The Role of Self-Confidence in Teamwork: Experimental Evidence

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Abstract

Teamwork has become increasingly important in modern organizations and the labor market. Yet, little is known about the role of self-confidence in teamwork. In this paper, we present evidence from a laboratory experiment using a team effort task. Effort and ability are complements and there are synergies between teammates' efforts. We exogenously manipulate subjects' self-confidence about their ability using easy and hard general knowledge quizzes. We find that overconfidence leads to more effort, less free riding, and higher team revenue. This finding is primarily due to a direct effect of overconfidence on own effort provision, while there is no evidence that subjects strategically respond to the teammate's overconfidence.

Keywords: Teamwork, Self-Confidence, Effort, Free Riding

JEL Classification: C71, C92, D91, D83

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1 Introduction

This paper studies the role of self-confidence in teamwork using a laboratory experiment. We address the following questions. First, to what extent does overconfidence raise effort, mitigate free riding, and increase revenue in teams? Second, what potential channels are at play? Third, can overconfidence increase individual and team payoffs?

Existing studies show that overconfidence matters for labor markets (Hoffman and Burks, 2020; Santos-Pinto and de la Rosa, 2020; Dargnies et al., 2019). In particular, it changes firms' design of labor contracts (Sautmann, 2013; de la Rosa, 2011; Santos-Pinto, 2008), workers' choice of compensation schemes (Dohmen and Falk, 2011; Niederle and Vesterlund, 2007), as well as entry and behavior in tournaments (Huffman et al., 2022; Möbius et al., 2022; Dohmen and Falk, 2011; Santos-Pinto, 2010; Niederle and Vesterlund, 2007).

However, the effect of overconfidence on teamwork has received less attention. This lack of attention is surprising given the growing importance of teamwork. According to Lazear and Shaw (2007), teamwork in US firms has increased substantially since the 1980s. For example, from 1987 to 1996, the share of large firms with more than a fifth of their workers in problem-solving teams rose from 37% to 66%. The percentage of large firms with workers in self-managed teams rose from 27% to 78%. The importance of teamwork has also been growing in the mutual fund industry, where 76% of US mutual funds are currently managed by a team (Rodríguez-Revilla and García-Gallego, 2023). Another example is the trend of increasing co-authorship in economics, where the share of co-authored papers increased from 50% in 1996 to 75% in 2014 (Jones, 2021; Kuld and O'Hagen, 2020; Barnett et al., 1988).

An exception is Gervais and Goldstein (2007) who take the effects of overconfidence on teamwork explicitly into account. They show theoretically that overconfidence may raise effort and mitigate free riding in teams. In their model, team revenue increases in players' abilities and efforts. That is, a player's marginal productivity of effort increases in own ability (effort and ability are complements) and the effort of others (efforts are strategic complements). There are two channels by which overconfidence raises efforts and reduces free riding. First, as effort and ability are complements, the overconfident player exerts more effort himself. Second, as efforts are strategic complements, the teammate anticipates the overconfident player's higher effort and increases her effort in turn. Hence, the presence of an overconfident player, i.e., someone overestimating his marginal productivity, leads to less free riding and, thus, may make all players better off, including the biased player himself.

In this study, we experimentally test the predictions of this model and identify the importance of the two channels. The experiment closely mirrors the model's features. It randomly assigns subjects into pairs and exposes them to a team task where they choose their individual efforts simultaneously.[1] In this task, team revenue reflects the complementarity between individual effort and ability as well as the strategic complementarity between the two subjects' efforts. A subject's ability in the team effort task corresponds to his rank in a general knowledge quiz among a group of twelve randomly matched subjects. We exogenously manipulate beliefs about ability using a between-subjects design, which exposes subjects either to an easy or a hard quiz. This manipulation of beliefs exploits that subjects overplace themselves in easy tasks and underplace themselves in hard tasks (Moore and Healy, 2008; Moore and Kim, 2003; Krueger and Mueller, 2002; Kruger, 1999; Kruger and Dunning, 1999).[2]

To measure a subject's self-confidence bias, we compare his true rank in the general knowledge quiz to his belief. We elicit the belief before the team effort task to mitigate strategic incentives to misreport beliefs and incentivize them using a binarized scoring rule (Hossain and Okui, 2013). If the subject's belief exceeds his true ability, he is overconfident; if it falls short of his true ability, he is underconfident.

The effort task is a team version of the ball catching task by Gächter et al. (2016). Each subject belongs to a team of two and has to move a tray to catch balls randomly falling from the top of the screen.[3] Effort corresponds to the number of clicks to move the tray and has a constant marginal cost. The marginal contribution of a catch to team revenue increases in the subject's ability and the teammate's number of catches. This ensures that effort and ability are complements, and subjects' efforts are strategic complements. Team revenue is split equally between the teammates.

Each subject performs the effort task over eight periods with the same teammate. The subject does not know his own ability. However, the subject observes his teammate's ability and belief about her ability, allowing him to infer the teammate's self-confidence bias. This is crucial for distinguishing the two channels through which overconfidence can raise effort and mitigate free riding. While the first channel – relying on effort and ability being complements

[1] Charness et al. (2018) show that real effort tasks are better at measuring effort provision than hypothetical effort tasks when the potential source of variation is a psychological aspect, as in this paper.

[2] Moore and Healy (2008) distinguish between three types of overconfidence: overestimation of one's skill (absolute overconfidence), overplacement (relative overconfidence), and excessive precision in one's beliefs (miscalibration or overprecision). Our study uses over- and underplacement in the general knowledge quiz to cause subjects to over- and underestimate their ability in the team effort task.

[3] The pace at which the balls fall does not pose a challenge to subjects' motor skills.

– directly increases an overconfident subject's effort, the second channel – relying on the strategic complementarity of efforts – requires that each subject is aware of his teammate's self-confidence bias.[4]

At the end of each period, the subject observes his own number of clicks and catches as well as his payoff. However, he does not observe the teammate's catches, clicks, and payoff. This ensures that the disclosure of payoff information does not allow the subject to calculate his true ability.

The results show that the belief manipulation worked. Beliefs reveal that subjects exposed to the easy quiz are overconfident and, on average, overestimate their rank by 1.2 places, while those exposed to the hard quiz are underconfident and, on average, underestimate their rank by 0.483 places.

The results also confirm the theory's main prediction – i.e., overconfidence increases effort, thus reducing free riding. Subjects exposed to the easy quiz provided 21.1% more effort than those exposed to the hard quiz. We also show that an exogenous shift in beliefs causes the treatment differences in effort provision.[5], rules out that mood effects are driving this result.

Furthermore, we uncover that the increase in effort and reduction in free riding is primarily due to the first channel, as a subject's self-confidence bias has a positive effect on own effort. However, there is no evidence for the second channel, as own effort does not react to the teammate's self-confidence bias.[6] We also find that team revenue increases in self-confidence bias. In addition, a subject's payoff increases in the teammate's self-confidence bias and is inversely u-shaped in his own bias.

These results have direct implications for organizations and labor economics. While worker overconfidence can be detrimental in many settings, we confirm that it can also have positive effects in the context of teamwork. If effort and ability are complements,

[4]In a real world setting where teammates interact repeatedly, colleagues can observe signals of an individual's confidence and true ability. For example, listening to others and openness to criticism are negatively correlated with overconfidence, while being persuasive and having high standards of individual and team performance are positively correlated with overconfidence (Kaplan et al., 2022). Furthermore, observing someone's performance repeatedly reveals the person's ability to the teammates. When someone's confidence surpasses his performance systematically, the teammates will infer the person is overconfident. Our experimental design, by revealing the teammate's ability and self-confidence bias in the first period, bypasses this process.

[5]A robustness check, detailed in Appendix J.

[6]Even though a subject's effort does not react to the teammate's self-confidence bias, it does react to the teammate's ability. Thus, subjects understand that they are in a team where the marginal returns to equilibrium effort increase in the teammate's ability.

overconfident workers may improve team performance by reducing free riding. In addition, the absence of the second channel suggests that disclosing the degree of overconfidence among the members of a team may not be a fruitful approach to increasing team performance.

The paper contributes to two strands of literature. First, it adds to the literature on teamwork and public good provision (for a comprehensive overview, see Drouvelis, 2021). The seminal theory contribution on teamwork is by Holmström (1982). In this model, workers have an incentive to free ride whenever the efforts of other teammates are unobservable and team revenue is shared. Consequently, teamwork produces a social dilemma in which individually rational decisions lead to an inefficient outcome. However, the experimental literature on teamwork and public good provision finds that subjects do not systematically free ride. Moreover, heterogeneity in teammates' preferences, beliefs, and demographics affect team production (Ivanonva-Stenzel and Kübler, 2011; Lavy, 2002; Knez and Simister, 2001; Nalbantian and Schotter, 1997). For instance, social preferences reduce free riding in teams, as some are willing to incur costs to punish free riders (Falk and Ichino, 2006; Kandel and Lazear, 1992), others view free riding as a violation of social norms (Fehr and Fischbacher, 2004; Fehr and Gächter, 2000), and some are conditional cooperators (Sherstyuk et al., 2002; Fischbacher et al., 2001; Rotemberg, 1994). The paper extends this literature by analyzing the effects of overconfidence on teamwork. It is the first to show that overconfidence leads to higher efforts and less free riding and identifies the underlying channel.[7]

Second, the paper adds to the literature on overconfidence. Except for Gervais and Goldstein (2007), this literature has largely neglected the effects of overconfidence on teamwork. Seminal papers in this strand of literature have mainly focused on the impact of overconfidence on principal-agent relationships. For instance, Bénabou and Tirole (2002) and Bénabou and Tirole (2003) demonstrate that overconfidence raises the agent's effort when effort and ability are complements. Chen and Schilberg-Hörisch (2019) show empirically that negative information on individual ability diminishes the agent's effort provision. Our paper extends this strand of literature by providing evidence on the effects of overconfidence in a team setting, where subjects are partners without a hierarchical relationship. In that sense, the paper also links the first strand of literature on teamwork and public good provision to this second strand on overconfidence.

The paper has the following structure. Section 2 presents the theoretical model and

[7] Unpublished work by a partly overlapping set of co-authors looks into how perceptions of skill influence teamwork using a hypothetical effort task and without exogenously manipulating beliefs (Vialle et al., 2011).

the hypotheses we derive from it. Section 3 describes the experiment. Section 4 discusses the results on the effectiveness of the belief manipulation, the effects of self-confidence on teamwork, potential learning effects about own ability, and delayed reactions to information about the teammate. Section 5 concludes.

2 Model

In this section, we present the setup of our model to study the impact of overconfidence on teamwork. Subsequently, we discuss the main hypotheses stemming from this model.

2.1 Setup

The seminal contribution to the literature on teamwork and overconfidence is Gervais and Goldstein (2007). They consider a model of teamwork where team revenue is increasing in players' abilities and efforts. They postulate two types of complementarities: i) each player's ability and effort are complements, that is, the returns to increasing effort for a high-ability player are greater than those of a low-ability player; ii) players' efforts are strategic complements, that is, the returns of a player's effort are increasing in the other's effort. Moreover, they assume a team is composed of an overconfident player and an unbiased player. The overconfident player overestimates his ability but is unaware of this bias. The unbiased player knows about the overconfident player's bias. The overconfident player knows the unbiased player thinks that he is biased but disagrees with her. The solution concept follows the approach by Heifetz et al. (2007a,b) for games with complete information and by Squintani (2006) for games with incomplete information.

We consider a modified version of this model, which retains its main features and adapts it to our experiment. A team comprises two players, i and j. Team revenue is

$$R = 2w\left[a_i\, q(e_i) + a_j\, q(e_j) + s\, q(e_i)\, q(e_j)\right] , \tag{1}$$

where $w > 0$, a_i is player i's ability multiplier, and $q(e_i)$ is i's individual output, given by an increasing and concave function of effort. The parameter $s > 0$ governs the complementarity between the two players' efforts. It implies the two players create positive externalities on each other, as in Alchian and Demsetz (1972). Hence, i's ability multiplier and effort are complements, i.e., $\partial^2 R/\partial a_i \partial e_i > 0$; and the two players' efforts are strategic complements,

$\partial^2 R/\partial e_i \partial e_j > 0$. The players are risk neutral and face linear costs of effort, $c(e_i) = c\, e_i$, with $c > 0$.

Each player i is unaware of his ability multiplier, a_i, but has a belief about its value. We call this belief player i's perceived ability multiplier and denote it by $\tilde{a}_i$. Thus, i's self-confidence bias, b_i, is the difference between his perceived and true ability multipliers: $b_i = \tilde{a}_i - a_i$. When $b_i > 0$, i is overconfident; whereas when $b_i < 0$, he is underconfident. Moreover, player i also knows the perceived and true ability multipliers of the other player j. Hence, player i is informed about j's self-confidence bias.

Team revenue is shared equally between the two players i and j, regardless of their efforts and ability multipliers. Each player i chooses his effort to maximize his perceived payoff

$$U_i = w\left[\tilde{a}_i\, q(e_i) + a_j\, q(e_j) + s\, q(e_i)\, q(e_j)\right] - c\, e_i\,.$$

For tractability and without loss of generality, we assume $q(e_i) = \sqrt{e_i}$.[8] Under this assumption, the optimal effort levels of players i and j satisfy the following first-order conditions:

$$\begin{cases} w\, \tilde{a}_i + s\, w\, \sqrt{e_j} = 2c\, \sqrt{e_i} \\ w\, \tilde{a}_j + s\, w\, \sqrt{e_i} = 2c\, \sqrt{e_j} \end{cases}.$$

Solving the above system of equations, and using $\tilde{a}_i = a_i + b_i$ as well as $\tilde{a}_j = a_j + b_j$, yields player i's equilibrium effort:

$$e_i^* = k\left[w\,(a_i + b_i) + \frac{s\, w^2}{2c}\,(a_j + b_j)\right]^2, \tag{2}$$

where $k = (2c)^2/(4c^2 - s^2 w^2)^2$ is a positive constant. Hence, equilibrium effort increases in the players' ability multipliers, a_i and a_j, and self-confidence biases, b_i and b_j.

Our model differs from the one by Gervais and Goldstein (2007) in three relevant dimensions. First, $q(e_i)$ is concave instead of linear. Second, the cost of effort is linear instead of convex. These two dimensions map the team production to the effort task in the experiment and ensure player i's second-order condition is satisfied. Third, we allow both players to be biased, whereas Gervais and Goldstein (2007) allow only one player to be biased. Even though our model differs in these three main dimensions, the qualitative predictions are identical to those derived by Gervais and Goldstein (2007), as shown in Appendix B.

[8] In Appendix A, we show the analysis generalizes for a sufficiently concave $q(e_i)$.

2.2 Hypotheses

We now turn to the main hypotheses. The first three hypotheses concern the effects of overconfidence on equilibrium efforts and team revenue. We obtain them directly from Equation (2).

Hypothesis 1 *Player i's self-confidence bias has a positive effect on his equilibrium effort.*

The first hypothesis follows from the assumption that a player's ability multiplier and his effort are complements. Hence, an overconfident player overestimates the marginal productivity of his effort.

Hypothesis 2 *Player j's self-confidence bias has a positive effect on player i's equilibrium effort.*

The second hypothesis follows from the assumption that the players' efforts are strategic complements. In other words, the marginal productivity of a player's effort increases in the other's effort. Thus, if an overconfident player exerts more effort, providing higher effort becomes more attractive to the teammate.

Hypothesis 3 *Team revenue increases in self-confidence bias.*

The third hypothesis follows directly from Hypotheses 1 and 2.

Our next three hypotheses concern the impact of overconfidence on the players' individual payoffs and on the team payoff. We obtain them from further analysis of the model, which we detail in Appendix C.

Hypothesis 4 *A player's equilibrium payoff increases in the other's self-confidence bias.*

If the other player exerts more effort (due to overconfidence), team revenue is higher at no additional cost to the focal player.

Hypothesis 5 *A player's equilibrium payoff is inversely u-shaped in his self-confidence bias.*

A player's self-confidence bias has two effects on his equilibrium payoff: i) a direct effect resulting from the mistake in optimization and ii) a strategic effect resulting from the other's reaction due to the strategic complementarity of the players' efforts. The direct effect is always negative, while the sign of the strategic effect depends on whether the player is over-or underconfident. If the player is underconfident, the strategic effect is negative, because he provides too little effort compared to a rational player. This, in turn, discourages the other's effort. Consequently, both effects lower the player's payoff. In contrast, if the player is overconfident, the strategic effect is positive because the player provides too much effort, which encourages the other's effort. In this case, whether the direct or the strategic effect dominates, depends on the extent of the player's self-confidence bias. If his bias is small, the strategic effect dominates, and he is better off; while if his bias is large, the direct effect dominates, and he is worse off.

The final hypothesis concerns the effect of self-confidence biases on team payoff, i.e., team revenue minus the sum of individual costs of effort.

Hypothesis 6 *Team payoff increases in self-confidence bias.*

If an overconfident player exerts more effort, this extra effort directly reduces free-riding by this player and raises team payoffs. In addition, due to the complementarity between the players' efforts, it also increases the other's marginal productivity and, thus, the other's effort. As a result, team payoffs raise even further. All six hypotheses are in line with the original model of Gervais and Goldstein (2007).

3 Experiment

In this section, we present the experiment. We first describe its general structure and, subsequently, explain each of its four main blocks in detail.

3.1 General Structure

The experiment took place at the laboratory of the University of Lausanne (LABEX) in November 2019. It involved mostly students of various academic fields from the University of Lausanne and the École Polytechnique Fédérale de Lausanne (EPFL), whom we recruited from the subject pool of the LABEX via ORSEE (Greiner, 2015). Our two main treatments involved 240 subjects, 10 sessions, each comprising 24 subjects.[9] In every session, we randomly assigned subjects into two *groups* of 12. Within each group, we randomly matched subjects into 6 *teams* of two players.

[9]The experiment involves two additional treatments to rule out mood effects which are described in Appendix J.

