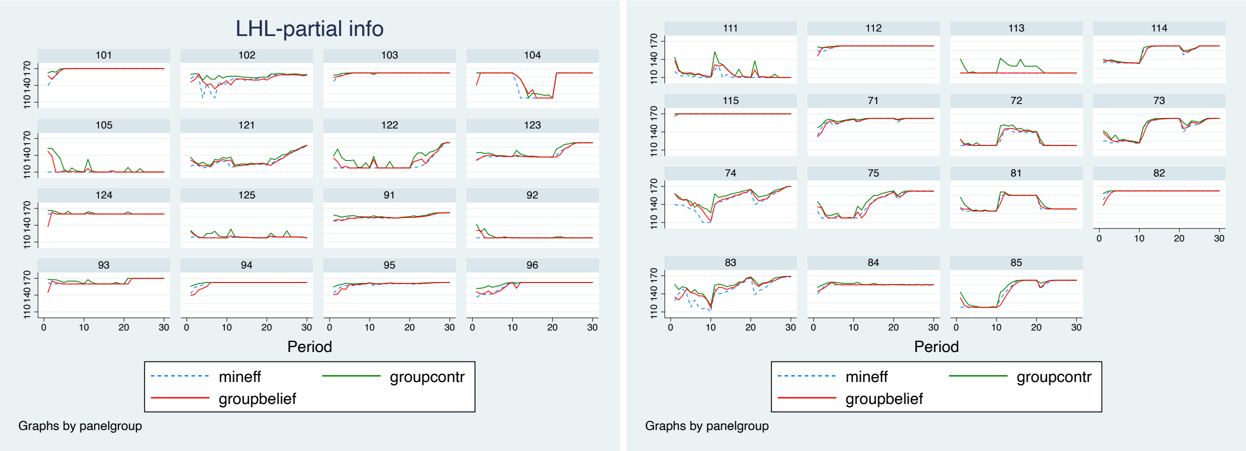
6.2 Additional Figures and Tables

6.2.1 Group Level Data



(a) LHL-full information

(b) HLH-full information



(c) LHL-partial information

(d) HLH-partial information

Figure 4. Average minimum effort, contribution and belief by group

Figure 4 displays minimum effort, average belief and average contribution at group level for each of the four treatments. We find that some groups are insensitive towards change in cost. Typically, these are groups that converge quickly either towards the maximum or the minimum contribution. Overall, contributions are higher than beliefs whenever a group has not converged. This shows that some members in those groups try to push up the minimum effort, since excess contributions are not observed just once, but for many subsequent periods.

It can be seen that many groups eventually converge, most of them to the maximum effort, and fewer to the minimum. Only few groups do not converge over the course of the 30 periods and remain on intermediate levels for the group minimum. For the latter we typically see an effect of the change in cost in the middle block. Contributions almost always exceed beliefs in periods before a group converges. In groups that do not converge to the maximum, especially with high cost, we see excess contributions for many periods, but towards the end of the three blocks, those who contribute more seem to give up their attempts to bring the group to higher effort levels, and contributions then equal beliefs. This shows us that we do not observe random errors of individuals here when contributions exceed beliefs, but rather that this is a systematic and intentional deviation.

6.2.2 Other Figures and Tables

Table 7. Adjustment of Contributions and Beliefs from Previous Period's Minimum

		full information				partial information			
		Diff(cont$_t$-min$_{t-1}$)		**Diff(belief$_t$-min$_{t-1}$)**		**Diff(cont$_t$-min$_{t-1}$)**		**Diff(belief$_t$-min$_{t-1}$)**	
Block	Period	LHL	HLH	LHL	HLH	LHL	HLH	LHL	HLH
1	1-5	13.21***	14.35***	5.57***	7.57***	11.27**	6.55*	2.80	2.75**
		(6.25)	(11.10)	(2.79)	(7.28)	(7.65)	(3.35)	(3.09)	(2.32)
	6-10	5.02	3.19	1.38	1.28	4.69	3.22	1.30	2.00**
		(4.91)	(3.64)	(1.66)	(2.22)	(6.49)	(4.82)	(2.50)	(3.52)
2	11-15	4.83***	8.96**	1.16	3.83	3.47***	11.35**	1.25	4.56
		(6.13)	(9.22)	(3.34)	(4.30)	(3.20)	(8.51)	(3.23)	(4.40)
	16-20	1.06	1.71	0.24	1.07	1.10	3.42	0.11	1.09
		(2.54)	(3.91)	(0.54)	(3.20)	(1.86)	(5.15)	(0.44)	(1.80)
3	21-25	4.10**	4.23**	1.84	1.90	5.53***	2.75	2.17	0.65
		(6.07)	(5.79)	(3.36)	(3.74)	(7.85)	(3.46)	(4.40)	(2.79)
	26-30	1.24	0.87	0.33	0.65	1.52	0.93	1.00	0.56
		(2.85)	(1.67)	(0.76)	(1.47)	(3.45)	(1.58)	(2.64)	(1.12)

Note: Standard Deviation in Parentheses. Sign test (two tails) of differences between early and late periods within the same block. Significance at *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ levels.

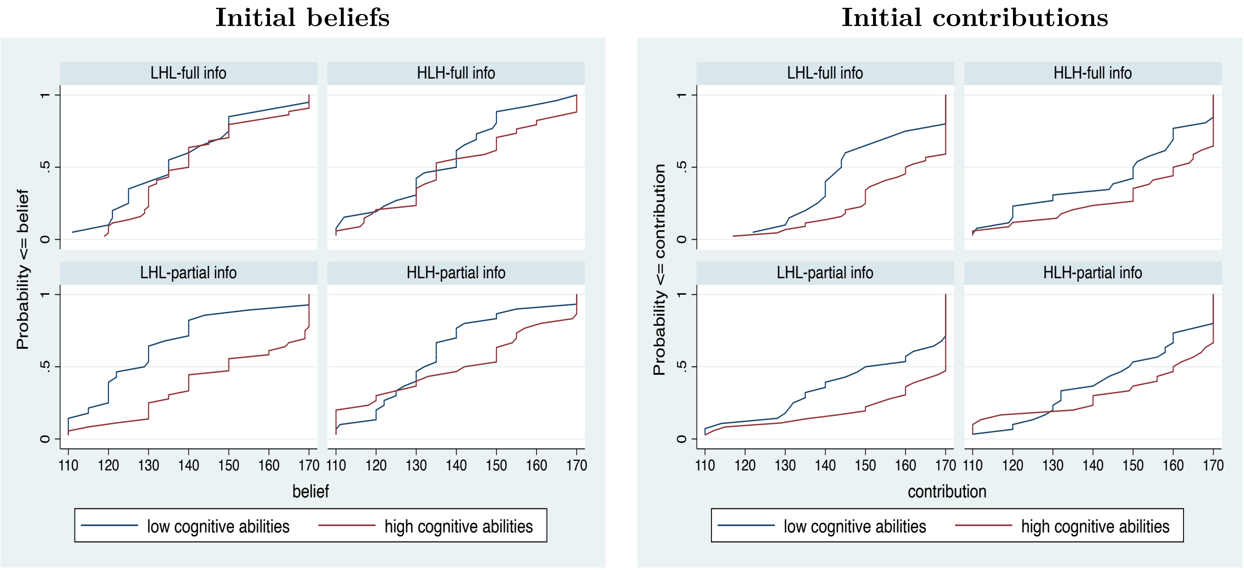


Figure 5. Effect of cognitive skills on initial beliefs and contributions

6.3 Causal Effects of Beliefs on Contributions

The observed differences in beliefs and contributions reject the main idea of Nash behavior in the minimum effort game, namely that contributions are equal to beliefs. The obvious question then is how beliefs are mapped into observed contributions.[26] The systematic elicitation of beliefs in each period may revert the causality of these two variables of interest, therefore, the causal effect needs to be investigated.

In our separate estimations of beliefs and contributions we have identified different determinants, in particular, an individual's contribution is dependent on its lagged variable. Since estimating auto-regressive models with fixed effects is inconsistent, Wooldridge (2010) suggests the Arellano-Bond method as an alternative to fixed effects estimation. Random-effects regression estimators are generally more efficient in large samples, and including lagged variables yieds consistent estimation for the noncensored case and if the remaining regressors are strictly exogenous (see Roodman, 2009). We clearly have censored data, and, as stated above, a concern is whether beliefs have a causal effect on contributions in our experiment. One may thus suspect that there is a possible endogeneity problem. The common solution to endogeneity problems is the use of instrumental variables. We follow the approaches by Smith (2013) and Costa-Gomes et al. (2014) in using instrumental variables to detemine the causal effect of beliefs on contributions. Since we have 30 periods of observations for the relevant variables, we have a longer panel of data available to use lagged variables as instruments for endogenous regressors.

Using the Arrellano-Bond method with instrumental variables for beliefs, we first check that beliefs are not auto-regressive of order 2 (see Table 8) and then proceed by using beliefs and minimum efforts with lag 2 or more as regressors for beliefs. Table 9 shows that belief_{t-2}, belief_{t-3} and min_{t-2} are good instruments for beliefs. Finally, we can estimate contributions using these instruments for beliefs. Table 5 in the main text then shows the causal effect of beliefs in both treatments LHL and HLH.[27] As the Arellano-Bond framework does not offer

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[26] Given that we elicit subjects' beliefs before they make the contribution decision, one may conjecture that this could increase cogitation and thus lead subjects to more conscious decisions. Systematic belief elicitation may thus lead to different decisions. In the literature, a general conclusion about possible effects, direction and magnitude cannot be drawn from the various experimental studies on public goods games, trust and coordination games that systematically elicit beliefs (see Schlag et al., 2015). However, since beliefs are elicited in every round, this does not confound behavior within treatments.

[27] We apply Stata's *xtabond2* command using two-step difference the general method of moments, and

Table 8. Arellano-Bond panel data estimation: Beliefs are AR(1)

	Belief$_t$ in LHL		Belief$_t$ in HLH	
Belief$_{t-1}$	0.613***	(0.079)	0.699***	(0.187)
Belief$_{t-2}$	0.135*	(0.055)	0.128	(0.077)
Period	0.112*	(0.047)	0.111	(0.148)
First cost change	−2.984***	(0.598)	5.898***	(1.732)
Second cost change	0.909**	(0.332)	−6.303***	(1.272)
Constant	37.590*	(17.140)	24.300	(33.700)
N	3456		3240	
Test for zero autocorrelation in first-differenced errors:				
Order 1	$p < 0.001$		$p < 0.001$	
Order 2	$p = 0.390$		$p = 0.531$	

Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 9. Instrumental Variables for Beliefs

	Belief$_t$ in LHL		Belief$_t$ in HLH	
Belief$_{t-2}$	0.147***	(0.028)	0.116***	(0.032)
Belief$_{t-3}$	−0.031	(0.022)	−0.066*	(0.027)
Min$_{t-2}$	0.515***	(0.031)	0.786***	(0.037)
Min$_{t-3}$	0.036	(0.033)	−0.067	(0.042)
Period	0.237***	(0.028)	0.106**	(0.033)
First cost change	−0.877	(0.972)	6.673***	(1.136)
Second cost change	1.348	(1.001)	−6.085***	(1.372)
Constant	45.49***	(3.477)	32.59***	(2.499)
N	1936		1996	

Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

the possibility to test for the endogeneity of beliefs using post-estimation diagnostic tests, Table 10 provides the results of an IV-regression with OLS where the same instruments are used for *belief*. The Hausman test shows that the null hypothesis of exogeneity of *belief* can be rejected, and the Hansen J-statistic shows the validity of our instrumental variables. Using instrumental variables we can thus identify the causal effect of beliefs on contribution in treatments LHL and HLH.

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standard errors are clustered by group. We also ran the regressions excluding groups which have already converged on the maximum level. The results are similar, the coefficient of beliefs is slighly larger, so the estimation of the effect of beliefs displayed in Table 5 can be considered conservative.