To test our hypotheses, the experiment features a between-subjects design with two main treatments. In these treatments, we exogenously manipulate the subjects' belief regarding their ability multiplier by employing either an easy or a hard general knowledge quiz. Each team of two engages in an effort task. Half of the sessions expose subjects to the EASY treatment, while the other half exposes them to the HARD treatment.[10]

The experiment comprises four main blocks as shown in Table 1. We now describe the different blocks in more detail. Instructions for the experiment, including control questions, can be found in Appendix L.

Table 1: Main Blocks of the Experiment

Block 1	Belief manipulation & elicitation of prior beliefs
Block 2	Team effort task
Block 3	Elicitation of posterior beliefs, social & risk preferences, and demographics
Block 4	Payment

3.2 Belief Manipulation & Elicitation of Prior Beliefs

In Block 1, subjects are first randomly assigned to the two treatments, EASY and HARD, which exogenously manipulate self-confidence using a general knowledge quiz. The quiz is based on Moore and Healy (2008) and comprises 46 questions which are divided into six different general knowledge topics: Science, Geography, Movies, Music, History, and Switzerland. Depending on the treatment, the questions are either easy or hard. Easy questions induce overconfidence and hard ones induce underconfidence due to the "hard-easy" effect in relative placement (Kruger, 1999; Moore and Kim, 2003; Moore and Cain, 2007; Moore and Healy, 2008; Dargnies et al., 2019). Subjects have 20 minutes to complete the quiz.

The number of correct answers determines a subject's rank, r_i, within his group of twelve. The best performer gets a rank of $r_i = 1$, while the worst performer gets a rank of $r_i = 12$. Ties are broken randomly. A subject's rank directly maps into his ability multiplier measured in tokens,

$$a_i = (13 - r_i) \times 20 \,,$$

[10] Descriptive statistics on the distribution of the social and risk preferences as well as the demographics are in Appendix D. They reveal that the randomization worked in most dimensions.

which remains constant throughout the team effort task.[11] For instance, the second best performer with rank $r_i = 2$ gets an ability multiplier of $a_i = 220$. Throughout the experiment, subjects are never told about their rank or ability multiplier.

Next, we elicit the subjects' prior belief about their rank $\tilde{r}_i$. Subjects replied to the following request: "We wish you to provide us with your estimate of your rank as an integer between 1 and 12." As subjects may report biased and inaccurate beliefs (Grether, 1992), we elicit beliefs in an incentive-compatible way using the binarized scoring rule by Hossain and Okui (2013). Under this scoring rule, subjects have an incentive to disclose their true belief, irrespective of their risk preferences, even if they are non-expected utility maximizers. The prior belief maps into the perceived ability multiplier, $\tilde{a}_i = (13 - \tilde{r}_i) \times 20$, determining the self-confidence bias $b_i = \tilde{a}_i - a_i$. Notice that to mitigate strategic incentives to misreport beliefs, we elicited beliefs before the team effort task.[12]

3.3 Team Effort Task

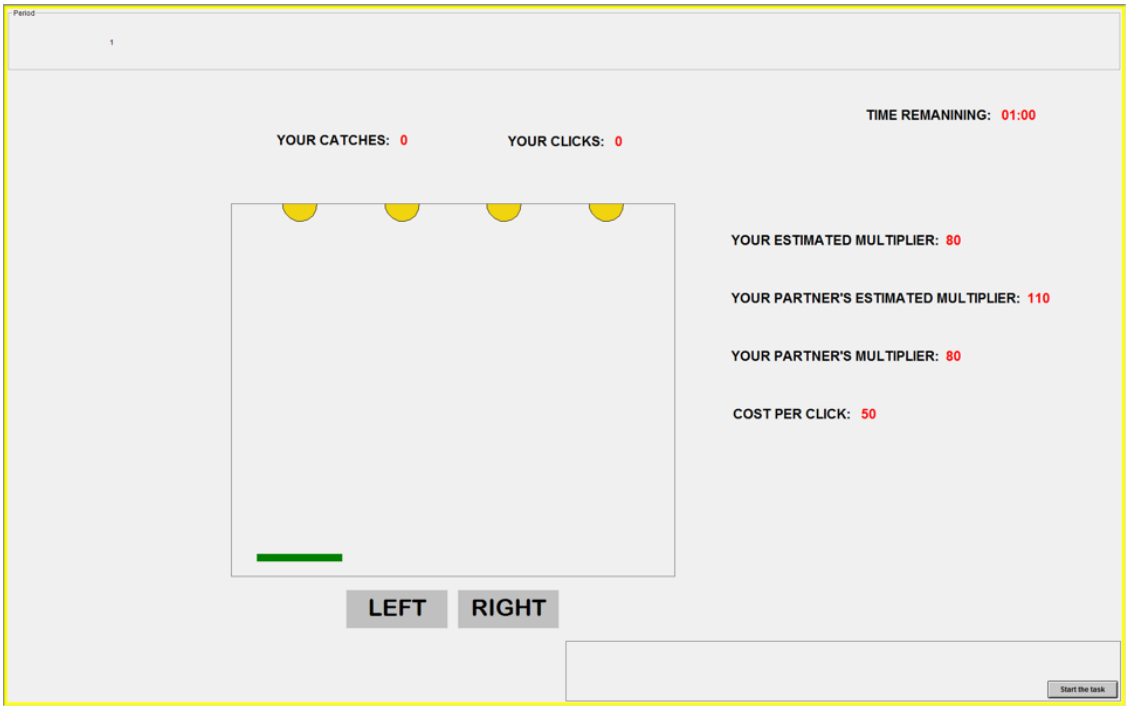
In Block 2, subjects were exposed to a team version of the ball catching task by Gächter et al. (2016). This effort task offers two main advantages. First, it ensures that all subjects face the same cost of effort, which can be defined by the experimenter. Second, effort provision has proven to be more sensitive to changes in incentives than in other common effort tasks (Gächter et al., 2016; Araujo et al., 2016).

The interface of our version of the ball catching task is shown in Figure 1. Balls randomly

[11] In the instructions, we present this mapping as a table containing all possible ranks and their corresponding ability multipliers.

[12] To avoid any potential forms of deception, subjects were provided with the full set of instructions at the start of the experiment. This opens one potential way for strategic incentives to misreport beliefs to arise. Namely, if subjects realize that their teammate will later observe their true and perceived ability during the team effort task, subjects may overstate their perceived ability to make the teammate exert more effort. However, we believe this is highly unlikely for several reasons. First, the instructions are long (see Appendix L). Second, in the two additional treatments to detect potential mood effects, subjects have no incentive to strategically misreport their beliefs as the true ability multipliers of the two team members were disclosed to both before the start of the team effort task. Despite that, there is no significant difference in the levels of self-confidence biases in these additional treatments and the corresponding main treatments in the paper (see Appendix J for further details). Third, by overstating their belief, subjects would trade off a certain lower payment in the belief elicitation task for an uncertain higher payment in the team effort task. We find no evidence that risk-tolerant subjects overstate their beliefs more than risk-averse subjects (again, see Appendix J for further details). We thank an anonymous referee for pointing this out.

Figure 1: Interface of the Ball Catching Task



fall from one of the four positions at the top of the screen. Each subject has to catch them by moving the green tray at the bottom of the screen in order to earn tokens. A click on the buttons "LEFT" and "RIGHT" moves the tray by one position in the corresponding direction at a cost of c tokens per click. In addition, the screen provides the subject with the following information (in clockwise order): i) his number of catches and clicks; ii) the remaining time to complete the task; iii) his own perceived ability multiplier, $\tilde{a}_i$; iv) the other subject j's perceived and true ability multipliers, $\tilde{a}_j$ and a_j, respectively; and v) the cost per click.

The subject's ability multiplier and catches, a_i and q_i, as well as the other's ability multiplier and catches, a_j and q_j, determine the team revenue in tokens as in Equation (1). We set the team revenue parameter $w = 1$, the effort complementarity parameter $s = 5$, and the unit cost of clicks $c = 50$ tokens. This parametrization, together with the range of the ability multipliers, creates a non-trivial trade-off between benefits and costs of effort where subjects with high ability multipliers have an incentive to click more to catch balls further away from the tray. The subject knows that his individual payoff and the other's payoff will correspond to half of the team revenue minus the individual costs of effort.

Each team performs the ball catching task over eight periods. At the end of every period, each subject is informed about his number of catches, clicks, and individual payoff. To familiarize subjects with the task, there were also trial periods at the beginning, where each subject participated in the individual version of ball catching task of Gächter et al. (2016) with varying ability multipliers. We confirm that effort provision is sensitive to changes in incentives, i.e., changes in ability multipliers (see Appendix E).

Note that the absence of a relation between the general knowledge quiz and the ball-catching task enables us to cleanly identify the causal effect of self-confidence bias on teamwork. This mitigates potential confounding factors associated with using the same task to gauge both self-confidence and effort provision.

3.4 Elicitation of Posterior Beliefs, Social & Risk Preferences, and Demographics

In Block 3, we elicit subjects' posterior beliefs about their ranks, their social and risk preferences as well as some of their demographic characteristics.

Subjects can update their beliefs about their rank and state a posterior belief. We give them this option as the information about individual clicks, catches, and payoffs at the end of each period could lead to learning. This information represents a series of eight signals about a subject's ability multiplier and, thus, her rank. However, the signals are noisy as the subject's payoff in a given period also depends on the teammate's catches. In case a subject updates her belief, there is a fifty-fifty chance that either the prior or the posterior belief counts for payment. In case the subject does not update her belief, the prior belief counts for payment.

For eliciting social preferences, we use the task by Balafoutas et al. (2012), which allows us to classify each subject either as efficiency-loving, inequality-averse, inequality-loving, or spiteful. For eliciting risk preferences, we apply the Bomb Risk Elicitation Task (BRET) by Crosetto and Filippin (2013), which is easy to understand and provides an individual index of risk aversion. We also asked subjects to provide the following demographics: age, gender, nationality, whether only child (0/1), parents' educational attainment, number of acquaintances, whether living in a big town (0/1), being enrolled at the University of Lausanne (0/1), study program (Bachelor/Master), and GPA.

3.5 Payment

In Block 4, each subject receives his payment. All payments occur in this final block to avoid any income effects. The total payment comprises the following five elements: i) a show-up fee of CHF 5.00; ii) a payment for relative performance in the general knowledge quiz in the group, ranging from CHF 0.20 to 2.40; iii) a payment for the accuracy of the belief about the rank in the group, ranging from CHF 0.00 to 2.00; iv) a payment for a randomly selected period of the ball catching task, amounting to CHF 16.67, on average; v) a payment for the elicitation of the distributional and risk preferences, ranging from CHF 0.62 to 1.05 and from CHF 0 to 2.48, respectively. The average total payment is CHF 30.60 for a duration of approximately 90 minutes. The conversion rate is CHF 1.00 per 300 tokens. At the time of the experiment, CHF 1.00 was worth roughly USD 1.01.

4 Results

In this section, we present the results. We first discuss the descriptive results of the belief manipulation. Subsequently, we show how the treatment affects effort via a shift in beliefs, and we turn to the regressions that test the hypotheses derived from the theory. Finally, we look into potential learning effects and delayed reactions to the teammate's ability and self-confidence bias.

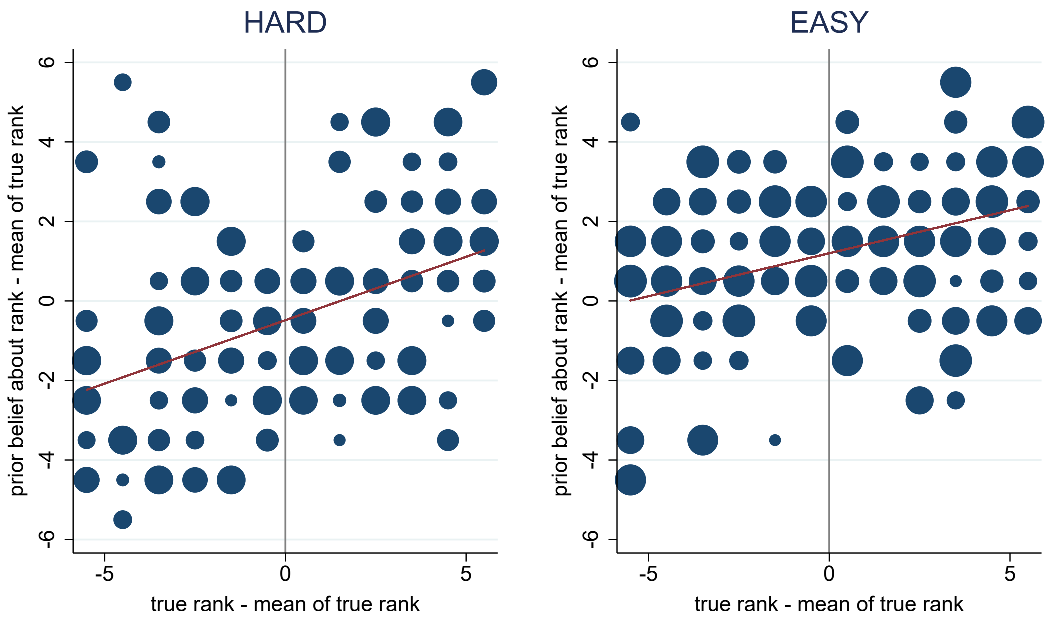
4.1 Belief Manipulation

Figure 2 confirms that the belief manipulation succeeded. It exhibits the relationship between subjects' true ranks and prior beliefs about their rank across the two treatments. The left panel shows this relationship for the HARD treatment while the right panel shows it for the EASY treatment.

The scaling of the axes ensures that the intercepts of the depicted regression lines reflect the subjects' average level of overconfidence. That is, the horizontal axis displays the demeaned version of the subjects' true ranks, $r_i - \bar{r}$, where $\bar{r} = 6.5$. The vertical axis shows the difference between the subjects' prior beliefs about their rank and the mean of the *true* ranks, $\tilde{r}_i - \bar{r}$. Hence, the regressions underlying the two depicted lines have the following specification:

$$\tilde{r}_i - \bar{r} = \alpha_0 + \alpha_1 (r_i - \bar{r}) + u_i \,. \tag{3}$$

Figure 2: Relationship between Prior Beliefs and True Ranks



The horizontal axis displays the demeaned version of the subjects' true ranks, $r_i - \bar{r}$, where $\bar{r} = 6.5$. The vertical axis shows the difference between the subjects' prior beliefs about their rank and the mean of the *true* ranks, $\tilde{r}_i - \bar{r}$. Regression lines are obtained from regressions based on the specification in Equation (3). The size of the circles is proportional to the number of subjects represented by them.

In this specification, the intercept indicates whether subjects are, on average, overconfident ($\alpha_0 > 0$) or underconfident ($\alpha_0 < 0$). The slope reflects whether their beliefs are precise (α_1 close to 1) or noisy (α_1 close to zero).

The first finding confirms that the belief manipulation is effective. In the HARD treatment, subjects underestimate their ranks ($\hat{\alpha}_0 = -0.483$; two-sided t-test: p-value=0.022); while in the EASY treatment, they overestimate their ranks ($\hat{\alpha}_0 = 1.200$; two-sided t-test: p-value<0.001).

The second finding reveals that prior beliefs react to true ranks and that there is substantial noise in prior beliefs. In the HARD treatment $\hat{\alpha}_1 = 0.319$ (two-sided t-test: p-value<0.001), while in the EASY treatment $\hat{\alpha}_1 = 0.216$ (two-sided t-test: p-value < 0.001).[13] Prior beliefs predict $R^2 = 19.0\%$ of the variance in true ranks in the HARD treatment and

[13] A joint regression with a treatment dummy on the intercept and slope parameters confirms that the two slopes are not significantly different (two-sided t-test: p-value = 0.189).

$R^2 = 14.3\%$ in the EASY treatment.

Although the mechanism through which our treatment, EASY vs. HARD quiz, changes subjects' beliefs about their ability is not the main scope of the paper, there is an interesting similarity to the work by Butler (2016). In an experiment that randomly assigns inequality in payments, he shows that such inequality causes the advantaged to display higher beliefs about their relative ability than the disadvantaged. In contrast, in our experiment, inequality in payments is not salient as we do not directly manipulate earnings. Yet, subjects exposed to an EASY quiz may still perceive themselves to be in an advantageous position relative to others, which could be the reason behind their higher self-confidence. Hence, an avenue for future research is to investigate whether inequality in opportunities influences self-confidence even in settings, such as ours, where it is not salient.[14]

4.2 Treatment Effects through Shifts in Beliefs

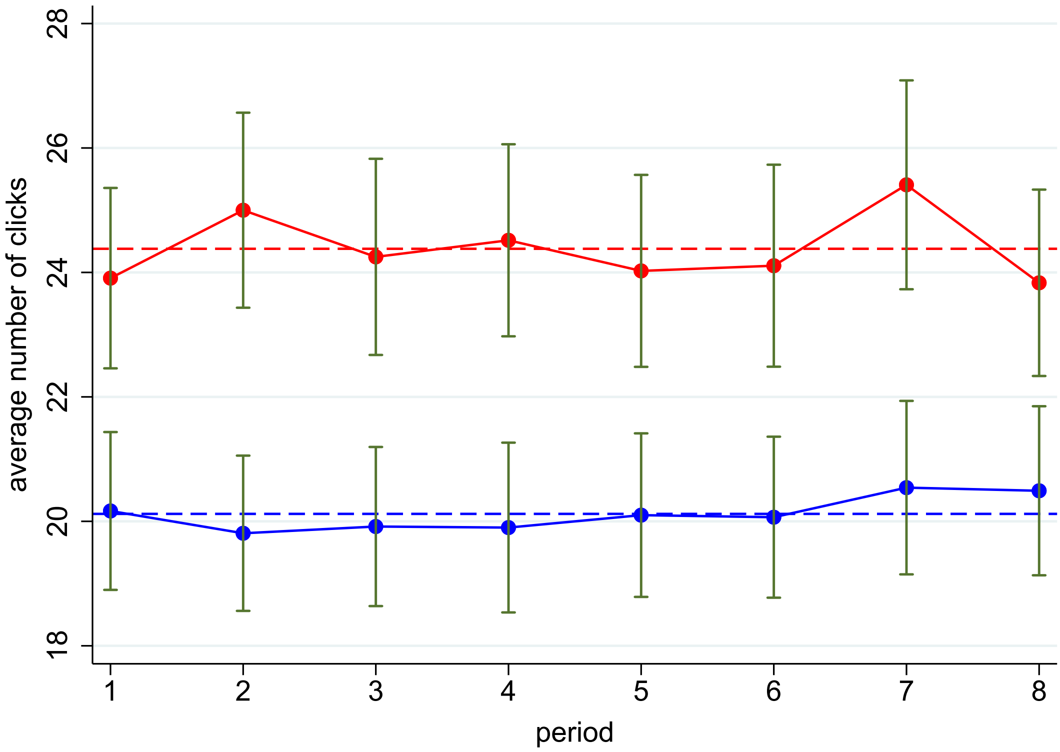
Figure 3 reveals that, across all eight periods, the average effort per period in the HARD treatment falls consistently short of the one in the EASY treatment. Subjects provide an average effort per period of 20.12 clicks in the HARD treatment and 24.38 clicks in the EASY treatment (dashed lines), corresponding to a difference of 21.1% (two-sided z-test from a Generalized Least Squares (GLS) regression: p-value = 0.020).