Table 10. Causal Effect of Beliefs using IV regression with OLS (Random-effects)

	Cont_t in LHL		Cont_t in HLH	
Belief_t	0.445***	(0.057)	0.403***	(0.072)
Cont_{t-1}	0.562***	(0.057)	0.598***	(0.071)
Period	-0.025	(0.019)	0.019	(0.012)
First cost change	2.780*	(1.283)	15.86***	(2.561)
Second cost change	4.195***	(1.136)	-1.005	(1.512)
N	3456		3240	
Hansen J-statistic	$p = 0.327$		$p = 0.542$	
Hausman test for endogeneity	$p = 0.009$		$p < 0.001$	

Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix B: Instructions

(Translated from German)

- Text in Italics Was Not Part of the Instructions -

General information

Thank you for participating in our experiment. Please read these instructions carefully. If you have any questions, please raise your hand, and an experimenter will come to answer your questions.

You can earn a considerable amount of money in this experiment. At this point, you have already earned 4 Euros for showing up on time to the experiment. How much money you will earn in total will depend on your own decision and the decisions of other participants in this experiment. During the experiment you are assigned a participation code, your decisions remain anonymous. You will be paid out your earnings by means of the participation code after completion of the experiment.

The experiment

The experiment consists of 30 periods. At the beginning, you will be assigned to groups of four people. The groups will remain unchanged during the 30 periods, i.e. you remain within the same group of four participants in the course of the entire experiment.

The rules for periods 1-10:

In each period, each participant must choose a number between 110 and 170. Only integers are allowed (decimals or fractions are not permitted). In each period, the smallest number that has been chosen by a member of your group will be determined. Your **profit** for this period is this smallest number that has been chosen in your group minus your cost. Your cost amounts to 0.1 times the number that you have chosen yourself in this period.

profit = smallest number in group - 0.1 × your chosen number

Example 1:
You choose the number 135. The other three group members choose 168, 122, and 145. The smallest number chosen in your group is thus 122. Your profit for this period thus amounts to 122 – 0.1*135 = 108.5 points.

Example 2:
You choose the number 150. The other three group members choose 168, 162, and 159. The smallest number chosen in your group is thus 150. Your profit for this period thus amount to 150 – 0.1*150 = 135 points.

The profit is calculated in the same way for all group members. You can try out what profit you would obtain with different combinations of numbers by using the on-screen calculator. You can also use the attached table, which lists your profit for all possible combinations of your number and the smallest number that may be chosen in your group (including yourself). In this table there are also combinations without an entry for profit. This means that this combination of your number and the smallest number within your group is not possible. For example, if you choose the number 120, then the smallest number within your group cannot be larger than 120. This is why in this case there is no entry in the table for all numbers from 121 to 170.

Asking about your expectation:
At the beginning of each period you will also be asked what, according to your expectation, will be the smallest number chosen by any other member of your group. This determines the earnings from guessing for the current period. The earnings from guessing are calculated as follows:

earnings from guessing =
100 - (your guess – actual smallest number of other group members)^2

In case this turns out to be a negative number, your earnings from guessing are set to zero. The farther away your guess is from the smallest number that has actually been chosen by another member of your group, the smaller are your earnings from guessing. In the worst case it is zero points, in the best case it is 100 points.

Example 3:
Suppose you enter the number 130 as your guess for the smallest number of the other group members. Suppose further that the three other members of your group actually chose 168, 122 and 145 (as in Example 1 above). Your earnings from guessing for this period would then be $100 – (130 – 122)^2 = 100 - 8^2 = 100 - 64 = 36$ points.

Example 4:
Suppose you enter the number 130 as a guess for the smallest number of the other group members. Suppose further that the three other members of your group actually chose 168, 158 and 170. Your earnings from guessing for this period would then be $100 – (130 – 158)^2 = 100 – (-28)^2 = 100 – 784 = - 684$. Since this number is negative, your earnings from guessing are set to zero points.

Information *(Text in Full-Information Treatment)*
At the end of each period you will be informed about all numbers chosen by the other members of your group. You will, however, not be informed who chose which number. This information remains anonymous. You will also be informed about your earnings in points and your earnings from guessing in the current period.

Paying out your earnings:
For each period you will be paid out either your profit from choosing a number in the group or your earnings from guessing. At the end of the experiment 6 periods will be selected, for which your earnings from guessing are paid out. For the remaining 24 periods, your profit from choosing a number is paid out. For each point you earned in the experiment you will receive 0.5 cents, i.e.

200 points correspond to 1 Euro

You will receive information about your total earnings at the end of the experiment on your screen.

The rules for periods 11-20 will be explained after period 10. The rules for periods 21-20 will be explained after period 20.

At the end of the experiment you will see some questions for which you are asked to give your opinion or evaluation.

The rules for periods 11-20

The only change in the current rules regard your cost:
In periods 11-20 your cost amounts to 0.5 times the number that you have chosen.

Earnings in points = smallest number in group - 0.5 × your chosen number

Example 1:
You choose the number 135. The other three group members choose 168, 122, and 145. The smallest number chosen in your group is thus 122. Your earnings in points for this period thus amount to 122 – 0.5*135 = 54.5.

Example 2:
You choose the number 150. The other three group members choose 168, 162, and 159. The smallest number chosen in your group is thus 150. Your earnings in points for this period thus amount to 150 – 0.5*150 = 75.

You can try out what earnings you would obtain with different combinations of numbers by using the on-screen calculator. You can also use the attached table, which lists your earnings in points for all possible combinations of your number and the smallest number that may be chosen in your group (including yourself).

The rules for periods 21-30

The only change in the current rules regard your cost:
In periods 21-30 your cost amounts to 0.1 times the number that you have chosen.

Earnings in points = smallest number in group - 0.1 × your chosen number

The rules for periods 21-30 are thus identical to those of periods 1-10. You can take a look at the examples from the corresponding previous description.

You can try out what earnings you would obtain with different combinations of numbers by using the on-screen calculator. You can also use the attached table, which lists your earnings in points for all possible combinations of your number and the smallest number that may be chosen in your group (including yourself).

Note:

- *The instructions above are for the treatment LHL-fullinfo. For HLH-fullinfo, the description of the cost sequence was changed correspondingly.*
- *For the No-Info treatments, the text marked in green above was substituted by the following:*

  Information

  At the end of each period you will be informed about the overall smallest number chosen in your group. You will, however, not be informed who chose this number. You will also be informed about your earnings in points and your earnings from guessing in the current period.

Post-experimental questionnaire

Now you will see some questions. For some questions you can win or lose points, which are added to your total earnings from this experiment. For other questions we just ask for your opinion. At the end, you will see a list of all points earned in this experiment.