Next, we analyze whether the observed difference in effort across treatments is due to differences in beliefs about ability multipliers. Table 2 exhibits the results of three Generalized Least Squares (GLS) regressions, where the dependent variable is always effort in clicks. The regressions feature random effects to account for the ball-catching task's stochastic production function, where the marginal revenue of a click depends on the random order of the falling balls. Standard errors are clustered at the team level. The specification in Column (1) confirms the average treatment difference in effort across all periods discussed above. The specification in Column (2) controls for the subjects' true ability multipliers as well as gender. It shows that men provide, on average, 9.85 clicks more than women and that the treatment difference remains significant. The specification in Column (3) adds the subjects' perceived ability multipliers. It reveals that, once we control for the focal subject i's perceived ability multiplier the treatment dummy gets much smaller in size and becomes insignificant. Thus, the treatment indeed affects beliefs: subjects exert more effort in the

[14] We thank an anonymous referee for highlighting this similarity.

EASY treatment because they are more confident regarding their ability multiplier.

Figure 3: Average Efforts across Periods and Treatments



The treatment HARD is depicted in blue, and the treatment EASY in red. Solid lines show the average effort per period, while dashed lines show the average effort over all periods. Standard errors (in green) are clustered at the team level.

Moreover, Figure 4 shows additional differences between treatments. In particular, it reveals that moving from the HARD to the EASY treatment raises the number of catches by 4.8%, team revenue by 6.4%, and average individual payoffs by 4.0%. Although these differences are not statistically significant, they go in the expected direction and their sizes are large. Note that over the eight periods, there is a decline in catches, team revenue, and individual payoffs in the EASY treatment. This decline cannot be due to learning about own ability since that would imply a change in the average number of clicks (which, as we saw in Figure 3, remains constant). Hence, this decline is most likely due to subjects' complacency or fatigue in the EASY treatment.

Since we test the significance of differences in outcomes across four dimensions in the same sample, we adjust for multiple hypotheses testing (List et al., 2019). Appendix F shows the corresponding adjusted p-values and reveals that the main result regarding effort,

Table 2: Treatment, Beliefs, and Effort Provision

Effort in Clicks	(1)	(2)	(3)
constant	20.1240***	9.3452***	2.1390
	(1.2019)	(2.5603)	(3.4583)
EASY	4.2573**	2.8621*	0.0531
	(1.8316)	(1.6765)	(1.8404)
i's ability multiplier (a_i)		0.0153	-0.0063
		(0.0133)	(0.0141)
j's ability multiplier (a_j)		0.0323**	0.0317**
		(0.0130)	(0.0135)
male		9.8481***	8.7378***
		(1.6631)	(1.6852)
i's perceived ability multiplier ($\tilde{a}_i$)			0.0871***
			(0.0230)
j's perceived ability multiplier ($\tilde{a}_j$)			0.0011
			(0.0188)
No. of observations	1,920	1,920	1,920
R^2	0.0179	0.1366	0.1867

The table reports the results of random-effects GLS regression with the number of clicks as dependent variable and a dummy for the EASY treatment as the main regressor. Standard errors are clustered at the team level. Significantly different from zero at 1% (***), 5% (**), 10% (*).

measured as the number of clicks, remains significant. Hence, the treatments exogenously shift subjects' beliefs about their ability multipliers and result in a significantly different effort provision.[15]

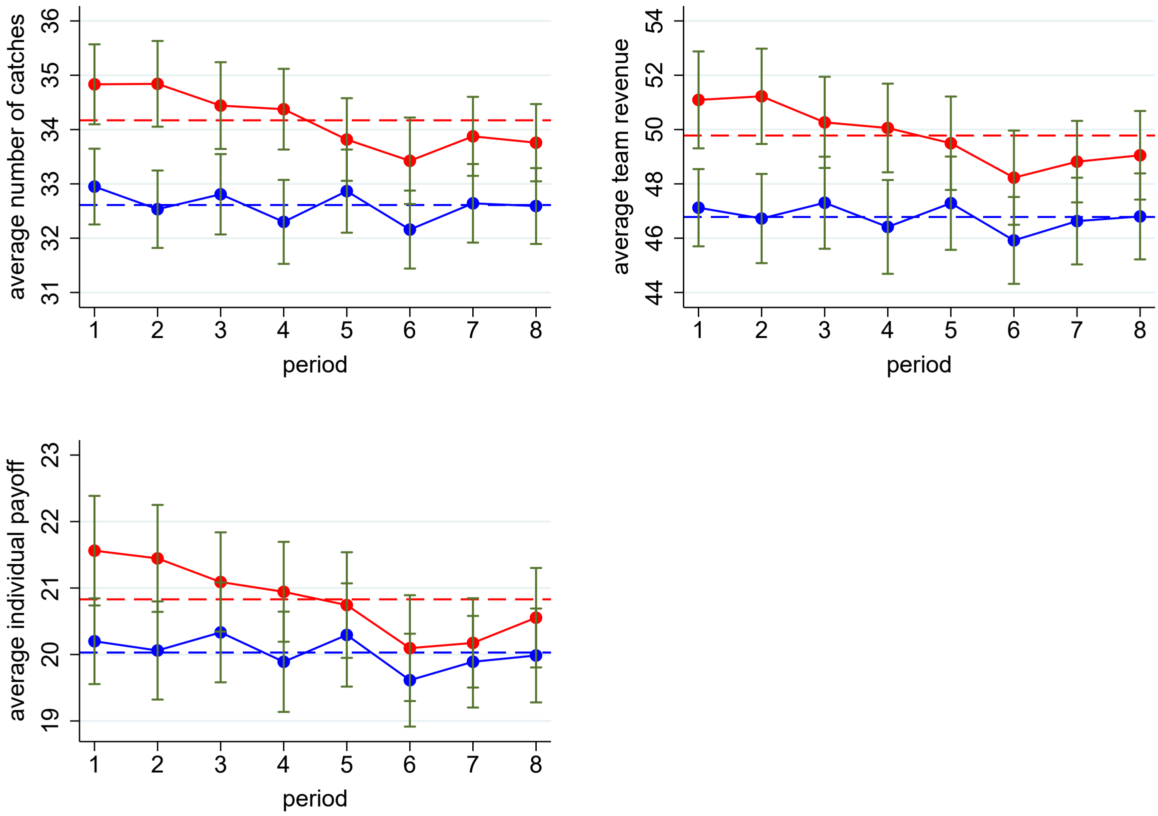
4.3 Test of Model Hypotheses

We now test Hypotheses 1 and 2 using a random-effects GLS regression on effort provision with the following specification:

$$e_{it} = \beta_0 + \beta_1 a_i + \beta_2 b_i + \beta_3 a_j + \beta_4 b_j + \beta_5' X_i + \beta_6' P_t + u_{it}\,. \tag{4}$$

[15] Figures 9 and 10 in Appendix G depict the distributions of clicks and catches in each treatment. They reveal that the distributions of clicks and catches are more skewed to the left in the HARD than in the EASY treatment.

Figure 4: Catches, Team Revenue, and Payoffs across Periods and Treatments



The treatment HARD is depicted in blue, and the treatment EASY in red. Solid lines show the average catches, team revenue, and individual payoff per period. Dashed lines display the average catches, team revenue, and individual payoff over all eight periods. Standard errors (in green) are clustered at the team level.

The dependent variable is the effort of subject i in period t, e_{it}, measured in clicks. X_i is a vector comprising i's social and risk preferences as well as demographic characteristics, P_t is a vector of period dummies, and u_{it} is the stochastic error term. In this specification, each subject in a team appears twice, once as the focal individual i and once as the teammate j. To take this into account, standard errors are clustered at the team level.[16]

To test Hypothesis 3, we use a random-effects GLS regression on team revenue with the following specification:

$$R_{ijt} = \gamma_0 + \gamma_1 a_i + \gamma_2 b_i + \gamma_3 a_j + \gamma_4 b_j + \gamma_5' X_{ij} + \gamma_6' P_t + u_{ijt}\,. \tag{5}$$

The dependent variable is the team revenue of subjects i and j in period t, R_{ijt}, measured in CHF. In this specification, i always represents the subject with the higher ability multiplier relative to the teammate j, i.e., $a_i > a_j$. X_{ij} contains team-specific controls, while P_t is the vector of period dummies as before. Notice that by including ability multipliers as well as self-confidence biases, any correlation between these variables is taken into account.

Table 3 exhibits the results of the two regressions. We start with the first regression on effort provision. The estimate $\hat{\beta}_2$ indicates that subject i's own self-confidence bias has a highly significant and positive effect on his effort. That is, a unit increase in i's self-confidence bias increases his effort by 0.10 clicks on average. This first result confirms Hypothesis 1. To check the robustness of Result 1, we analyzed subjects' behavior separately in period 1 and all following periods. Details can be found in Appendix K. Overall, our results remain robust. Moreover, the analysis of period 1 behavior suggests that the information disclosed during the first period reinforced subjects' understanding that they are in a team setting and that, on average, teammates with higher ability multipliers are more productive.

Result 1 *Subject i's self-confidence bias has a positive effect on his effort.*

The estimate $\hat{\beta}_4$ reveals that the other subject j's self-confidence bias has no significant effect on i's effort. This second result does not support Hypothesis 2.

Result 2 *The other subject j's self-confidence bias has no significant effect on the focal subject i's effort.*

[16] As a robustness check, and to be even closer to the theoretical equilibrium in Equation (2), we also ran Regression (4) using the square root of effort as the dependent variable. Results remain unchanged as can be seen in Appendix H. However, in the main text we stick to the linear specification as the square root of individual effort may not exactly reflect the concavity of $q(e_i)$.

Table 3: Effort and Team Revenue Regressions

		Effort in Clicks (e_{it})			Team Revenue in CHF (R_{ijt})	
constant	$\hat{\beta}_0$	3.0259	3.2969	$\hat{\gamma}_0$	-2.7900	11.1897
		(3.5799)	(8.8708)		(4.4331)	(14.4512)
i's ability multiplier (a_i)	$\hat{\beta}_1$	0.1065***	0.0706***	$\hat{\gamma}_1$	0.2130***	0.1699***
		(0.0199)	(0.0208)		(0.0273)	(0.0289)
i's self-confidence bias (b_i)	$\hat{\beta}_2$	0.1042***	0.0860***	$\hat{\gamma}_2$	0.0752***	0.0507**
		(0.0230)	(0.0213)		(0.0234)	(0.0230)
j's ability multiplier (a_j)	$\hat{\beta}_3$	0.0351*	0.0409**	$\hat{\gamma}_3$	0.1686***	0.1752***
		(0.0186)	(0.0178)		(0.0215)	(0.0223)
j's self-confidence bias: (b_j)	$\hat{\beta}_4$	0.0089	0.0045	$\hat{\gamma}_4$	0.0356**	0.0273
		(0.0186)	(0.0185)		(0.0181)	(0.0171)
Controls (X and P)		no	yes		no	yes
No. of observations		1,920	1,920		960	960
R^2		0.1182	0.2511		0.6469	0.7125

The table shows the results of Regressions (4) and (5) with and without controls. These are GLS regressions with random effects and standard errors clustered at the team level. A version of the table showing all estimates, including the ones for the controls, is in Appendix I. Significantly different from zero at 1% (***), 5% (**), 10% (*).

However, even though subjects do not react to the other's self-confidence bias, they do react to the other's ability multiplier as shown by the positive and significant estimate $\hat{\beta}_3$. Thus, subjects understand that they are in a team where, in equilibrium, the marginal returns to effort increase in the other's ability multiplier.

Overall, Results 1 and 2 together imply that the first channel –relying on effort and ability being complements– accounts for most of the positive effect of overconfidence on increasing effort and reducing free-riding. At the same time, there is no evidence for the second channel, relying on a strategic reaction to the perceived overconfidence of the teammate.

We now turn to the second regression on team revenue to test Hypothesis 3. The estimates $\hat{\gamma}_2$ and $\hat{\gamma}_4$ show that team revenue significantly increases in both subjects' self-confidence biases. A unit increase in the high-ability subject i's self-confidence bias raises the average team revenue by CHF 0.21, while a unit increase in the low-ability subject j's self-confidence bias raises the average team revenue by CHF 0.17. This third result confirms Hypothesis 3.

Result 3 *Team revenue increases in self-confidence bias.*

To test Hypotheses 4 and 5, we estimate the following random-effects GLS regression on individual payoffs:

$$U_{it} = \delta_0 + \delta_1 a_i + \delta_2 b_i + \delta_3 b_i^2 + \delta_4 a_j + \delta_5 b_j + \delta_6' X_i + \delta_7' P_t + u_{it} \,. \tag{6}$$

The dependent variable is the payoff of subject i in period t, U_{it}, measured in CHF. Apart from the quadratic form of the self-confidence bias to test Hypothesis 5 – i.e., that a player's payoff is inversely u-shaped in his self-confidence bias – the specification is analogous to the one on effort.

To test Hypothesis 6, we estimate the following random-effects GLS regression on team payoff:

$$\pi_{ijt} = \eta_0 + \eta_1 a_i + \eta_2 b_i + \eta_3 a_j + \eta_4 b_j + \eta_5' X_{ijt} + \eta_6' P_t + u_{ijt} \,, \tag{7}$$

where the dependent variable $\pi_{ijt} = R_{ijt} - ce_{it} - ce_{jt}$ is team payoff, measured in CHF. As in Regression (5), i is the subject with the relatively higher ability multiplier in the team, X_{ijt} denotes team-specific controls, and P_t represents period dummies.

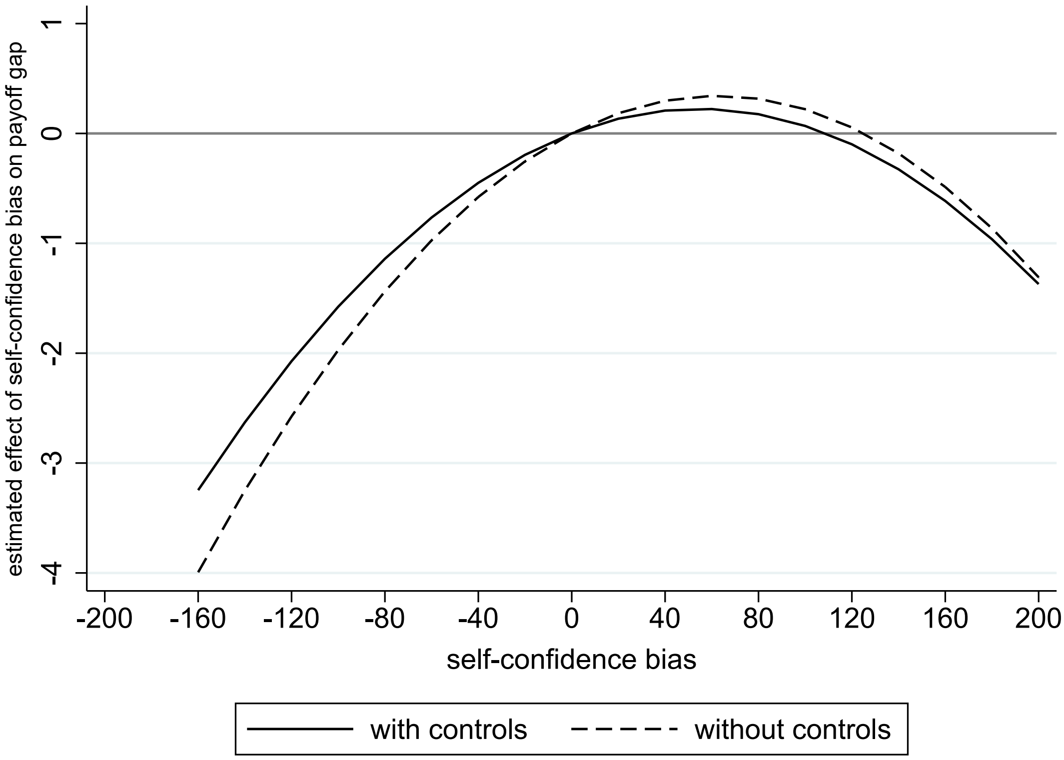
Table 4 exhibits the results of Regressions (6) and (7). The estimate $\hat{\delta}_4$ confirms that the other subject j's self-confidence bias has a positive and significant effect on subject i's payoff. A unit increase in j's self-confidence bias raises i's payoff, on average, by CHF 0.45. This result confirms Hypothesis 4.

Table 4: Payoff Regressions

		Individual Payoff in CHF (U_{it})			Team Payoff in CHF (π_{ijt})	
constant	$\hat{\delta}_0$	-0.6219	4.7491	$\hat{\eta}_0$	-2.8971	7.2910
		(1.3575)	(3.1904)		(3.3883)	(11.0106)
i's ability multiplier (a_i)	$\hat{\delta}_1$	0.0770***	0.0734***	$\hat{\eta}_1$	0.1791***	0.1474***
		(0.0054)	(0.0059)		(0.0209)	(0.0210)
i's self-confidence bias (b_i)	$\hat{\delta}_2$	0.0110**	0.0082	$\hat{\eta}_2$	0.0502***	0.0313*
		(0.0055)	(0.0061)		(0.0170)	(0.0162)
i's self-confidence bias squared (b_i^2)	$\hat{\delta}_3$	-0.0350	-0.0303			
		(0.0221)	(0.0256)			
j's ability multiplier (a_j)	$\hat{\delta}_4$	0.0862***	0.0869***	$\hat{\eta}_3$	0.1526***	0.1570***
		(0.0059)	(0.0059)		(0.0154)	(0.0152)
j's self-confidence bias: (b_j)	$\hat{\delta}_5$	0.0222***	0.0216***	$\hat{\eta}_4$	0.0186	0.0134
		(0.0058)	(0.0059)		(0.0144)	(0.0140)
p-value of Wald test for joint significance of b_i and b_i^2		0.0497**	0.2657			
Controls (X and P)		no	yes		no	yes
No. of observations		1,920	1,920		960	960
R^2		0.6823	0.7005		0.7160	0.7624

The table shows the results of Regressions (6) and (7) with and without controls. These are GLS regressions with random effects and standard errors clustered at the team level. A version of the table showing all estimates, including the ones for the controls, is in Appendix I. Significantly different from zero at 1% (***), 5% (**), 10% (*).

Figure 5: Self-Confidence Bias and Payoff



The figure displays the predicted payoff gap in CHF relative to an unbiased subject with the same ability, teammate, and characteristics. The estimated shape is based on Regression (6).

Result 4 *The other subject j's self-confidence bias raises the focal subject i's payoff.*

The estimates $\hat{\delta}_2$ and $\hat{\delta}_3$ confirm that a subject's self-confidence bias has an inverse u-shaped effect on his payoff. The estimates are significant in the version without controls (Wald test for joint significance: p-value = 0.050) but, due to the larger standard errors, become insignificant once we add controls (Wald test for joint significance: p-value = 0.266). Figure 5 illustrates the result by showing how the self-confidence bias affects the payoff gap relative to an unbiased subject with the same ability, teammate, and characteristics. This result supports Hypothesis 5.

Result 5 *A subject's self-confidence bias has an inversely u-shaped effect on his payoff.*

The estimates $\hat{\eta}_2$ and $\hat{\eta}_4$ reveal that a subject's self-confidence bias has a positive effect on team payoff, although only the coefficient for the high-ability subject i is statistically significant. This result confirms the final Hypothesis 6.

Result 6 *Team payoff increases in teammates' self-confidence biases.*

One potential concern is that our results may be primarily driven by mood effects. If the EASY quiz induced a positive mood and the HARD quiz a negative one, and a better mood led subjects to exert more effort, then the difference in moods could be responsible for the higher effort in the EASY treatment. To rule out this alternative explanation we conducted two additional treatments. These treatments replicate the original ones, including belief elicitation about quiz ranking, but we let subjects know their true ability multipliers when they perform the team effort task. This allows us to test whether mood effects play a role as we rule out self-confidence effects. The results reveal that mood effects only play a minor role. The average effort in the EASY treatment is only 8.5% higher than in the HARD treatment, but this difference is not statistically significant.[17]

4.4 Potential Learning and Delayed Reaction to the Teammate's Ability and Self-Confidence Bias

We now look into potential learning effects with regard to subjects' own ability and delayed reaction to the teammate's ability and self-confidence bias.

4.4.1 Learning with Regard to Own Ability

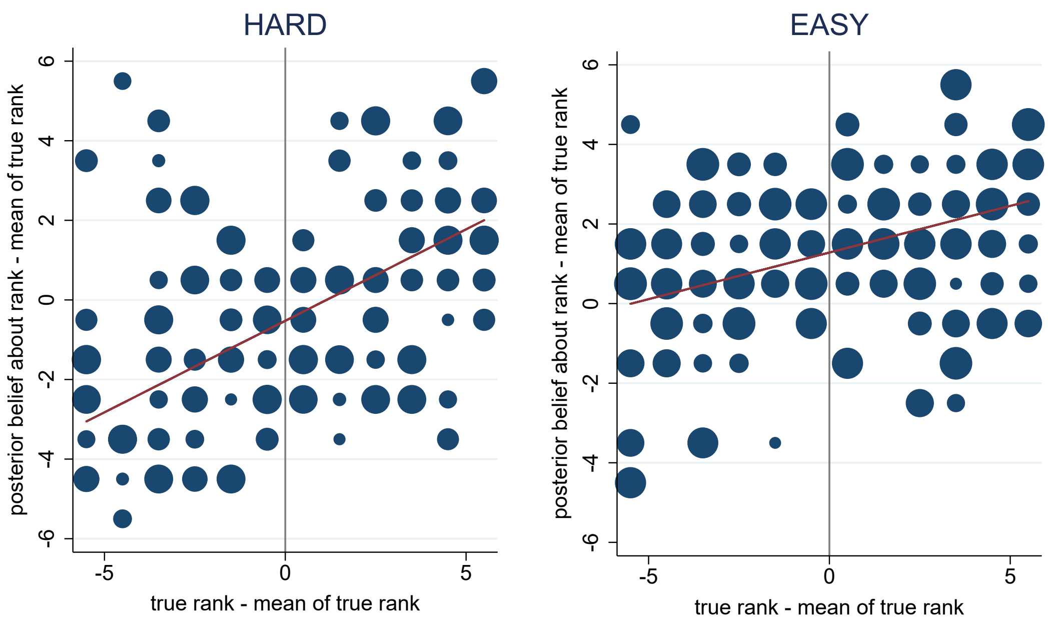
As discussed in Section 3.4, after performing the team effort task in Block 2, we gave subjects the option to update their belief about their rank. The aim was to check whether there was any systematic decline in self-confidence biases over the eight periods due to learning.

Overall, 113 out of the 240 subjects updated their beliefs. In the HARD treatment, 62 subjects made an update, while in the EASY treatment, just 51 updated their beliefs. This difference is not statistically significant (two-sided t-test: p-value = 0.156).

Figure 6 shows how posterior beliefs relate to ranks. It is analogous to Figure 2 but uses posterior instead of prior beliefs. The belief manipulation is still effective as, on average, subjects underestimate their rank in the HARD treatment ($\hat{\alpha}_0 = -0.525$; two-sided t-test: p-value = 0.008) and overestimate it in the EASY treatment ($\hat{\alpha}_0 = 1.283$; two-sided t-test: p-value < 0.001). Moreover, posterior beliefs react to true ranks but there is substantial noise. In the HARD treatment $\hat{\alpha}_1 = 0.460$ (two-sided t-test: p-value < 0.001), while in the EASY treatment $\hat{\alpha}_1 = 0.234$ (two-sided t-test: p-value < 0.001).

[17] Appendix J describes the details of these additional treatments.

Figure 6: Relationship between Posterior Beliefs and True Ranks



The horizontal axis displays the demeaned version of the subjects' true ranks, $r_i - \bar{r}$, where $\bar{r} = 6.5$. The vertical axis shows the difference between the subjects' posterior beliefs about their rank and the mean of the *true* ranks, $\tilde{r}_i - \bar{r}$. Notice that for subjects who did not update their belief, the posterior equals the prior belief. Regression lines are obtained from regressions based on the specification in Equation (3), where we replace prior with posterior beliefs. The size of the circles is proportional to the number of subjects represented by them.

Table 5: Potential Delay in Effort

	Effort in Clicks (e_{it})	
constant	3.8004	4.2864
	(3.5972)	(8.8217)
i's ability multiplier (a_i)	0.1065***	0.0706***
	(0.0199)	(0.0208)
i's self-confidence bias (b_i)	0.1042***	0.0860***
	(0.0230)	(0.0213)
period counter (p_t)	-0.1721	-0.1721
	(0.2888)	(0.2900)
j's ability multiplier (a_j)	0.0284	0.0342*
	(0.0191)	(0.0183)
$a_j \times p_t$	0.0015	0.0015
	(0.0019)	(0.0019)
j's self-confidence bias: (b_j)	-0.0045	-0.0089
	(0.0207)	(0.0201)
$b_j \times p_t$	0.0030	0.0030
	(0.0022)	(0.0022)
p-value of Wald test for joint significance of p_t, $a_j \times p_t$ and $b_j \times p_t$	0.5270	0.5305
Controls (X and P)	no	yes
No. of observations	1920	1920
R^2	0.1187	0.2512

The table shows the results of the random-effects GLS regression with and without controls. Standard errors are clustered at the team level. Significantly different from zero at 1% (***), 5% (**), 10% (*).

In sum, the average self-confidence bias (indicated by the intercept) remains virtually unchanged in both treatments. However, at the individual level, there is evidence for some learning in the HARD treatment but not in the EASY treatment. In the HARD treatment, posterior beliefs explain $R^2 = 36.6\%$ of the variance in ranks, whereas prior beliefs only explain $R^2 = 19.0\%$. In the EASY treatment, the two percentages are nearly identical and amount to $R^2 = 15.6\%$ and $R^2 = 14.3\%$, respectively.

4.4.2 Delayed Reaction to the Teammate's Ability and Self-Confidence Bias

Next, we look into whether subjects' effort reacts in a delayed manner to the information about the teammate's ability and self-confidence bias. To do so, we re-estimate a version of the random-effects GLS Regression (4), which interacts with the teammate's ability multiplier, a_j, and her self-confidence bias, b_j, each with a period counter, $p_t \in \{1, 2, \ldots, 8\}$. We replace the period dummies with the period counter to keep the model parsimonious and get a linear approximation of the potential delay in the subjects' effort in clicks.

Table 5 exhibits the results. There is no evidence of a delayed reaction in subjects' effort, neither with respect to the teammate's ability nor with respect to her self-confidence bias. The corresponding coefficients are all insignificant, both individually and jointly (p-values of Wald tests for joint significance: $p = 0.527$ for the regression without controls, $p = 0.531$ for the regression with controls)

5 Conclusion

Our findings have direct implications for setting up and managing teams. While worker overconfidence can have many negative consequences, we point out one way in which it can be beneficial. Our main finding, that overconfidence leads to more effort and less free riding, indicates that organizations could benefit from setting up overconfident teams and promoting overconfidence among their existing members. At the same time, the lack of evidence for the second channel, which relies on the perceived overconfidence of teammates, suggests that a strategy whereby workers signal own overconfidence to get their teammates to exert more effort is likely bound to fail. Similarly, a team leader making her subordinates aware of the prevailing overconfidence in the team may not result in higher effort.

In addition, the findings are economically significant. Subjects in the EASY treatment provide 21.1% more effort and catch 4.8% more balls than subjects in the HARD treatment.

This increase in effort provision and productivity in the EASY treatment translates into a 6.4% increase in team revenue. Furthermore, our estimates indicate that, if a subject's overconfidence increases by 3 ranks (i.e., roughly one standard deviation), his effort increases by 6.25 clicks, which corresponds to 28.1% of the average effort in our task. According to the estimates of team revenue, this increase in effort would result in an average increase in team revenue by 9.3%. Hence, setting up overconfident teams could lead to meaningful gains in team output.

There is also room for future research. The paper empirically tests the model of Gervais and Goldstein (2007), which rests on two main assumptions regarding teamwork. The first assumption is that players' efforts are strategic complements. This first assumption finds empirical support in Friebel et al. (2017) who show in a field experiment in a large retail chain that complementarities in workers' efforts are a feature of teamwork. The second assumption is that a player's ability and effort are complements. For instance, in tasks where time (effort) and cognitive skills (ability) matter, a more able employee will produce higher output in the same time than a less able colleague (Sautmann, 2013). There is less empirical support for this assumption. Chen and Schilberg-Hörisch (2019) show in a laboratory experiment that ability and effort are complements, however the experiment is on individual and not on team effort. Ultimately, the validity of this assumption hinges on whether, in the trade-off between leisure and compensation, the substitution or the income effect dominates. Although extensively investigated in labor market literature with mixed results (for an overview, see Keane (2011, 2022)), to the best of our knowledge, this question has not yet been empirically examined within the context of teamwork.

Finally, potential detrimental effects of overconfidence, such as excessive risk-taking, intimidation of colleagues, and other negative effects on corporate culture, are beyond the scope of the paper. Future research could also investigate whether the findings are robust or whether they change if subjects know certain characteristics of their teammates, such as their gender or age.

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A Generalized Model with a Concave $q(e)$ Function

In this appendix we show that the comparative static results of the theory model extend to a general concave $q(e)$ function:

$$q(e_i) = \alpha + \beta e_i^{\gamma}, \ i = 1, 2, \tag{A.1}$$

where $\alpha, \beta > 0$ and $\gamma \in (0, 1/2]$. Note that the theory model in the paper assumes $\alpha = 0$, $\beta = 1$, and $\gamma = 1/2$. From (A.1) we have

$$q'(e_i) = \beta\gamma e_i^{\gamma-1}, \ i = 1, 2, \tag{A.2}$$

and

$$q''(e_i) = -(1-\gamma)\beta\gamma e_i^{\gamma-2}, \ i = 1, 2. \tag{A.3}$$

The perceived team revenue of player i is

$$\tilde{R}_i = 2w(\tilde{a}_1 q(e_1) + a_2 q(e_2) + sq(e_1)q(e_2)), \ i = 1, 2.$$

The perceived payoff of player i is

$$\tilde{U}_i = w(\tilde{a}_1 q(e_1) + a_2 q(e_2) + sq(e_1)q(e_2)) - ce_i, \ i = 1, 2.$$

The first-order conditions of players 1 and 2 are

$$\begin{aligned} wq'(e_1)\left[\tilde{a}_1 + sq(e_2)\right] - c &= 0 \\ wq'(e_2)\left[\tilde{a}_2 + sq(e_1)\right] - c &= 0 \end{aligned}$$

or

$$\begin{aligned} wq'(e_1)\left[(a_1 + b_1) + sq(e_2)\right] - c &= 0 \\ wq'(e_2)\left[(a_2 + b_2) + sq(e_1)\right] - c &= 0 \end{aligned}$$

Differentiation of the first-order conditions with respect to e_1, e_2, and b_1 gives us:

$$\begin{aligned} wq''(e_1)\frac{\partial e_1}{\partial b_1}\left[(a_1 + b_1) + sq(e_2)\right] + wq'(e_1)\left[1 + sq'(e_2)\frac{\partial e_2}{\partial b_1}\right] &= 0 \\ wq''(e_2)\frac{\partial e_2}{\partial b_1}\left[(a_2 + b_2) + sq(e_1)\right] + swq'(e_2)q'(e_1)\frac{\partial e_1}{\partial b_1} &= 0 \end{aligned}$$

Solving the first-order condition of player 2 with respect to $\partial e_2/\partial b_1$ we obtain

$$\frac{\partial e_2}{\partial b_1} = -\frac{sq'(e_2)q'(e_1)}{q''(e_2)\left[(a_2 + b_2) + sq(e_1)\right]}\frac{\partial e_1}{\partial b_1}. \tag{A.4}$$

Substituting this equation into the first-order condition of player 1 we obtain

$$q''(e_1)\frac{\partial e_1}{\partial b_1}\left[(a_1+b_1)+sq(e_2)\right]+q'(e_1)\left[1-\frac{s^2[q'(e_2)]^2q'(e_1)}{q''(e_2)\left[(a_2+b_2)+sq(e_1)\right]}\frac{\partial e_1}{\partial b_1}\right]=0,$$

or

$$q''(e_1)\frac{\partial e_1}{\partial b_1}\left[(a_1+b_1)+sq(e_2)\right]+q'(e_1)-\frac{s^2[q'(e_2)]^2[q'(e_1)]^2}{q''(e_2)\left[(a_2+b_2)+sq(e_1)\right]}\frac{\partial e_1}{\partial b_1}=0,$$

or

$$\frac{\partial e_1}{\partial b_1}\left[q''(e_1)\left[(a_1+b_1)+sq(e_2)\right]-\frac{s^2[q'(e_2)]^2[q'(e_1)]^2}{q''(e_2)\left[(a_2+b_2)+sq(e_1)\right]}\right]=-q'(e_1),$$

or

$$\begin{aligned}\frac{\partial e_1}{\partial b_1} &= -\frac{q'(e_1)}{q''(e_1)\left[(a_1+b_1)+sq(e_2)\right]-\frac{s^2[q'(e_2)]^2[q'(e_1)]^2}{q''(e_2)[(a_2+b_2)+sq(e_1)]}}\\ &= -\frac{q'(e_1)q''(e_2)\left[(a_2+b_2)+sq(e_1)\right]}{q''(e_1)\left[(a_1+b_1)+sq(e_2)\right]q''(e_2)\left[(a_2+b_2)+sq(e_1)\right]-s^2[q'(e_2)]^2[q'(e_1)]^2}\end{aligned} \tag{A.5}$$

It follows from (A.5) that the equilibrium effort of player 1 is increasing in his self-confidence bias as long as

$$q''(e_1)\left[(a_1+b_1)+sq(e_2)\right]q''(e_2)\left[(a_2+b_2)+sq(e_1)\right]>s^2[q'(e_2)]^2[q'(e_1)]^2. \tag{A.6}$$

From the first-order conditions we have

$$\begin{aligned}\left[(a_1+b_1)+sq(e_2)\right] &= \frac{c}{wq'(e_1)}\\ \left[(a_2+b_2)+sq(e_1)\right] &= \frac{c}{wq'(e_2)}\end{aligned}$$