(Questions regarding cognitive abilities)
1. A pot and a cover cost 110 Euro in total. The pot costs 100 Euro more than the cover. How much does the cover cost?

For the correct answer you receive 100 points.

2. If it takes 10 workers 10 minutes to make 10 plastic bottles, how long would it take 100 workers to make 100 plastic bottles?

For the correct answer you receive 100 points.

3. A biologist finds out that the area of a test tube covered by bacteria doubles in size every hour. If it takes 24 hours for the bacteria to cover the entire area of the test tube, how long would it take to cover half of the test tube?

For the correct answer you receive 100 points.

(Questions regarding risk attitude)
4. You have to choose between two alternatives.
Alternative A: You receive 100 points.
Alternative B: With a probability of 75% you receive 200 points and with probability of 25% zero points.

At the end of the experiment this lottery is played. That is, the computer displays a random number between 1 and 100 for each participant. If this number is smaller or equal to 75, you will earn 200 points in case you chose Alternative B in this question. If the random number is larger than 75, you will earn 0 points in case you chose Alternative B. If you chose Alternative A, you will earn 100 points, independent of which random number has been drawn for you.

Which alternative do you choose? Please click on the corresponding alternative.

5. You have to choose again between two alternatives.
Alternative A: You lose 100 points from the points earned in the experiment.
Alternative B: With a probability of 75% you lose 200 points and with a probability of 25% you do not lose any points.

At the end of the experiment this lottery is played. That is, the computer displays a random number between 1 and 100 for each participant. If this number is smaller or equal to 75, you will lose 200 points from those you earned in the experiment in case you chose

Alternative B in this question. If the random number is larger than 75, you will lose 0 points in case you chose Alternative B. If you chose Alternative A, you will lose 100 points, independent of which random number has been drawn for you.

Which alternative do you choose? Please click on the corresponding alternative.

(Questions regarding trust)
6. Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?

Possible answers:
1 Most people can be trusted
2 You can never be too careful when dealing with others

7. We are interested in how much you trust various groups of people. Do you trust them completely, somewhat, not very much or not at all?

a) People you know

b) People you meet for the first time

Possible answers:
1 completely
2 somewhat
3 not very much
4 not at all

8. We are going to name a number of organizations. For each one, could you tell us how much confidence you have in them: is it a great deal of confidence, quite a lot of confidence, not very much confidence or none at all?

The churches
The media
Labor unions
The police
The courts
The government
Political parties
Parliament
Universities
Major companies
Banks
NGOs
European Union

Possible answers:
1 a great deal of confidence
2 quite a lot of confidence
3 not very much confidence
4 none at all

Your possible profit with cost factor 0.1

your chosen number

smallest number in your group	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130
110	99,0	98,9	98,8	98,7	98,6	98,5	98,4	98,3	98,2	98,1	98,0	97,9	97,8	97,7	97,6	97,5	97,4	97,3	97,2	97,1	97,0
111		99,9	99,8	99,7	99,6	99,5	99,4	99,3	99,2	99,1	99,0	98,9	98,8	98,7	98,6	98,5	98,4	98,3	98,2	98,1	98,0
112			100,8	100,7	100,6	100,5	100,4	100,3	100,2	100,1	100,0	99,9	99,8	99,7	99,6	99,5	99,4	99,3	99,2	99,1	99,0
113				101,7	101,6	101,5	101,4	101,3	101,2	101,1	101,0	100,9	100,8	100,7	100,6	100,5	100,4	100,3	100,2	100,1	100,0
114					102,6	102,5	102,4	102,3	102,2	102,1	102,0	101,9	101,8	101,7	101,6	101,5	101,4	101,3	101,2	101,1	101,0
115						103,5	103,4	103,3	103,2	103,1	103,0	102,9	102,8	102,7	102,6	102,5	102,4	102,3	102,2	102,1	102,0
116							104,4	104,3	104,2	104,1	104,0	103,9	103,8	103,7	103,6	103,5	103,4	103,3	103,2	103,1	103,0
117								105,3	105,2	105,1	105,0	104,9	104,8	104,7	104,6	104,5	104,4	104,3	104,2	104,1	104,0
118									106,2	106,1	106,0	105,9	105,8	105,7	105,6	105,5	105,4	105,3	105,2	105,1	105,0
119										107,1	107,0	106,9	106,8	106,7	106,6	106,5	106,4	106,3	106,2	106,1	106,0
120											108,0	107,9	107,8	107,7	107,6	107,5	107,4	107,3	107,2	107,1	107,0
121												108,9	108,8	108,7	108,6	108,5	108,4	108,3	108,2	108,1	108,0
122													109,8	109,7	109,6	109,5	109,4	109,3	109,2	109,1	109,0
123														110,7	110,6	110,5	110,4	110,3	110,2	110,1	110,0
124															111,6	111,5	111,4	111,3	111,2	111,1	111,0
125																112,5	112,4	112,3	112,2	112,1	112,0
126																	113,4	113,3	113,2	113,1	113,0
127																		114,3	114,2	114,1	114,0
128																			115,2	115,1	115,0
129																				116,1	116,0
130																					117,0
131																					
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169																					
170																					