Substituting these two equations into (A.6) we obtain

$$q''(e_1)\frac{c}{wq'(e_1)}q''(e_2)\frac{c}{wq'(e_2)}>s^2[q'(e_2)]^2[q'(e_1)]^2,$$

or

$$\frac{c^2}{w^2}\frac{q''(e_1)q''(e_2)}{q'(e_1)q'(e_2)}>s^2[q'(e_2)]^2[q'(e_1)]^2,$$

or

$$c^2q''(e_1)q''(e_2)>s^2w^2[q'(e_2)]^3[q'(e_1)]^3.$$

Making use (A.2) and (A.3) we have

$$c^2(1-\gamma)^2\beta^2\gamma^2e_1^{\gamma-2}e_2^{\gamma-2}>s^2w^2\beta^6\gamma^6e_1^{3\gamma-3}e_2^{3\gamma-3},$$

or

$$c^2(1-\gamma)^2e_1^{1-2\gamma}e_2^{1-2\gamma}>s^2w^2\beta^4\gamma^4. \tag{A.7}$$

If equilibrium effort is greater than 1 and $\gamma \in (0, 1/2]$, then inequality (A.7) is satisfied provided that

$$c^2(1-\gamma)^2 > s^2 w^2 \beta^4 \gamma^4. \tag{A.8}$$

Hence, if (A.8) holds, then the equilibrium effort of player 1 is increasing in his self-confidence bias, that is,

$$\frac{\partial e_1}{\partial b_1} > 0.$$

Furthermore, the equilibrium effort of player 2 is increasing with player 1's self-confidence bias since $\partial e_1/\partial b_1 > 0$, (A.4), and $q''(e_2) < 0$ imply

$$\frac{\partial e_2}{\partial b_1} > 0.$$

B Theory Comparison to Gervais and Goldstein (2007)

This Appendix summarizes the theory model by Gervais and Goldstein (2007) and its predictions.[18] It also shows that our theory model makes similar predictions. Gervais and Goldstein (2007) assume that production derives from a single one-period project, which can either succeed or fail with probability π and $1-\pi$, respectively. The project generates $\sigma > 0$ dollars if it succeeds, and zero if it fails. Therefore, the firm's expected profit is given by $\pi\sigma$. The probability of success π depends on the choice of effort $e_i \in [0,1]$ by each player i and is given by

$$\pi = a_1 e_1 + a_2 e_2 + s e_1 e_2,$$

where $a_i \geq 0$, $s > 0$, and $a_1 + a_2 + s < 1$. The parameter a_i is interpreted as the ability of player i. The parameter s captures the effect of the interaction between the two players. Since $s > 0$ the two players create positive externalities on each other. The players are risk neutral, choose their effort to maximize their expected utility, and sustain a private utility cost of effort given by $c(e_i) = e_i^2/2$. Player 1 is unbiased or rational whereas player 2 suffers from a self-confidence bias. Moreover, player 2 thinks that he is more skilled than he really is, and therefore overestimates the contribution of his effort to the project's chance of success. Specifically, he thinks his ability is $\tilde{a}_2 \geq a_2$, although it is actually only a_2. Hence, player 2's self-confidence bias is $b \equiv \tilde{a}_2 - a_2 \in [0, 1 - a_1 - a_2 - s)$. Player i is paid w_i if the project succeeds, and zero if it fails. Hence, player 2 solves the following maximization problem

$$\max_{e_2 \in [0,1]} w_2[a_1 e_1 + (a_2 + b)e_2 + s e_1 e_2] - \frac{1}{2} e_2^2.$$

From this it follows that player 2 chooses

$$e_2 = w_2(a_2 + b + s e_1).$$

A similar maximization problem for the rational player 1 gives

$$e_1 = w_1(a_1 + s e_2).$$

Lemma 1 in Gervais and Goldstein (2007) shows that the equilibrium efforts are given by

$$e_1 = \frac{[a_1 + (a_2 + b) s w_2] w_1}{1 - s^2 w_1 w_2},$$

[18] We do not explain the firm's choice of compensation contracts since this is neither part of our theory model or our experiment.

and

$$e_2 = \frac{(a_2 + b + a_1 s w_1) w_2}{1 - s^2 w_1 w_2}.$$

It is easy to verify that the equilibrium effort levels of the two players are increasing in w_1, w_2, a_1, a_2, s, and b. Next, Proposition 1 in Gervais and Goldstein (2007) shows that (i) firm value, $F = (\sigma - w_1 - w_2)(a_1 e_1 + a_2 e_2 + s e_1 e_2)$, is increasing in b; (ii) the payoff of player 1 is increasing in b; and (iii) the payoff of player 2 is increasing in b if and only if

$$b < \frac{s(a_1 + a_2 s w_2) w_1}{1 - 2 s^2 w_1 w_2},$$

that is, if his overconfidence is not too extreme. Note that in the special case where the entire profit is distributed and split equally between the two players we have

$$w_1 = w_2 = \frac{\sigma}{2}.$$

As we have seen, our theory model assumes team revenue is deterministic and given by

$$R = 2w[a_1 q(e_1) + a_2 q(e_2) + s q(e_1) q(e_2)],$$

where $a_i > 0$, $s > 0$, and $q(e_i)$ satisfies $q'(e_i) > 0$ and $q''(e_i) < 0$. The players are risk neutral, choose their effort to maximize their perceived utility, and sustain a private utility cost of effort given by $c(e_i) = c e_i$, with $c > 0$. Both players can be biased. Player i's self-confidence bias is $b_i \equiv \tilde{a}_i - a_i$. Player i receives half of team revenue and hence solves the following maximization problem

$$\max_{e_i} w[(a_i + b_i) q(e_i) + a_j q(e_j) + s q(e_i) q(e_j)] - c e_i.$$

Hence, the equilibrium effort levels of players 1 and 2 satisfy

$$w\left[(a_1 + b_1) + s q(e_2)\right] q'(e_1) = c,$$

and

$$w\left[(a_2 + b_2) + s q(e_1)\right] q'(e_2) = c.$$

Since $q(e_i)$ is strictly concave and $c(e_i)$ is linear, the second-order conditions are satisfied. Furthermore, as we have seen in Appendix A, assuming

$$q(e_i) = \alpha + \beta e_i^{\gamma},$$

with $\alpha, \beta > 0$, $\gamma \in (0, 1/2]$, and $c^2(1-\gamma)^2 > s^2 w^2 \beta^4 \gamma^4$ implies the equilibrium effort of player i is increasing in w, a_1, a_2, s, b_i and b_j.

C Derivation of Hypotheses 4, 5, and 6

This appendix shows that our theory model implies: (i) the payoff of player i is increasing in b_j; (ii) the payoff of player i is inversely u-shaped in his self-confidence bias b_i; (iii) an increase in a player i's self-confidence bias raises team payoff. The equilibrium payoff of player i is

$$U_i = w[a_i q(e_i) + a_j q(e_j) + sq(e_i)q(e_j)] - ce_i,$$

where e_i and e_j are the equilibrium efforts of the two players given by the first-order conditions in Appendix A. We know from Appendix A that an increase in player j's self-confidence bias b_j raises the equilibrium effort of player j, e_j. Since the payoff of player i increases in the effort of player j, an increase in b_j raises the payoff of player i. This proves (i). The effect of an increase in b_i on U_i is given by

$$\begin{aligned}
\frac{\partial U_i}{\partial b_i} &= w\left[a_i q'(e_i)\frac{\partial e_i}{\partial b_i} + a_j q'(e_j)\frac{\partial e_j}{\partial b_i} + sq'(e_i)q(e_j)\frac{\partial e_i}{\partial b_i} + sq(e_i)q'(e_j)\frac{\partial e_j}{\partial b_i}\right] - c\frac{\partial e_i}{\partial b_i} \\
&= \left[wq'(e_i)\left[a_i + sq(e_j)\right] - c\right]\frac{\partial e_i}{\partial b_i} + wq'(e_j)\left[a_j + sq(e_i)\right]\frac{\partial e_j}{\partial b_i} \\
&= \left[wq'(e_i)\left[a_i + sq(e_j)\right] - c\right]\frac{\partial e_i}{\partial b_i} + wq'(e_j)\left[a_j + sq(e_i)\right]\frac{\partial e_j}{\partial b_i} \\
&= \left[wq'(e_i)\left[a_i + b_i - b_i + sq(e_j)\right] - c\right]\frac{\partial e_i}{\partial b_i} + wq'(e_j)\left[a_j + sq(e_i)\right]\frac{\partial e_j}{\partial b_i} \\
&= \left[wq'(e_i)\left[a_i + b_i + sq(e_j)\right] - c\right]\frac{\partial e_i}{\partial b_i} - b_i wq'(e_i)\frac{\partial e_i}{\partial b_i} + wq'(e_j)\left[a_j + sq(e_i)\right]\frac{\partial e_j}{\partial b_i} \\
&= -b_i wq'(e_i)\frac{\partial e_i}{\partial b_i} + wq'(e_j)\left[a_j + sq(e_i)\right]\frac{\partial e_j}{\partial b_i} \\
&= -b_i wq'(e_i)\frac{\partial e_i}{\partial b_i} - \frac{sw\left[a_j + sq(e_i)\right]\left[q'(e_j)\right]^2 q'(e_i)}{q''(e_j)\left[a_j + b_j + sq(e_i)\right]}\frac{\partial e_i}{\partial b_i} \\
&= wq'(e_i)\left[-b_i - \frac{s\left[a_j + sq(e_i)\right]\left[q'(e_j)\right]^2}{q''(e_j)\left[a_j + b_j + sq(e_i)\right]}\right]\frac{\partial e_i}{\partial b_i}.
\end{aligned}$$

We know from Appendix A that $\partial e_i/\partial b_i > 0$. Hence, $\partial U_i/\partial b_i > 0$ when

$$-b_i - \frac{s\left[a_j + sq(e_i)\right]\left[q'(e_j)\right]^2}{q''(e_j)\left[a_j + b_j + sq(e_i)\right]} > 0,$$

or

$$b_i < -s\frac{\left[q'(e_j)\right]^2}{q''(e_j)}\frac{a_j + sq(e_i)}{a_j + b_j + sq(e_i)}.$$

Since $q'(e_j) = \gamma\beta e_j^{\gamma-1}$ and $q''(e_j) = -(1-\gamma)\gamma\beta e_j^{\gamma-2}$ we have

$$b_i < s\frac{\gamma^2\beta^2 e_j^{2(\gamma-1)}}{(1-\gamma)\gamma\beta e_j^{\gamma-2}}\frac{a_j + sq(e_i)}{a_j + b_j + sq(e_i)},$$

or

$$b_i < s\frac{\gamma\beta e_j^\gamma}{1-\gamma}\frac{a_j + s(\alpha+\beta e_i^\gamma)}{a_j+b_j+s(\alpha+\beta e_i^\gamma)}. \tag{A.9}$$

This inequality indicates that the payoff of player i is increasing in his self-confidence bias b_i for low values of the bias and decreasing with his self-confidence bias for high values of the bias (an inversely u-shaped relationship). However, since the equilibrium efforts e_i and e_j are themselves a function of b_i we cannot know for sure this relationship holds. However, we can show that this relationship holds in our theory model presented in the paper, that is, assuming $\alpha = 0$, $\beta = 1$, $\gamma = 1/2$. Under this specification we have

$$e_i = k\left[w(a_i+b_i) + \frac{sw^2}{2c}(a_j+b_j)\right]^2,$$

where $k = (2c)^2/(4c^2 - s^2w^2)^2$. Hence, (A.9) becomes

$$b_i < s\sqrt{k}\left[w(a_j+b_j)+\frac{sw^2}{2c}(a_i+b_i)\right]\frac{a_j + s\sqrt{k}\left[w(a_i+b_i)+\frac{sw^2}{2c}(a_j+b_j)\right]}{a_j+b_j+s\sqrt{k}\left[w(a_i+b_i)+\frac{sw^2}{2c}(a_j+b_j)\right]}.$$

Taking $i = 2$ and $j = 1$ we have

$$b_2 < s\sqrt{k}\left[w(a_1+b_1)+\frac{sw^2}{2c}(a_2+b_2)\right]\frac{a_1 + s\sqrt{k}\left[w(a_2+b_2)+\frac{sw^2}{2c}(a_1+b_1)\right]}{a_1+b_1+s\sqrt{k}\left[w(a_2+b_2)+\frac{sw^2}{2c}(a_1+b_1)\right]}. \tag{A.10}$$

Let us now assume $b_1 = 0$ and $b_2 > 0$. In this case (A.10) becomes

$$b_2 < s\sqrt{k}\left[wa_1 + \frac{sw^2}{2c}(a_2+b_2)\right],$$

or

$$b_2 < s\frac{2c}{4c^2-s^2w^2}\left[wa_1+\frac{sw^2}{2c}(a_2+b_2)\right],$$

or

$$\left(4c^2 - s^2w^2\right)b_2 < s\left[2wca_1 + sw^2(a_2+b_2)\right],$$

or

$$\left(4c^2 - 2s^2w^2\right)b_2 < sw\left(2ca_1 + swa_2\right),$$

or

$$b_2 < \frac{sw\left(2ca_1+swa_2\right)}{4c^2-2s^2w^2}$$

This proves (ii) when $\alpha = 0$, $\beta = 1$, $\gamma = 1/2$, $b_1 = 0$, and $b_2 = b$. Note further that we can collapse our model to Gervais and Goldstein (2007) by assuming $b_1 = 0$, $b_2 = b$, $c = 1/2$, $w_1 = w$, and $w_2 = w$. Under this specification (A.10) becomes

$$b < sw_1\sqrt{k}\left[a_1 + sw_2(a_2+b)\right],$$

or

$$b < sw_1 \frac{1}{1 - s^2 w_1 w_2} \left[a_1 + sw_2(a_2 + b) \right],$$

or

$$b < \frac{sw_1}{1 - s^2 w_1 w_2} \left[a_1 + sw_2(a_2 + b) \right],$$

or

$$(1 - s^2 w_1 w_2) b < sw_1 a_1 + s^2 w_1 w_2 a_2 + s^2 w_1 w_2 b,$$

or

$$(1 - 2s^2 w_1 w_2) b < sw_1 a_1 + s^2 w_1 w_2 a_2,$$

or

$$b < \frac{s(a_1 + a_2 s w_2) w_1}{1 - 2s^2 w_1 w_2}.$$

This last inequality is identical to that provided by Gervais and Goldstein (2007) in Proposition 1 (see Appendix B).

Team payoff is given by

$$\pi = 2w[a_i q(e_i) + a_j q(e_j) + sq(e_i)q(e_j)] - c(e_i + e_j).$$

The effect of an increase in player i's bias on π is given by

$$\begin{aligned}
\frac{\partial \pi}{\partial b_i} &= 2w \left[a_i q'(e_i) \frac{\partial e_i}{\partial b_i} + a_j q'(e_j) \frac{\partial e_j}{\partial b_i} + sq'(e_i)q(e_j) \frac{\partial e_i}{\partial b_i} + sq(e_i)q'(e_j) \frac{\partial e_j}{\partial b_i} \right] \\
&\quad - c \left(\frac{\partial e_i}{\partial b_i} + \frac{\partial e_j}{\partial b_i} \right) \\
&= \left[2wq'(e_i) \left[a_i + sq(e_j) \right] - c \right] \frac{\partial e_i}{\partial b_i} + \left[2wq'(e_j) \left[a_j + sq(e_i) \right] - c \right] \frac{\partial e_j}{\partial b_i} \\
&= \left[wq'(e_i) \left[a_i - b_i + sq(e_j) \right] + wq'(e_i) \left[(a_i + b_i) + sq(e_j) \right] - c \right] \frac{\partial e_i}{\partial b_i} \\
&\quad + \left[wq'(e_j) \left[a_j - b_j + sq(e_i) \right] + wq'(e_j) \left[(a_j + b_j) + sq(e_i) \right] - c \right] \frac{\partial e_j}{\partial b_i} \\
&= wq'(e_i) \left[a_i - b_i + sq(e_j) \right] \frac{\partial e_i}{\partial b_i} + wq'(e_j) \left[a_j - b_j + sq(e_i) \right] \frac{\partial e_j}{\partial b_i}, \qquad \text{(A.11)}
\end{aligned}$$

where the last equality follows from the first-order conditions of players i and j. Recall from Appendix A that $\partial e_i / \partial b_i > 0$ and $\partial e_j / \partial b_i > 0$. Hence, it follows from (A.11) that if a team is composed of two underconfident players, i.e., $b_i < 0$ and $b_j < 0$, then $\partial \pi / \partial b_i > 0$. It also follows from (A.11) that if a team is composed of one overconfident player i and one underconfident player j, i.e., $b_i > 0$ and $b_j < 0$, then a sufficient condition for $\partial \pi / \partial b_i > 0$ is that $a_i - b_i > 0$. Furthermore, it follows from (A.11) that if a team is composed of two overconfident players, i.e., $b_i > 0$ and $b_j > 0$, then a sufficient condition for $\partial\pi/\partial b_i > 0$ is that $a_i - b_i > 0$ and $a_j - b_j > 0$. In other words, in a team composed of two overconfident players, a sufficient condition for an increase in player i's overconfidence to raise team payoff is that each player's overconfidence bias is less than that player's true ability. Note also that if a team is composed of two overconfident players who have a true ability above the median, then $b_i < a_i$ and $b_j < a_j$, and therefore $\partial\pi/\partial b_i > 0$. This means that if a team is composed of two overconfident players, the sufficient condition only matters when at least one player has a true ability below the median. The intuition behind this result is that a very large overconfidence bias can lead the players to choose effort levels above the first-best. When that happens, an increase in player i's overconfidence lowers team payoff.

Note that the first-best effort levels are the solution to

$$\max_{e_i,e_j} 2w[a_i q(e_i) + a_j q(e_j) + sq(e_i)q(e_j)] - c(e_i + e_j).$$

The first-order conditions of this problem are

$$\begin{aligned} \frac{\partial R(e_i,e_j)}{\partial e_i} - c &= 2w[a_i + sq(e_j)]q'(e_i) - c = 0 \\ \frac{\partial R(e_i,e_j)}{\partial e_j} - c &= 2w[a_j + sq(e_i)]q'(e_j) - c = 0 \end{aligned} \tag{A.12}$$

When both players are unbiased, i.e., $b_i = b_j = 0$, the equilibrium effort levels are given by the first-order conditions

$$\begin{aligned} \frac{1}{2}\frac{\partial R(e_i,e_j)}{\partial e_i} - c &= w[a_i + sq(e_j)]q'(e_i) - c = 0 \\ \frac{1}{2}\frac{\partial R(e_i,e_j)}{\partial e_j} - c &= w[a_j + sq(e_i)]q'(e_j) - c = 0 \end{aligned} \tag{A.13}$$

Note that the assumption that $q(e_i)$ is concave implies that team revenue is a concave function of effort since

$$\frac{\partial^2 R(e_i,e_j)}{\partial e_i^2} = 2w[a_i + sq(e_j)]q''(e_i) < 0.$$

It follows from (A.12), (A.13), and concavity of team revenue, that when both players are unbiased, they under provide effort relative to the first-best. This is due to the free-riding problem: when a player raises his effort this increases team revenue but he only receives half of that increase. Hence, an increase in overconfidence of either player will raise the effort of both players and team payoff as long as players' efforts are below the first-best.

D Distribution of Individual Characteristics across Treatments

Table 6: Individual Characteristics across Treatments

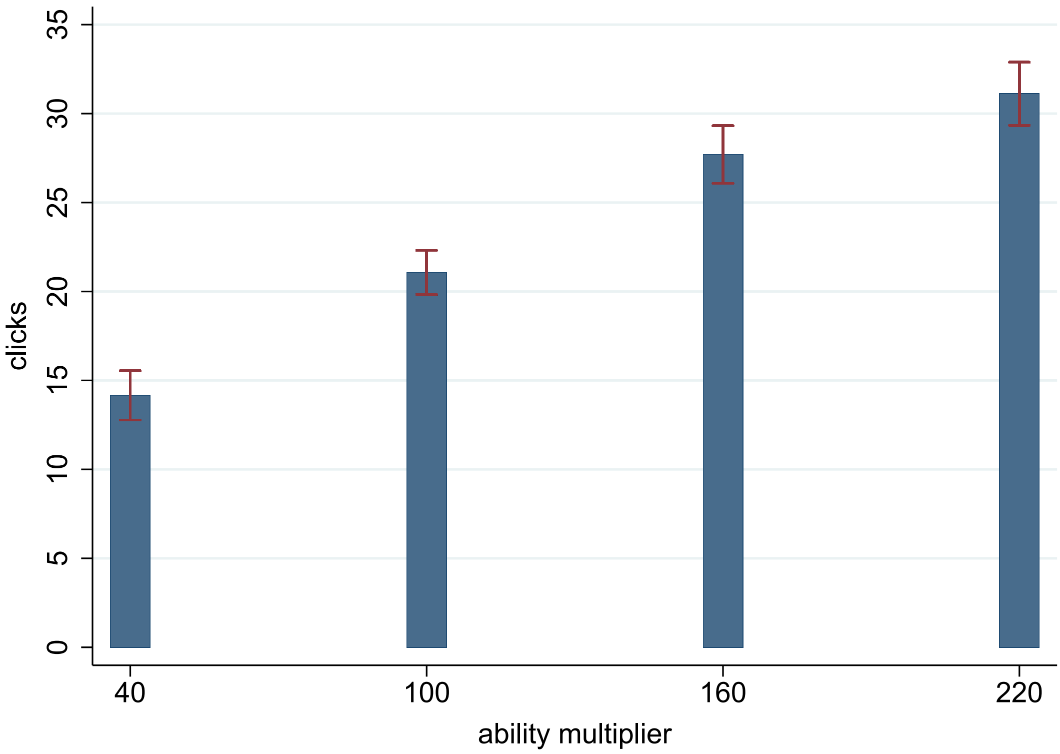
	ALL	EASY	HARD	p-value EASY-HARD
age	21.4292	21.3917	21.4667	0.8829
	(3.9329)	(3.5911)	(4.2623)	
male	0.5375	0.6083	0.4667	0.0278
	(0.4996)	(0.4902)	(0.5010)	
risk aversion	-7.6458	-10.0417	-5.25	0.0483
	(18.8137)	(19.4255)	(17.9431)	
preferences efficiency	0.6625	0.6667	0.6583	0.8920
	(0.4738)	(0.4734)	(0.4763)	
inequality aversion	0.2	0.15	0.25	0.0531
	(0.4008)	(0.3586)	(0.4348)	
inequality loving	0.0333	0.0417	0.025	0.4741
	(0.1799)	(0.2007)	(0.1568)	
spiteful	0.0125	0.025	n.a.[a]	n.a.[a]
	(0.1113)	(0.1568)		
swiss	0.5667	0.5583	0.575	0.7955
	(0.4966)	(0.4987)	(0.4964)	
only child	0.0958	0.0917	0.1	0.8273
	(0.2950)	(0.2898)	(0.3013)	
education parents	0.4833	0.4833	0.4833	1
	(0.5000)	(0.5018)	(0.5018)	
people known	0.3208	0.3333	0.3083	0.7586
	(0.6281)	(0.5397)	(0.7077)	
big town	0.5667	0.5583	0.575	0.7955
	(0.4966)	(0.4987)	(0.4964)	
unil	0.6417	0.5917	0.6917	0.1071
	(0.4805)	(0.4936)	(0.4637)	
bachelor	0.775	0.8167	0.7333	0.1232
	(0.4185)	(0.3886)	(0.441)	
grade	4.6333	4.6583	4.6083	0.4614
	(0.5244)	(0.4936)	(0.5545)	
No. of observations	240	120	120	

Standard errors are shown in parentheses.

[a] The difference on spiteful could not be estimated, as there are no spiteful subjects in the HARD treatment.

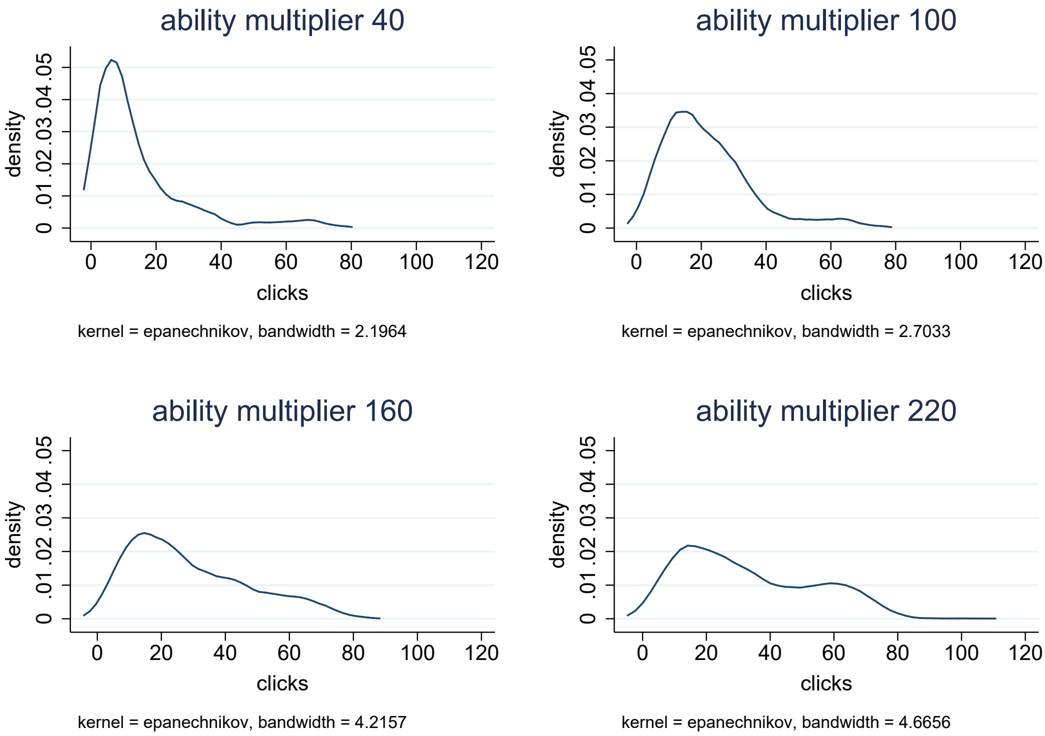
E Effect of Ability Multiplier on Effort Provision in Trial Periods

Figure 7: Average number of clicks per multiplier during trial periods



This figure depicts the average number of clicks in the trial periods for each of the four ability multipliers (40,100,160,220). The mean number of clicks is 14.16, 21.07, 27.70, and 31.11. Confidence intervals are depicted in red.

Figure 8: Density of number of clicks per multiplier during trial periods



This figure displays the density of the number of clicks for each of the four multiplier.

F Adjusting for Multiple Hypotheses Testing

Since in Section 4.2 we have four outcomes on which we regress our binary treatment variable, the resulting p-values should be adjusted for multiple hypothesis testing (see for example List et al. (2019)). To the best of our knowledge the procedure proposed by List et al. (2019), with its associated *mhtexp* stata command, works only for OLS specifications without clustering. The underlying multiple hypothesis procedure used in List et al. (2019) is the Romano-Wolf test statistic (Romano and Wolf, 2005a,b, 2016). However, we employ another resample-based multiple testing statistic from Westfall and Young (1993). The Westfall-Young test statistic has the advantage to allow for clustering but, unfortunately, not for the GLS specification. Given that the clustered standard errors in OLS and in GLS with random effects are similiar, as it can be seen in Table 7, we use the Westfall-Young (WY) test statistics for the correction of multiple hypotheses. We see that the main result, concerning the number of clicks, remains significant. Resample-based test statistics are usually more efficient than simple correction procedures, such as Bonferroni or Holm, which we also report in Table 7 and which give qualitatively the same results.

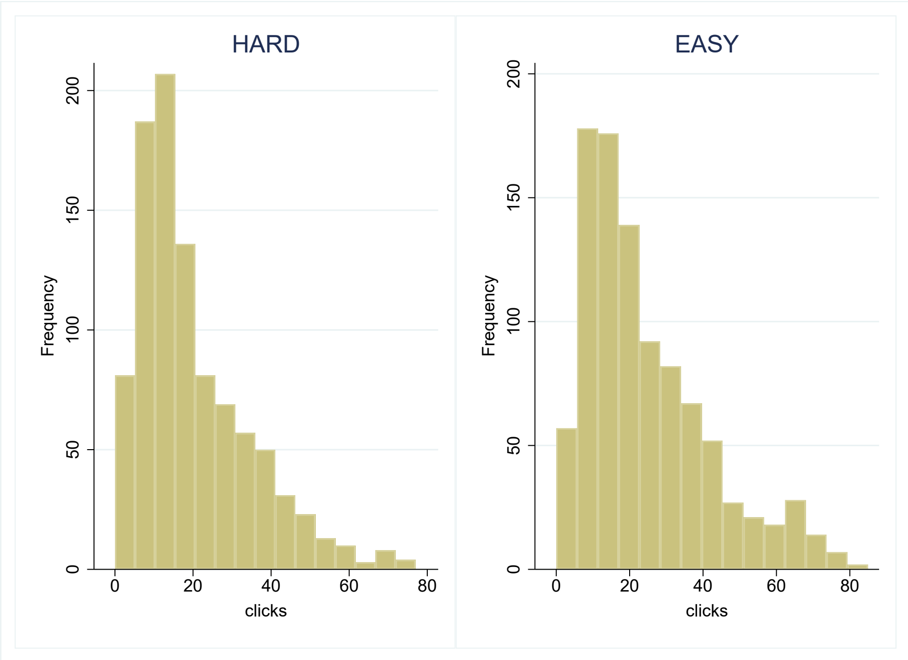
Table 7: Adjusting for Multiple Hypotheses Testing

		p values				
		unadjusted		adjusted		
Regression Type		GLS	OLS	OLS		
Standard Errors		Clustered	Clustered	Clustered		
Outcome	Diff. in means			WY	Holm	Bonferroni
Clicks	4.2573	0.0201**	0.0218**	0.0489**	0.0872*	0.0872*
Catches	1.5646	0.1021	0.1048	0.1702	0.3143	0.4190
Team revenue	3.0045	0.3417	0.3437	0.3741	0.6873	1
Individual payoffs	0.7927	0.5663	0.5673	0.5689	0.5673	1

WY stands for Westfall-Young. Significantly different from zero at 1% (***), 5% (**), 10% (*).

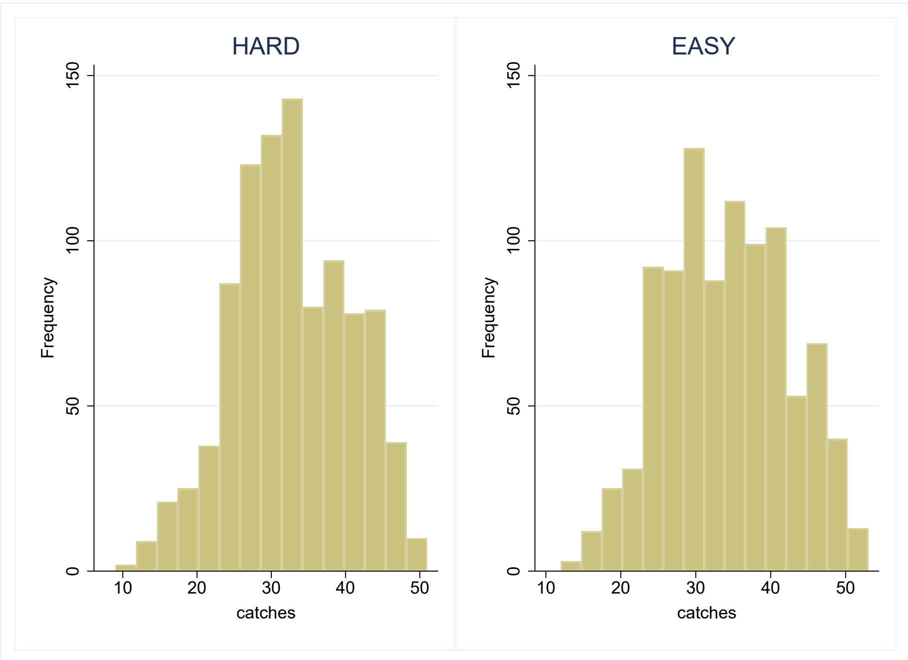
G Distribution of Clicks and Catches per Treatment

Figure 9: Distribution of Number of Clicks per Treatment



This figure displays the distribution of the number of clicks in each treatment.

Figure 10: Distribution of Number of Catches per Treatment



This figure displays the distribution of the number of catches in each treatment.

H Regression (4) with the Square Root of Effort as the Dependent Variable

Table 8: Square Root of Effort Regression

		Effort in squared root of clicks ($\sqrt{e_{it}}$)
constant	$\hat{\beta}_0$	2.401** (0.9365)
i's ability multiplier (a_i)	$\hat{\beta}_1$	0.079*** (0.0021)
i's self-confidence bias (b_i)	$\hat{\beta}_2$	0.0093*** (0.0021)
j's ability multiplier (a_j)	$\hat{\beta}_3$	0.0036** (0.0018)
j's self-confidence bias: (b_j)	$\hat{\beta}_4$	-0.0002 (0.0018)
age		0.0059 (0.0214)
gender		0.9168*** (0.1741)
risk aversion		0.0008 (0.0045)
preferences efficiency		0.5013* (0.3047)
inequality aversion		0.1003 (0.3240)
inequality loving		-0.0161 (0.5970)
spiteful		1.7971 (1.6964)
swiss		0.1071 (0.1642)
only child		-0.6486*** (0.2321)
education parents		-0.2296 (0.1729)
people known		-0.0380 (0.1192)
big town		-0.0649 (0.1708)
unil		-0.1845 (0.1925)
bachelor		-0.4017* (0.2256)
grade		0.0159 (0.1447)
period 2		0.0210 (0.0502)
period 3		-0.0236 (0.0640)
period 4		-0.0122 (0.0724)
period 5		-0.0378 (0.0761)
period 6		-0.0380 (0.0749)
period 7		0.0489 (0.0873)
period 8		-0.0137 (0.0776)
No. of observations		1,920
R^2		0.2625

The table shows the results of Regression (4) with all controls with the dependant being the squared root of the number of clicks instead of the number of clicks. These are GLS regressions with random effects and standard errors clustered at the team level. Significantly different from zero at 1% (***), 5% (**), 10% (*).