Your possible profit with cost factor 0.1

	your chosen number																				
smallest number in your group	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151
110	96,9	96,8	96,7	96,6	96,5	96,4	96,3	96,2	96,1	96,0	95,9	95,8	95,7	95,6	95,5	95,4	95,3	95,2	95,1	95,0	94,9
111	97,9	97,8	97,7	97,6	97,5	97,4	97,3	97,2	97,1	97,0	96,9	96,8	96,7	96,6	96,5	96,4	96,3	96,2	96,1	96,0	95,9
112	98,9	98,8	98,7	98,6	98,5	98,4	98,3	98,2	98,1	98,0	97,9	97,8	97,7	97,6	97,5	97,4	97,3	97,2	97,1	97,0	96,9
113	99,9	99,8	99,7	99,6	99,5	99,4	99,3	99,2	99,1	99,0	98,9	98,8	98,7	98,6	98,5	98,4	98,3	98,2	98,1	98,0	97,9
114	100,9	100,8	100,7	100,6	100,5	100,4	100,3	100,2	100,1	100,0	99,9	99,8	99,7	99,6	99,5	99,4	99,3	99,2	99,1	99,0	98,9
115	101,9	101,8	101,7	101,6	101,5	101,4	101,3	101,2	101,1	101,0	100,9	100,8	100,7	100,6	100,5	100,4	100,3	100,2	100,1	100,0	99,9
116	102,9	102,8	102,7	102,6	102,5	102,4	102,3	102,2	102,1	102,0	101,9	101,8	101,7	101,6	101,5	101,4	101,3	101,2	101,1	101,0	100,9
117	103,9	103,8	103,7	103,6	103,5	103,4	103,3	103,2	103,1	103,0	102,9	102,8	102,7	102,6	102,5	102,4	102,3	102,2	102,1	102,0	101,9
118	104,9	104,8	104,7	104,6	104,5	104,4	104,3	104,2	104,1	104,0	103,9	103,8	103,7	103,6	103,5	103,4	103,3	103,2	103,1	103,0	102,9
119	105,9	105,8	105,7	105,6	105,5	105,4	105,3	105,2	105,1	105,0	104,9	104,8	104,7	104,6	104,5	104,4	104,3	104,2	104,1	104,0	103,9
120	106,9	106,8	106,7	106,6	106,5	106,4	106,3	106,2	106,1	106,0	105,9	105,8	105,7	105,6	105,5	105,4	105,3	105,2	105,1	105,0	104,9
121	107,9	107,8	107,7	107,6	107,5	107,4	107,3	107,2	107,1	107,0	106,9	106,8	106,7	106,6	106,5	106,4	106,3	106,2	106,1	106,0	105,9
122	108,9	108,8	108,7	108,6	108,5	108,4	108,3	108,2	108,1	108,0	107,9	107,8	107,7	107,6	107,5	107,4	107,3	107,2	107,1	107,0	106,9
123	109,9	109,8	109,7	109,6	109,5	109,4	109,3	109,2	109,1	109,0	108,9	108,8	108,7	108,6	108,5	108,4	108,3	108,2	108,1	108,0	107,9
124	110,9	110,8	110,7	110,6	110,5	110,4	110,3	110,2	110,1	110,0	109,9	109,8	109,7	109,6	109,5	109,4	109,3	109,2	109,1	109,0	108,9
125	111,9	111,8	111,7	111,6	111,5	111,4	111,3	111,2	111,1	111,0	110,9	110,8	110,7	110,6	110,5	110,4	110,3	110,2	110,1	110,0	109,9
126	112,9	112,8	112,7	112,6	112,5	112,4	112,3	112,2	112,1	112,0	111,9	111,8	111,7	111,6	111,5	111,4	111,3	111,2	111,1	111,0	110,9
127	113,9	113,8	113,7	113,6	113,5	113,4	113,3	113,2	113,1	113,0	112,9	112,8	112,7	112,6	112,5	112,4	112,3	112,2	112,1	112,0	111,9
128	114,9	114,8	114,7	114,6	114,5	114,4	114,3	114,2	114,1	114,0	113,9	113,8	113,7	113,6	113,5	113,4	113,3	113,2	113,1	113,0	112,9
129	115,9	115,8	115,7	115,6	115,5	115,4	115,3	115,2	115,1	115,0	114,9	114,8	114,7	114,6	114,5	114,4	114,3	114,2	114,1	114,0	113,9
130	116,9	116,8	116,7	116,6	116,5	116,4	116,3	116,2	116,1	116,0	115,9	115,8	115,7	115,6	115,5	115,4	115,3	115,2	115,1	115,0	114,9
131	117,9	117,8	117,7	117,6	117,5	117,4	117,3	117,2	117,1	117,0	116,9	116,8	116,7	116,6	116,5	116,4	116,3	116,2	116,1	116,0	115,9
132		118,8	118,7	118,6	118,5	118,4	118,3	118,2	118,1	118,0	117,9	117,8	117,7	117,6	117,5	117,4	117,3	117,2	117,1	117,0	116,9
133			119,7	119,6	119,5	119,4	119,3	119,2	119,1	119,0	118,9	118,8	118,7	118,6	118,5	118,4	118,3	118,2	118,1	118,0	117,9
134				120,6	120,5	120,4	120,3	120,2	120,1	120,0	119,9	119,8	119,7	119,6	119,5	119,4	119,3	119,2	119,1	119,0	118,9
135					121,5	121,4	121,3	121,2	121,1	121,0	120,9	120,8	120,7	120,6	120,5	120,4	120,3	120,2	120,1	120,0	119,9
136						122,4	122,3	122,2	122,1	122,0	121,9	121,8	121,7	121,6	121,5	121,4	121,3	121,2	121,1	121,0	120,9
137							123,3	123,2	123,1	123,0	122,9	122,8	122,7	122,6	122,5	122,4	122,3	122,2	122,1	122,0	121,9
138								124,2	124,1	124,0	123,9	123,8	123,7	123,6	123,5	123,4	123,3	123,2	123,1	123,0	122,9
139									125,1	125,0	124,9	124,8	124,7	124,6	124,5	124,4	124,3	124,2	124,1	124,0	123,9
140										126,0	125,9	125,8	125,7	125,6	125,5	125,4	125,3	125,2	125,1	125,0	124,9
141											126,9	126,8	126,7	126,6	126,5	126,4	126,3	126,2	126,1	126,0	125,9
142												127,8	127,7	127,6	127,5	127,4	127,3	127,2	127,1	127,0	126,9
143													128,7	128,6	128,5	128,4	128,3	128,2	128,1	128,0	127,9
144														129,6	129,5	129,4	129,3	129,2	129,1	129,0	128,9
145															130,5	130,4	130,3	130,2	130,1	130,0	129,9
146																131,4	131,3	131,2	131,1	131,0	130,9
147																	132,3	132,2	132,1	132,0	131,9
148																		133,2	133,1	133,0	132,9
149																			134,1	134,0	133,9
150																				135,0	134,9
151																					135,9
152																					
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170																					

Your possible profit with cost factor 0.1

your chosen number

smallest number in your group

	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170
110	94,8	94,7	94,6	94,5	94,4	94,3	94,2	94,1	94,0	93,9	93,8	93,7	93,6	93,5	93,4	93,3	93,2	93,1	93,0
111	95,8	95,7	95,6	95,5	95,4	95,3	95,2	95,1	95,0	94,9	94,8	94,7	94,6	94,5	94,4	94,3	94,2	94,1	94,0
112	96,8	96,7	96,6	96,5	96,4	96,3	96,2	96,1	96,0	95,9	95,8	95,7	95,6	95,5	95,4	95,3	95,2	95,1	95,0
113	97,8	97,7	97,6	97,5	97,4	97,3	97,2	97,1	97,0	96,9	96,8	96,7	96,6	96,5	96,4	96,3	96,2	96,1	96,0
114	98,8	98,7	98,6	98,5	98,4	98,3	98,2	98,1	98,0	97,9	97,8	97,7	97,6	97,5	97,4	97,3	97,2	97,1	97,0
115	99,8	99,7	99,6	99,5	99,4	99,3	99,2	99,1	99,0	98,9	98,8	98,7	98,6	98,5	98,4	98,3	98,2	98,1	98,0
116	100,8	100,7	100,6	100,5	100,4	100,3	100,2	100,1	100,0	99,9	99,8	99,7	99,6	99,5	99,4	99,3	99,2	99,1	99,0
117	101,8	101,7	101,6	101,5	101,4	101,3	101,2	101,1	101,0	100,9	100,8	100,7	100,6	100,5	100,4	100,3	100,2	100,1	100,0
118	102,8	102,7	102,6	102,5	102,4	102,3	102,2	102,1	102,0	101,9	101,8	101,7	101,6	101,5	101,4	101,3	101,2	101,1	101,0
119	103,8	103,7	103,6	103,5	103,4	103,3	103,2	103,1	103,0	102,9	102,8	102,7	102,6	102,5	102,4	102,3	102,2	102,1	102,0
120	104,8	104,7	104,6	104,5	104,4	104,3	104,2	104,1	104,0	103,9	103,8	103,7	103,6	103,5	103,4	103,3	103,2	103,1	103,0
121	105,8	105,7	105,6	105,5	105,4	105,3	105,2	105,1	105,0	104,9	104,8	104,7	104,6	104,5	104,4	104,3	104,2	104,1	104,0
122	106,8	106,7	106,6	106,5	106,4	106,3	106,2	106,1	106,0	105,9	105,8	105,7	105,6	105,5	105,4	105,3	105,2	105,1	105,0
123	107,8	107,7	107,6	107,5	107,4	107,3	107,2	107,1	107,0	106,9	106,8	106,7	106,6	106,5	106,4	106,3	106,2	106,1	106,0
124	108,8	108,7	108,6	108,5	108,4	108,3	108,2	108,1	108,0	107,9	107,8	107,7	107,6	107,5	107,4	107,3	107,2	107,1	107,0
125	109,8	109,7	109,6	109,5	109,4	109,3	109,2	109,1	109,0	108,9	108,8	108,7	108,6	108,5	108,4	108,3	108,2	108,1	108,0
126	110,8	110,7	110,6	110,5	110,4	110,3	110,2	110,1	110,0	109,9	109,8	109,7	109,6	109,5	109,4	109,3	109,2	109,1	109,0
127	111,8	111,7	111,6	111,5	111,4	111,3	111,2	111,1	111,0	110,9	110,8	110,7	110,6	110,5	110,4	110,3	110,2	110,1	110,0
128	112,8	112,7	112,6	112,5	112,4	112,3	112,2	112,1	112,0	111,9	111,8	111,7	111,6	111,5	111,4	111,3	111,2	111,1	111,0
129	113,8	113,7	113,6	113,5	113,4	113,3	113,2	113,1	113,0	112,9	112,8	112,7	112,6	112,5	112,4	112,3	112,2	112,1	112,0
130	114,8	114,7	114,6	114,5	114,4	114,3	114,2	114,1	114,0	113,9	113,8	113,7	113,6	113,5	113,4	113,3	113,2	113,1	113,0
131	115,8	115,7	115,6	115,5	115,4	115,3	115,2	115,1	115,0	114,9	114,8	114,7	114,6	114,5	114,4	114,3	114,2	114,1	114,0
132	116,8	116,7	116,6	116,5	116,4	116,3	116,2	116,1	116,0	115,9	115,8	115,7	115,6	115,5	115,4	115,3	115,2	115,1	115,0
133	117,8	117,7	117,6	117,5	117,4	117,3	117,2	117,1	117,0	116,9	116,8	116,7	116,6	116,5	116,4	116,3	116,2	116,1	116,0
134	118,8	118,7	118,6	118,5	118,4	118,3	118,2	118,1	118,0	117,9	117,8	117,7	117,6	117,5	117,4	117,3	117,2	117,1	117,0
135	119,8	119,7	119,6	119,5	119,4	119,3	119,2	119,1	119,0	118,9	118,8	118,7	118,6	118,5	118,4	118,3	118,2	118,1	118,0
136	120,8	120,7	120,6	120,5	120,4	120,3	120,2	120,1	120,0	119,9	119,8	119,7	119,6	119,5	119,4	119,3	119,2	119,1	119,0
137	121,8	121,7	121,6	121,5	121,4	121,3	121,2	121,1	121,0	120,9	120,8	120,7	120,6	120,5	120,4	120,3	120,2	120,1	120,0
138	122,8	122,7	122,6	122,5	122,4	122,3	122,2	122,1	122,0	121,9	121,8	121,7	121,6	121,5	121,4	121,3	121,2	121,1	121,0
139	123,8	123,7	123,6	123,5	123,4	123,3	123,2	123,1	123,0	122,9	122,8	122,7	122,6	122,5	122,4	122,3	122,2	122,1	122,0
140	124,8	124,7	124,6	124,5	124,4	124,3	124,2	124,1	124,0	123,9	123,8	123,7	123,6	123,5	123,4	123,3	123,2	123,1	123,0
141	125,8	125,7	125,6	125,5	125,4	125,3	125,2	125,1	125,0	124,9	124,8	124,7	124,6	124,5	124,4	124,3	124,2	124,1	124,0
142	126,8	126,7	126,6	126,5	126,4	126,3	126,2	126,1	126,0	125,9	125,8	125,7	125,6	125,5	125,4	125,3	125,2	125,1	125,0
143	127,8	127,7	127,6	127,5	127,4	127,3	127,2	127,1	127,0	126,9	126,8	126,7	126,6	126,5	126,4	126,3	126,2	126,1	126,0
144	128,8	128,7	128,6	128,5	128,4	128,3	128,2	128,1	128,0	127,9	127,8	127,7	127,6	127,5	127,4	127,3	127,2	127,1	127,0
145	129,8	129,7	129,6	129,5	129,4	129,3	129,2	129,1	129,0	128,9	128,8	128,7	128,6	128,5	128,4	128,3	128,2	128,1	128,0
146	130,8	130,7	130,6	130,5	130,4	130,3	130,2	130,1	130,0	129,9	129,8	129,7	129,6	129,5	129,4	129,3	129,2	129,1	129,0
147	131,8	131,7	131,6	131,5	131,4	131,3	131,2	131,1	131,0	130,9	130,8	130,7	130,6	130,5	130,4	130,3	130,2	130,1	130,0
148	132,8	132,7	132,6	132,5	132,4	132,3	132,2	132,1	132,0	131,9	131,8	131,7	131,6	131,5	131,4	131,3	131,2	131,1	131,0
149	133,8	133,7	133,6	133,5	133,4	133,3	133,2	133,1	133,0	132,9	132,8	132,7	132,6	132,5	132,4	132,3	132,2	132,1	132,0
150	134,8	134,7	134,6	134,5	134,4	134,3	134,2	134,1	134,0	133,9	133,8	133,7	133,6	133,5	133,4	133,3	133,2	133,1	133,0
151	135,8	135,7	135,6	135,5	135,4	135,3	135,2	135,1	135,0	134,9	134,8	134,7	134,6	134,5	134,4	134,3	134,2	134,1	134,0
152	136,8	136,7	136,6	136,5	136,4	136,3	136,2	136,1	136,0	135,9	135,8	135,7	135,6	135,5	135,4	135,3	135,2	135,1	135,0
153		137,7	137,6	137,5	137,4	137,3	137,2	137,1	137,0	136,9	136,8	136,7	136,6	136,5	136,4	136,3	136,2	136,1	136,0
154			138,6	138,5	138,4	138,3	138,2	138,1	138,0	137,9	137,8	137,7	137,6	137,5	137,4	137,3	137,2	137,1	137,0
155				139,5	139,4	139,3	139,2	139,1	139,0	138,9	138,8	138,7	138,6	138,5	138,4	138,3	138,2	138,1	138,0
156					140,4	140,3	140,2	140,1	140,0	139,9	139,8	139,7	139,6	139,5	139,4	139,3	139,2	139,1	139,0
157						141,3	141,2	141,1	141,0	140,9	140,8	140,7	140,6	140,5	140,4	140,3	140,2	140,1	140,0
158							142,2	142,1	142,0	141,9	141,8	141,7	141,6	141,5	141,4	141,3	141,2	141,1	141,0
159								143,1	143,0	142,9	142,8	142,7	142,6	142,5	142,4	142,3	142,2	142,1	142,0
160									144,0	143,9	143,8	143,7	143,6	143,5	143,4	143,3	143,2	143,1	143,0
161										144,9	144,8	144,7	144,6	144,5	144,4	144,3	144,2	144,1	144,0
162											145,8	145,7	145,6	145,5	145,4	145,3	145,2	145,1	145,0
163												146,7	146,6	146,5	146,4	146,3	146,2	146,1	146,0
164													147,6	147,5	147,4	147,3	147,2	147,1	147,0
165														148,5	148,4	148,3	148,2	148,1	148,0
166															149,4	149,3	149,2	149,1	149,0
167																150,3	150,2	150,1	150,0
168																	151,2	151,1	151,0
169																		152,1	152,0
170																			153,0