I Regression Results Showing all Controls

Table 9: Effort and Team Revenue Regressions Showing all Controls

		Effort in Clicks (e_{it})		Team Revenue in CHF (R_{ijt})
constant	$\hat{\beta}_0$	3.2969 (8.8708)	$\hat{\gamma}_0$	11.1897 (14.4512)
i's ability multiplier (a_i)	$\hat{\beta}_1$	0.0706*** (0.0208)	$\hat{\gamma}_1$	0.1699*** (0.0289)
i's self-confidence bias (b_i)	$\hat{\beta}_2$	0.0860*** (0.0213)	$\hat{\gamma}_2$	0.0507** (0.0230)
j's ability multiplier (a_j)	$\hat{\beta}_3$	0.0409** (0.0178)	$\hat{\gamma}_3$	0.1752*** (0.0223)
j's self-confidence bias: (b_j)	$\hat{\beta}_4$	0.0045 (0.0185)	$\hat{\gamma}_4$	0.0273* (0.0171)
age		0.1286 (0.2107)		-0.0930 (0.1935)
male		8.4540*** (1.6425)		
male-male				9.4222*** (2.1456)
male-female				3.4482* (1.9380)
risk aversion		-0.0014 (0.0417)		-0.0026 (0.0519)
preferences efficiency		4.4552 (2.8312)		7.9681* (4.4523)
inequality aversion		0.6297 (2.9114)		3.1270 (4.4078)
inequality loving		0.5889 (6.2322)		0.4857 (9.7234)
spiteful		22.2901 (17.6590)		6.3875 (15.7544)
swiss		0.7134 (1.5688)		
swiss-swiss				1.2527 (2.3189)
swiss-other				2.5905 (2.1595)
only child		-6.3235*** (2.1420)		-3.8194 (3.1626)
education parents		-2.6719 (1.7271)		-1.0875 (2.7657)
people known		-0.7149 (1.1767)		0.3338 (2.2263)
big town		-1.3102 (1.7044)		-0.7440 (2.1125)
unil		-1.6747 (1.9778)		-1.4432 (7.5033)
bachelor		-4.0133* (2.1437)		-8.9509*** (3.4102)
grade		-0.0941 (1.4414)		-1.3513 (2.1864)
period 2		0.3667 (0.4988)		-0.1335 (0.6862)
period 3		0.0458 (0.6471)		-0.3228 (0.7495)
period 4		0.1708 (0.7255)		-0.8714 (0.8413)
period 5		0.025 (0.7459)		-0.7154 (0.9278)
period 6		0.05 (0.7383)		-2.0349** (0.8791)
period 7		0.9375 (0.9149)		-1.3835 (0.9348)
period 8		0.125 (0.7690)		-1.1808 (0.8913)
No. of observations		1,920		960
R^2		0.2511		0.7125

The table shows the results of Regressions (4) and (5) with all controls. In the regression on team revenue, controls are averaged over both teammates, except for the gender and nationality composition of the team and the period dummies. These are GLS regressions with random effects and standard errors clustered at the team level. Significantly different from zero at 1% (***), 5% (**), 10% (*).

Table 10: Payoff Regressions Showing all Controls

		Payoff in CHF (U_{it})		Team Payoff in CHF (π_{ijt})
constant	$\hat{\delta}_0$	4.7491 (3.1904)	$\hat{\eta}_0$	7.2910 (11.0106)
i's ability multiplier (a_i)	$\hat{\delta}_1$	0.0734*** (0.0059)	$\hat{\eta}_1$	0.1474*** (0.0210)
i's self-confidence bias (b_i)	$\hat{\delta}_2$	0.0082 (0.0061)	$\hat{\eta}_2$	0.0313* (0.0162)
i's self-confidence bias squared (b_i^2)	$\hat{\delta}_3$	-0.0303 (0.0256)		
j's ability multiplier (a_j)	$\hat{\delta}_4$	0.0869*** (0.0059)	$\hat{\eta}_3$	0.1570*** (0.0152)
j's self-confidence bias: (b_j)	$\hat{\delta}_5$	0.0216*** (0.0059)	$\hat{\eta}_4$	0.0140 (0.0140)
age		-0.1363 (0.1821)		-0.2058 (0.2984)
male		1.0289* (0.5415)		
male-male				6.5219*** (1.6385)
male-female				2.5375* (1.4360)
risk aversion		0.0015 (0.0107)		0.0153 (0.0377)
preferences efficiency		0.9349 (1.0194)		6.7764** (3.2143)
inequality aversion		0.5015 (1.1254)		3.3163 (3.1477)
inequality loving		-0.2319 (1.5928)		1.2104 (6.5852)
spiteful		-3.640 (3.0168)		1.7723 (11.5623)
swiss		-0.2519 (0.5249)		
swiss-swiss				1.2154 (1.7542)
swiss-other				2.5220 (1.6820)
only child		-0.6890 (0.9117)		-2.1320 (2.4230)
education parents		0.1154 (0.5235)		-0.1796 (2.0199)
people known		0.5315 (0.4026)		0.2597 (1.6254)
big town		-0.1197 (0.4509)		0.0212 (1.5909)
unil		0.1567 (0.5395)		-0.152 (5.7631)
bachelor		-1.5224** (0.7592)		-6.2709*** (2.4014)
grade		-0.6884 (0.4963)		-0.9785 (1.6582)
period 2		-0.1278 (0.3102)		-0.2557 (0.6252)
period 3		-0.1690 (0.3349)		-0.3381 (0.6751)
period 4		-0.4642 (0.3472)		-0.9283 (0.6998)
period 5		-0.3619 (0.3983)		-0.7238 (0.8029)
period 6		-1.0258*** (0.3640)		-2.0515*** (0.7336)
period 7		-0.8480** (0.3943)		-1.6960** (0.7949)
period 8		-0.6113 (0.3831)		-1.2225 (0.7721)
p-value of Wald test for joint significance of b_i and b_i^2		0.266		
No. of observations		1,920		960
R^2		0.7005		0.7624

The table shows the results of Regressions (6) and (7) with all controls. In the regression on team payoff, controls are averaged over both teammates, except for the gender and nationality composition of the team and the period dummies. These are GLS regressions with random effects and standard errors clustered at the team level. Significantly different from zero at 1% (***), 5% (**), 10% (*).

J Additional Treatments

The additional treatments for detecting potential mood effects comprise 240 subjects, as many as in the two main treatments. These subjects went through the same experiment as described in Section 3, except that i) they were informed about their true ability multipliers before they started working on the team effort task and, hence, ii) they did not have to state their posterior beliefs. Half of them was exposed to the EASY general knowledge quiz and the other half to the HARD quiz. These two additional treatments allow us to check for two potential confounds: mood effects and strategic misreporting of beliefs.

J.1 Mood Effects

Table 11 summarizes the main results of the additional treatments. As we can see, the difference in average effort per period between the EASY and the HARD treatments is only 2 clicks which amounts to 8.5%. This difference is not statistically significant using either unadjusted or adjusted tests. In addition, the differences in average catches, team revenue, and individual payoffs are also not statistically significant. Overall, this shows that mood effects only play a minor role.

Table 11: Additional Treatments: Main Results

		p values				
		unadjusted		adjusted		
Regression Type		GLS	OLS	OLS		
Standard Errors		Clustered	Clustered	Clustered		
Outcome	Diff. in means			WY	Holm	Bonferroni
Catches	1.3938	0.2140	0.2164	0.3579	0.8657	0.8657
Clicks	2.0021	0.3975	0.3992	0.5493	1	1
Team revenue	2.2020	0.5334	0.5346	0.5708	1	1
Individual payoffs	0.7673	0.5964	0.5974	0.5919	0.5974	1

WY stands for Westfall-Young. Significantly different from zero at 1% (***), 5% (**), 10% (*).

J.2 Strategic Misreporting

We analyze whether subjects strategically misreport their beliefs in two ways. First, we compare self-confidence bias between the main treatments and the additional treatments, where there is no incentive to misreport. Second, we explore whether risk tolerant subjects overstate their beliefs more than risk averse subjects in the main treatment.

Table 12 reports the results. Column (3) shows the coefficients of a fully saturated OLS regression of the subjects' self-confidence bias on binary indicators for being exposed to the EASY quiz and being in the Additional Treatments. As the indicator for the Additional Treatments is not significant, neither in levels nor interacted with EASY, there is no evidence that subjects's self-confidence bias in the main treatments is any different from those of subjects in the additional treatments. Columns (1) and (2) show the coefficients of OLS regressions of subjects' self-confidence bias in the main treatment on elicited risk aversion, without and with controls, respectively. Since the coefficient on risk aversion is not significant, risk tolerant subjects do not overstate their beliefs more than risk averse subjects. Hence, in both approaches we find no evidence for strategic misreporting.

Table 12: Testing for Strategic Misreporting

i's self-confidence bias	(1)	(2)	(3)
constant	6.2801	79.0826*	-9.6667*
	(4.6886)	(44.0814)	(5.8566)
risk aversion	-0.1160	-0.0224	
	(0.2249)	(0.2315)	
EASY			33.5***
			(8.3086)
Additional Treatments			-6.1667
			(8.3544)
EASY $\times$ Additional Treatments			0.1667
			(11.7561)
Treatments	Main	Main	Main & Additional
Controls	no	yes	no
No. of observations	240	240	480
R^2	0.0010	0.0934	0.0656

The first and second columns display OLS regressions with risk aversion as the main regressor, without and with controls, respectively. The third column displays a fully saturated OLS regression with indicators for being exposed to the EASY quiz and being assigned to the Additional Treatments. Standard errors are clustered at the team level. Significantly different from zero at 1% (***), 5% (**), 10% (*).

K Effort and Team Revenue Regressions Constrained on the First Period

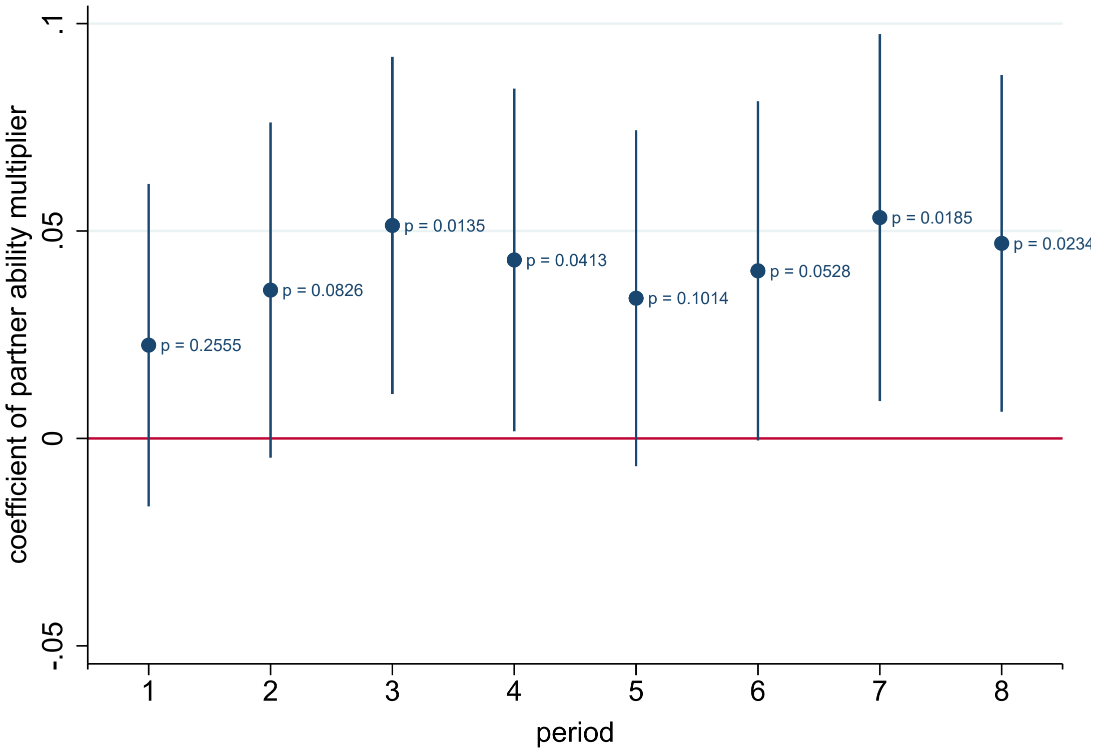
As a robustness check we constrain the regressions on effort in clicks and team revenue, equations 4 and 5, respectively, on period 1 behavior. Table 13 summarizes the results. In line with the results obtained in the regression on effort in clicks for all periods, i's ability multiplier and self-confidence bias are significant at 1%. In contrast, j's ability multiplier is not significant when conditioning on period 1 behavior. However, as Figure 11 shows, conditioning only on period 2 and only on each of the subsequent periods, j's ability multiplier is significant in all periods, except period 5. This suggests the information disclosed to the subjects in period 1 was helpful in reinforcing their understanding that they are in a team setting and that, on average, teammates with higher ability multipliers are more productive. The regression on team revenue conditioning on period 1 behavior shows qualitatively the same results as the one pooling all periods.

Table 13: Effort and Team Revenue Regressions Constrained on First Period

		Effort in Clicks (e_{i1})			Team Revenue in CHF (R_{ij1})	
constant	$\hat{\beta}_0$	3.3088	12.7177	$\hat{\gamma}_0$	-3.5938	21.9156
		(3.1136)	(10.5202)		(4.5395)	(16.0144)
i's ability multiplier (a_i)	$\hat{\beta}_1$	0.1160***	0.0963***	$\hat{\gamma}_1$	0.2103***	0.1882***
		(0.0198)	(0.0233)		(0.0282)	(0.0318)
i's self-confidence bias (b_i)	$\hat{\beta}_2$	0.1270***	0.1166***	$\hat{\gamma}_2$	0.0713***	0.0641**
		(0.0248)	(0.0267)		(0.0246)	(0.0260)
j's ability multiplier (a_j)	$\hat{\beta}_3$	0.0215	0.0225	$\hat{\gamma}_3$	0.1823***	0.1933***
		(0.0177)	(0.0180)		(0.0247)	(0.0291)
j's self-confidence bias: (b_j)	$\hat{\beta}_4$	-0.0073	-0.0137	$\hat{\gamma}_4$	0.0598***	0.0600***
		(0.0196)	(0.0206)		(0.0186)	(0.0198)
Controls (X and P)		no	yes		no	yes
No. of observations		240	240		120	120
R^2		0.1653	0.2528		0.6797	0.7282

The table shows the results of Regressions (4) and (5) for the first period of the ball catching task with and without controls. These are OLS regressions with standard errors clustered at the team level. Significantly different from zero at 1% (***), 5% (**), 10% (*).

Figure 11: Partner Ability Multiplier Coefficients Plot



The figure displays the estimated coefficient of the Partner Ability Multiplier $\hat{\beta}_3$ for each period separately. The estimated coefficients are based on Regression (4) for each period separately. The blue lines represent 95 % confidence intervals.

L Experimental Instructions

This appendix contains an English translation of the experimental instructions and the control questions.

General Instructions (Y)

Welcome to the experiment. You are about to participate in an experiment on decision making. We thank you for participating in our economic study.

Throughout the experiment you must not communicate with other participants. If you have a question or need assistance of any kind, please raise your hand, and a study administrator will come to your seat and you can discuss the question. The violation of the rule against communication will result in exclusion from the study and from all payments.

This experiment consists of a total of **7 parts**:

- In the **first part**, we ask you to answer a general knowledge quiz.
- In the **second part**, we ask you to make an estimate.
- In the **third part**, you are paired with another participant in your group and we ask both of you to perform a ball-catching task.
- In the **fourth part**, you have the possibility of making another estimate.
- In the **fifth part**, you are paired with yet another participant in your group and we ask both of you to make distributional decisions.
- In the **sixth part**, we ask you to make one risky decision.
- In the **seventh part**, we ask you to complete a questionnaire.

After you read the general instructions, you can proceed to the detailed instructions for the 7 parts of the experiment. The amount of money you will be paid in this experiment depends on your decisions. Therefore, **it is in your interest to read the general and detailed instructions carefully.**

How are the payments in this experiment determined?

1. You receive a fixed payment of CHF 5 for participating in the experiment. Additionally, you will also receive the payments described below.
2. In the **first part**, your payment depends on your relative performance on the general knowledge quiz within your group of 12 participants. Here, your payment can go from 720 tokens to 60 tokens.
3. In the **second part**, your payment depends on the accuracy of your estimate and can be either 600 tokens or 0 tokens.
4. In the **third part**, your payment depends on your and your matched participant's performance on the general knowledge quiz and on the ball-caching task. Here, the average payment is about 5000 tokens.

5. In the **fourth part**, if you make another estimate your payment depends on the accuracy of your estimate and the realization of a random device.
6. In the **fifth part**, your payment depends on your distributional decisions, those of a matched participant, and on the realization of a random device. Here, your payment can go from 315 tokens to 185 tokens.
7. In the **sixth part**, your payment depends on your risky decision and on the realization of a random device. Here, your payment can go from 742.5 tokens to 0 tokens.

At the end of the experiment, the number of tokens you have earned will be exchanged into CHF using the exchange rate:

300 tokens = 1 CHF

Please know that **your anonymity is guaranteed**. Also, you will not be informed of the identity of the participants who are paired with you.

Overview of the experiment

First Part:

Answer a general knowledge quiz

↓

Second Part:

Make an estimate

↓

Third Part

Perform the ball-catching task

↓

Fourth Part:

Option to make another estimate

↓

Fifth Part:

Make distributional decisions

↓

Sixth Part:

Make one risky decision

↓

Seventh Part:

Complete a questionnaire

First Part:

Answer a general knowledge quiz

As you walked into this room you were randomly assigned to a group of 12 participants. You will be in this group for the entire experiment.

In this first part of the experiment you will be asked to provide answers to 46 questions of general knowledge. You have 20 minutes for this purpose. The more questions you will be able to answer correctly, the higher your earnings in this task. If you are the best among the 12 participants in your group (rank 1), you will earn 720 tokens and for each subsequent rank, the number of tokens earned decreases by 60. For example, if you are the second-best in your group (rank 2), you receive 660 tokens, if you are the third-best in your group (rank 3) you receive 600 tokens, …, if you are the worst participant in your group (rank 12), you receive 60 tokens. Ties will be broken randomly. Furthermore, **the more questions you will be able to answer correctly, the higher your earnings will be in the third part of the experiment**. Hence, it is in your interest to provide as many correct answers as possible.

Note that the correct answers to some questions imply that you give the first and last name of famous people. You will get a full credit only if you get the first and last name of the relevant famous person. If you only write the correct first name or last name, you will get half credit for your answer. Questions without answers are considered as incorrect.

Second Part:
Make an estimate

In this second part of the experiment, you will be asked to provide an estimate. This estimate is about your rank in the quiz. In the following, we will explain you how you will indicate your estimate of your rank and how this estimate influences your earnings.

a) How will you indicate your estimate of your rank?