Your possible profit with cost factor 0.5

your chosen number

smallest number in your group

	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132
110	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0
111		55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0
112			56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0
113				56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0
114					57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0
115						57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0
116							58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0
117								58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0
118									59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0
119										59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0
120											60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0
121												60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0
122													61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0
123														61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0
124															62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0
125																62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0
126																	63,0	62,5	62,0	61,5	61,0	60,5	60,0
127																		63,5	63,0	62,5	62,0	61,5	61,0
128																			64,0	63,5	63,0	62,5	62,0
129																				64,5	64,0	63,5	63,0
130																					65,0	64,5	64,0
131																						65,5	65,0
132																							66,0
133																							
134																							
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170																							

Your possible profit with cost factor 0.5

	your chosen number																						
smallest number in your group	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155
110	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5	39,0	38,5	38,0	37,5	37,0	36,5	36,0	35,5	35,0	34,5	34,0	33,5	33,0	32,5
111	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5	39,0	38,5	38,0	37,5	37,0	36,5	36,0	35,5	35,0	34,5	34,0	33,5
112	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5	39,0	38,5	38,0	37,5	37,0	36,5	36,0	35,5	35,0	34,5
113	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5	39,0	38,5	38,0	37,5	37,0	36,5	36,0	35,5
114	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5	39,0	38,5	38,0	37,5	37,0	36,5
115	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5	39,0	38,5	38,0	37,5
116	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5	39,0	38,5
117	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5
118	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5
119	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5
120	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5
121	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5
122	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5
123	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5
124	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5
125	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5
126	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5
127	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5
128	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5
129	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5
130	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5
131	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5
132	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5
133	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5
134		67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5
135			67,5	67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5
136				68,0	67,5	67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5
137					68,5	68,0	67,5	67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5
138						69,0	68,5	68,0	67,5	67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5
139							69,5	69,0	68,5	68,0	67,5	67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5
140								70,0	69,5	69,0	68,5	68,0	67,5	67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5
141									70,5	70,0	69,5	69,0	68,5	68,0	67,5	67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5
142										71,0	70,5	70,0	69,5	69,0	68,5	68,0	67,5	67,0	66,5	66,0	65,5	65,0	64,5
143											71,5	71,0	70,5	70,0	69,5	69,0	68,5	68,0	67,5	67,0	66,5	66,0	65,5
144												72,0	71,5	71,0	70,5	70,0	69,5	69,0	68,5	68,0	67,5	67,0	66,5
145													72,5	72,0	71,5	71,0	70,5	70,0	69,5	69,0	68,5	68,0	67,5
146														73,0	72,5	72,0	71,5	71,0	70,5	70,0	69,5	69,0	68,5
147															73,5	73,0	72,5	72,0	71,5	71,0	70,5	70,0	69,5
148																74,0	73,5	73,0	72,5	72,0	71,5	71,0	70,5
149																	74,5	74,0	73,5	73,0	72,5	72,0	71,5
150																		75,0	74,5	74,0	73,5	73,0	72,5
151																			75,5	75,0	74,5	74,0	73,5
152																				76,0	75,5	75,0	74,5
153																					76,5	76,0	75,5
154																						77,0	76,5
155																							77,5
156																							
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168																							
169																							
170																							

Your possible profit with cost factor 0.5

smallest number in your group	your chosen number														
	156	**157**	**158**	**159**	**160**	**161**	**162**	**163**	**164**	**165**	**166**	**167**	**168**	**169**	**170**
110	32,0	31,5	31,0	30,5	30,0	29,5	29,0	28,5	28,0	27,5	27,0	26,5	26,0	25,5	25,0
111	33,0	32,5	32,0	31,5	31,0	30,5	30,0	29,5	29,0	28,5	28,0	27,5	27,0	26,5	26,0
112	34,0	33,5	33,0	32,5	32,0	31,5	31,0	30,5	30,0	29,5	29,0	28,5	28,0	27,5	27,0
113	35,0	34,5	34,0	33,5	33,0	32,5	32,0	31,5	31,0	30,5	30,0	29,5	29,0	28,5	28,0
114	36,0	35,5	35,0	34,5	34,0	33,5	33,0	32,5	32,0	31,5	31,0	30,5	30,0	29,5	29,0
115	37,0	36,5	36,0	35,5	35,0	34,5	34,0	33,5	33,0	32,5	32,0	31,5	31,0	30,5	30,0
116	38,0	37,5	37,0	36,5	36,0	35,5	35,0	34,5	34,0	33,5	33,0	32,5	32,0	31,5	31,0
117	39,0	38,5	38,0	37,5	37,0	36,5	36,0	35,5	35,0	34,5	34,0	33,5	33,0	32,5	32,0
118	40,0	39,5	39,0	38,5	38,0	37,5	37,0	36,5	36,0	35,5	35,0	34,5	34,0	33,5	33,0
119	41,0	40,5	40,0	39,5	39,0	38,5	38,0	37,5	37,0	36,5	36,0	35,5	35,0	34,5	34,0
120	42,0	41,5	41,0	40,5	40,0	39,5	39,0	38,5	38,0	37,5	37,0	36,5	36,0	35,5	35,0
121	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5	39,0	38,5	38,0	37,5	37,0	36,5	36,0
122	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5	39,0	38,5	38,0	37,5	37,0
123	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5	39,0	38,5	38,0
124	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0	39,5	39,0
125	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0	40,5	40,0
126	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0	41,5	41,0
127	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0	42,5	42,0
128	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0	43,5	43,0
129	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0	44,5	44,0
130	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0	45,5	45,0
131	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0	46,5	46,0
132	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0	47,5	47,0
133	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0	48,5	48,0
134	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0	49,5	49,0
135	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0	50,5	50,0
136	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0	51,5	51,0
137	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0	52,5	52,0
138	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0	53,5	53,0
139	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0	54,5	54,0
140	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0	55,5	55,0
141	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0	56,5	56,0
142	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0	57,5	57,0
143	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0	58,5	58,0
144	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0	59,5	59,0
145	67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0	60,5	60,0
146	68,0	67,5	67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0	61,5	61,0
147	69,0	68,5	68,0	67,5	67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0	62,5	62,0
148	70,0	69,5	69,0	68,5	68,0	67,5	67,0	66,5	66,0	65,5	65,0	64,5	64,0	63,5	63,0
149	71,0	70,5	70,0	69,5	69,0	68,5	68,0	67,5	67,0	66,5	66,0	65,5	65,0	64,5	64,0
150	72,0	71,5	71,0	70,5	70,0	69,5	69,0	68,5	68,0	67,5	67,0	66,5	66,0	65,5	65,0
151	73,0	72,5	72,0	71,5	71,0	70,5	70,0	69,5	69,0	68,5	68,0	67,5	67,0	66,5	66,0
152	74,0	73,5	73,0	72,5	72,0	71,5	71,0	70,5	70,0	69,5	69,0	68,5	68,0	67,5	67,0
153	75,0	74,5	74,0	73,5	73,0	72,5	72,0	71,5	71,0	70,5	70,0	69,5	69,0	68,5	68,0
154	76,0	75,5	75,0	74,5	74,0	73,5	73,0	72,5	72,0	71,5	71,0	70,5	70,0	69,5	69,0
155	77,0	76,5	76,0	75,5	75,0	74,5	74,0	73,5	73,0	72,5	72,0	71,5	71,0	70,5	70,0
156	78,0	77,5	77,0	76,5	76,0	75,5	75,0	74,5	74,0	73,5	73,0	72,5	72,0	71,5	71,0
157		78,5	78,0	77,5	77,0	76,5	76,0	75,5	75,0	74,5	74,0	73,5	73,0	72,5	72,0
158			79,0	78,5	78,0	77,5	77,0	76,5	76,0	75,5	75,0	74,5	74,0	73,5	73,0
159				79,5	79,0	78,5	78,0	77,5	77,0	76,5	76,0	75,5	75,0	74,5	74,0
160					80,0	79,5	79,0	78,5	78,0	77,5	77,0	76,5	76,0	75,5	75,0
161						80,5	80,0	79,5	79,0	78,5	78,0	77,5	77,0	76,5	76,0
162							81,0	80,5	80,0	79,5	79,0	78,5	78,0	77,5	77,0
163								81,5	81,0	80,5	80,0	79,5	79,0	78,5	78,0
164									82,0	81,5	81,0	80,5	80,0	79,5	79,0
165										82,5	82,0	81,5	81,0	80,5	80,0
166											83,0	82,5	82,0	81,5	81,0
167												83,5	83,0	82,5	82,0
168													84,0	83,5	83,0
169														84,5	84,0
170															85,0