The 12 participants in your group, including you, have answered the same quiz. According to the performance of all 12 participants in your group, each of them gets ranked. Rank 1 is assigned to the participant with the best performance in your group (in other words, this is the participant with the highest number of correct answers); rank 2 is assigned to the participant with the second best performance in your group,…, rank 12 is assigned to the participant with the worst performance in your group. We wish you to provide us with your estimate of your rank as an integer between 1 and 12.

b) How does your estimate of your rank influence your earnings?

The more your estimate of your rank is precise, the more likely it is that you will earn 600 tokens. In other words, the likelihood you earn the 600 tokens is greater the closer your estimate of your rank is to your real rank.

Your earnings in this part of the experiment are determined as follows.

First, the computer will randomly generate a number between 0 and 121. Each number from 0 to 121 is equally likely.

Second, the difference between your estimate of your rank and your real rank is your prediction error. If your prediction error multiplied by itself is not greater than the randomly generated number, you win **600 tokens**. Otherwise, you win **0 tokens**.

Important: You might wonder why we have chosen this payment rule. The reason is that this payment rule makes it optimal for you to state truthfully your estimate of your rank.

Example: Your estimate of your rank is 5, but given your relative performance at the quiz, your real rank is 8. In this case, your prediction error is 5-8 = -3. Your prediction error multiplied by itself is 9. If the randomly generated number is greater than or equal to 9, for example 35, then you win 600 tokens. If the randomly generated number is smaller than 9, for example 8, then you win 0 tokens.

Before the beginning of the third part of the experiment, you will be randomly matched to one of the other 11 participants in your group, henceforth referred to as *your partner*. In the third part of the experiment, your computer screen will display your partner's estimate of his/her rank and your partner's real rank. Similarly, your partner's computer screen will display your estimate of your rank and your real rank.

Please be aware that you will not be informed about your real rank until the very end of the experiment. Similarly, y**our partner will also not be informed about his/her real rank until the very end of the experiment.**

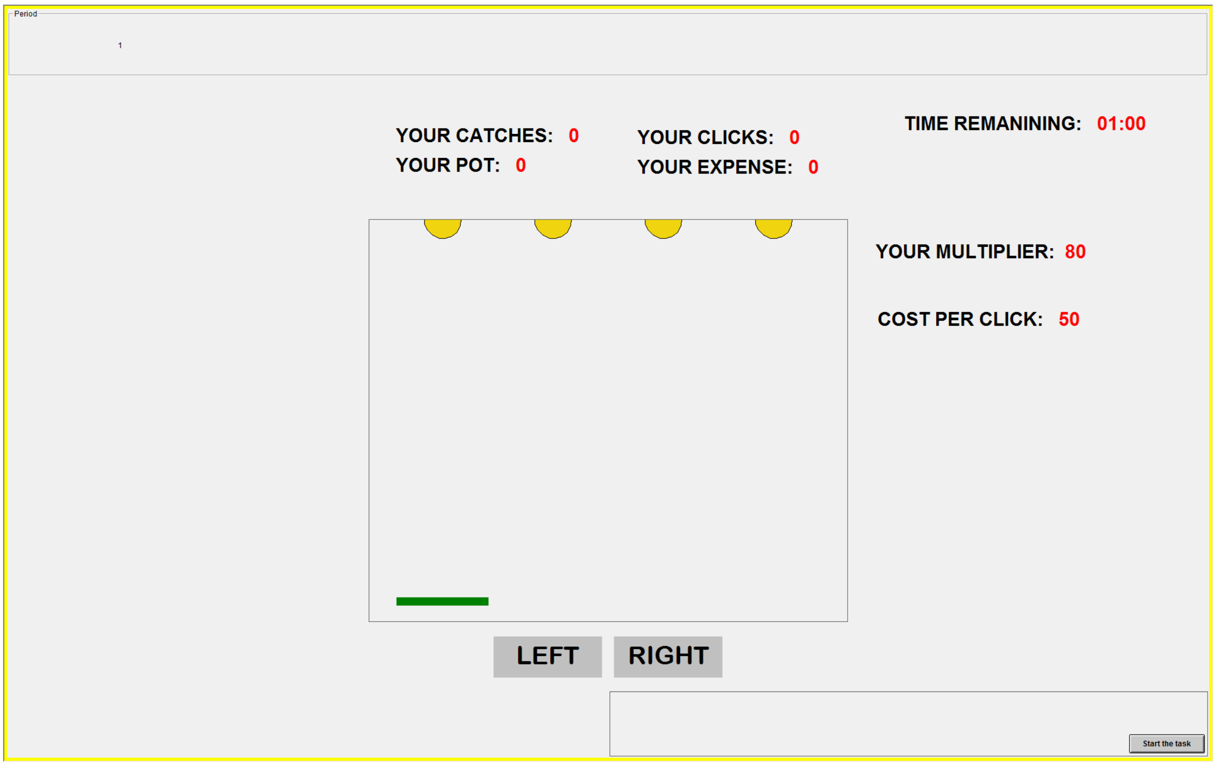
This is the end of the instructions of this part of the experiment. Do you have any questions? If you have questions, please raise your hand.

Third Part:

Perform the ball-catching task

In this part of the experiment, you will work on a computerized ball-catching task for **16 periods**. Each period lasts one minute. Please read these explanations carefully. You will only be able to continue the experiment after you answered correctly to control questions that will test your understanding of how your earnings in the ball-catching task are determined in each of the 16 periods.

In **periods 1 to 8**, there will be a task box in the middle of the task screen like the one shown below:



Once you click on the “Start the Task” button, the timer will start and balls will fall randomly from the top of the task box. You can move the tray at the bottom of the task box to catch the balls by using the mouse to click on the LEFT or RIGHT buttons. To catch a ball, your tray must be below the ball before it touches the bottom of the tray. When the ball touches the tray, your catches increase by one.

In **periods 1 to 8**, you will receive an amount (in tokens) for each ball you catch and incur a cost (in tokens) for each mouse click you make. At the beginning of each period you will be informed of your “multiplier”. Your multiplier determines the amount of tokens you will receive for each ball you catch and will be either 40, 100, 160, or 220 tokens. Your cost per mouse click will always be 50 tokens. Each of the four aforementioned multipliers will be valid during two consecutive periods as shown in the table below:

periods	1 and 2	3 and 4	5 and 6	7 and 8
Increasing multipliers	40	100	160	220
Decreasing multipliers	220	160	100	40

A random device will determine whether you will begin with a multiplier equal to 40 or, instead, begin with a multiplier equal to 220. Each of the two sequences of multipliers is equally likely.

In **periods 1 to 8**, the number of balls you caught so far (displayed as **YOUR CATCHES**), the number of mouse clicks you made so far (displayed as **YOUR CLICKS**), your accumulated amount of tokens so far (displayed as **YOUR POT**), and your accumulated mouse click costs so far (displayed as **YOUR EXPENSE**) are shown right above the task box. At the end of the period, **your pot** will be equal to your "multiplier" times your catches for the period and **your expense** will be equal to the cost per click of 50 tokens multiplied by your number of clicks for the period. At the end of the period, **your earnings** in tokens for the period will be **your pot** minus **your expense**. Please note that catching more balls by moving the tray more often does not necessarily lead to higher earnings because both **your pot** and **your expense** matter for determining **your earnings**.

At the end of each period from 1 to 8, you will see on your computer screen how many balls you caught, your clicks, and your earnings for that particular period.

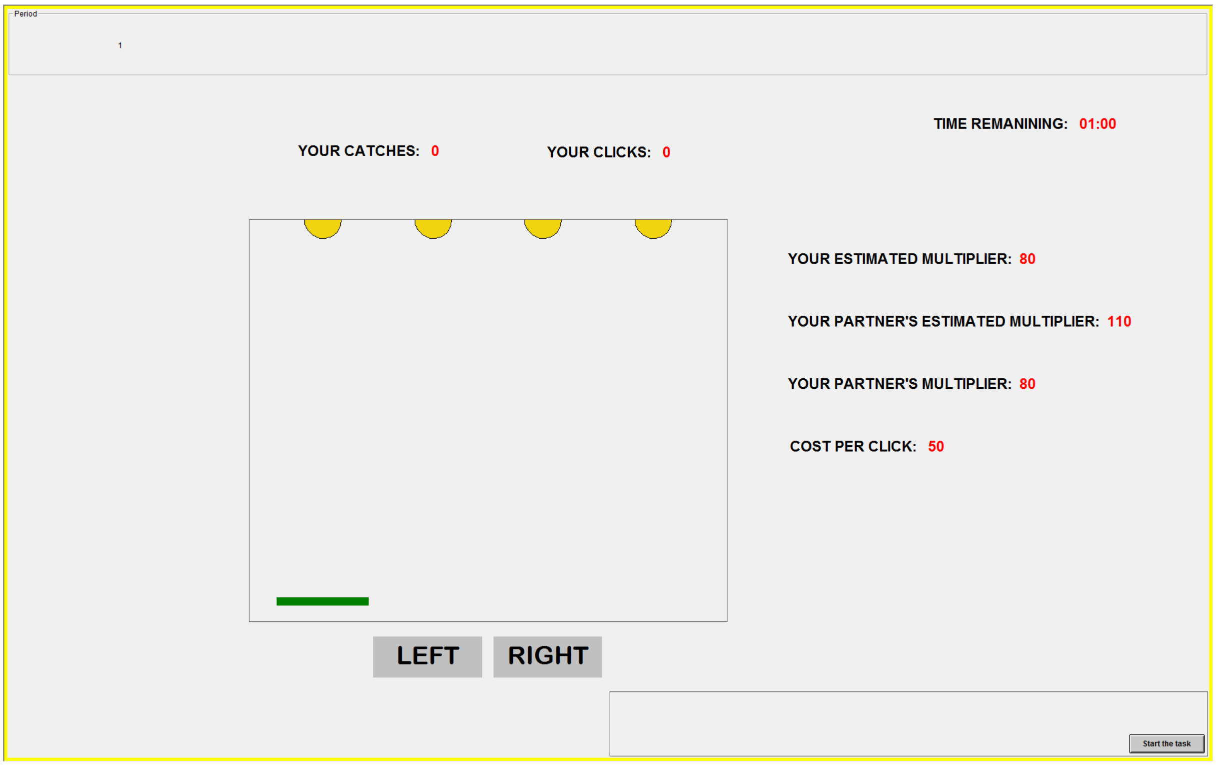
In **periods 9 to 16** your rank in the quiz determines your multiplier as follows:

rank in quiz	Multiplier
1	240
2	220
3	200

4	180
5	160
6	140
7	120
8	100
9	80
10	60
11	40
12	20

For example, if your rank in the quiz was 5, then your multiplier is 160. However, if your rank in the quiz was 8, then your multiplier is 100. In other words, the better your performance in the quiz is, the higher is your multiplier. Note that your partner's rank in the quiz determines his/her multiplier in the same way. For example, if your partner's rank in the quiz was 6, then his/her multiplier is 140.

In **periods 9 to 16** the task box in the middle of the screen is shown below:



As you can see above, the task box displays the time left (in seconds), your number of clicks and catches (updated in real time), your estimated multiplier associated to your estimated rank in the quiz, your partner's estimated multiplier associated with his/her estimated rank in the quiz, your partner's multiplier determined by his/her rank in the quiz, and the cost per click.

In **periods 9 to 16**, your multiplier, your catches, your partner's multiplier, and your partner's catches determine **your earnings** in tokens as follows:

your earnings = (common pot)/2 – your expense.

That is, in **periods 9 to 16** your earnings are equal to half of the "**common pot**" minus **your expense**. Your expense is equal to the cost per click of 50 tokens multiplied by your number of clicks for the period.

Similarly, in **periods 9 to 16**, your partner's earnings in tokens are determined as follows:

your partner's earnings = (common pot)/2 – your partner's expense.

That is, in **periods 9 to 16**, your partner's earnings are equal to half of the "**common pot**" minus **your partner's expense**. Your partner's expense is equal the cost per click of 50 tokens multiplied by your partner's number of clicks for the period.

In **periods 9 to 16**, the **common pot** is:

common pot = (your multiplier x your catches)
+ (your partner's multiplier x your partner's catches)
+ (5 x your catches x your partner's catches).

That is, in **periods 9 to 16**, the **common pot** is the sum of three components: **your multiplier times your catches** (**first component**), plus **your partner's multiplier times your partner's catches** (**second component**), plus **5 times your catches times your partner's catches** (**third component**).

At the end of each period from 9 to 16, you will see on your computer screen how many balls you caught, your clicks, and your earnings for that particular period.

Please note that catching more balls by moving the tray more often does not necessarily lead to higher earnings in this part of the experiment. This is because both **your pot** or **common pot** and **your expense** matter for **your earnings**.

Recall that your earnings in tokens will be converted into Swiss Francs at the rate of 300 tokens to CHF 1. The example that follows illustrates how your earnings are computed in **periods 9 to 16**.

Example: Suppose that, amongst periods 9 to 16, the one that counts for payment is 11. Imagine your multiplier is 120, you caught 20 balls, and you clicked 15 times. Imagine also your partner's multiplier is 160, she caught 25 balls, and she clicked 30 times. Then, we have:

first component of the common pot = 120 x 20 = 2400

second component of the common pot = 160 x 25 = 4000

third component of the common pot = 5 x 20 x 25 = 2500

common pot = 2400 + 4000 + 2500 = 8900

your expense = (50 x 15) = 750

your earnings = 8900/2 – 750 = 4450 - 750 = 3700

your partner's earnings = 8900/2 – (50 x 30) = 4450 - 1500 = 2950

Your earnings at the ball-catching task will be determined by only one period from 1 to 16. The period that counts to determine your earnings will be randomly generated by the computer and each period is equally likely to be selected.

This is the end of the instructions of this part of the experiment. Do you have any questions? If you have questions, please raise your hand.

Fourth Part:

Option to make another estimate

In this part of the experiment, we will ask you if you would like to make another estimate of your rank in the quiz. If your answer is "**no**," then the first estimate is the one that counts for payment. If your answer is "**yes**," then you have to provide a **second estimate** of your rank in the quiz.

The payment for your second estimate is determined in the same way as was the payment for the first estimate. That is, the more your second estimate of your rank is precise, the more likely it is that you will earn **600 tokens**. The precise way your earnings are determined is the same as the one described in the instructions of the second part of the experiment.

If you provide a second estimate, then the estimate that counts for payment will be randomly generated by the computer and each of the two estimates (the first one and the second) is equally likely to be selected.

This is the end of the instructions of this part of the experiment. Do you have any questions? If you have questions, please raise your hand.

Fifth Part:

Make distributional decisions

In this part of the experiment, you will make 10 decisions that concern you and another participant from your group, excluding your partner at the ball-catching task. The other person will be randomly paired with you. You will never learn who this person is, and the other person will also not learn of your identity.

In each of the 10 decisions situations, you have exactly two options, an option LEFT and an option RIGHT. Each option involves a monetary amount for the "Decider" and a monetary amount for the "Receiver." The 10 decisions situations will be presented successively on two computer screens with 5 decision situations in each.

The 5 decisions situations on the first computer screen will be:

Dec. Nr.	**LEFT**		**Your Choice**	**RIGHT**	
	Decider earns	**Receiver Earns**		**Decider earns**	**Receiver earns**
1	**360 tokens**	**585 tokens**	LEFT ◯ ◯RIGHT	**450 tokens**	**450 tokens**
2	**405 tokens**	**585 tokens**	LEFT ◯ ◯RIGHT	**450 tokens**	**450 tokens**
3	**450 tokens**	**585 tokens**	LEFT ◯ ◯RIGHT	**450 tokens**	**450 tokens**
4	**495tokens**	**585 tokens**	LEFT ◯ ◯RIGHT	**450 tokens**	**450 tokens**
5	**540 tokens**	**585tokens**	LEFT ◯ ◯RIGHT	**450 tokens**	**450 tokens**

The first column displays the number of the decision situation. The second column, the payments to Decider and Receiver when the Decider chooses LEFT. The third column is where you make your choice. You click in option "LEFT" if you wish the Decider and the Receiver to receive the payments associated with LEFT. You click in option "RIGHT" if you wish the Decider and the Receiver to receive the payments associated with RIGHT The fourth column displays the payments to Decider and Receiver when the Decider chooses RIGHT.

The 5 decisions situations on the second computer screen will be:

Dec. Nr.	**LEFT**		**Your Choice**	**RIGHT**	
	Decider earns	**Receiver earns**		**Decider earns**	**Receiver earns**
6	**360 tokens**	**315 tokens**	LEFT ◯ ◯RIGHT	**450 tokens**	**450 tokens**
7	**405 tokens**	**315 tokens**	LEFT ◯ ◯RIGHT	**450 tokens**	**450 tokens**
8	**450 tokens**	**315 tokens**	LEFT ◯ ◯RIGHT	**450 tokens**	**450 tokens**
9	**495 tokens**	**315tokens**	LEFT ◯ ◯RIGHT	**450 tokens**	**450 tokens**
10	**540 tokens**	**315 tokens**	LEFT ◯ ◯RIGHT	**450 tokens**	**450 tokens**

When the experiment is over, the computer will randomly choose one of the 10 decision situations to determine the payments for this part. The computer will also randomly choose whether you are the Decider or the Receiver. That is, the computer will randomly choose if the option you have chosen in that decision situation is implemented, so that you will be the Decider or, on the other hand, if the option your matched participant has chosen in that particular decision situation is implemented, so that you will be the Receiver. It is equally likely the computer assigns you to the role of Decider or of Receiver.

In the case the computer assigns your option to be implemented you will receive the number of tokens corresponding to Decider in the chosen decision situation and your matched participant will receive the number of tokens corresponding to Receiver in that same decision situation.

For example, if the chosen decision situation was the 10th, the computer determined that your option is the one to be implemented, and you had chosen "LEFT", you would obtain 540 tokens while your matched participant would obtain 315 tokens.

If, on the other hand, if the chosen decision situation was the 10th, the computer determined that the option chosen by your matched participant is the one to be implemented, and your matched participant had chosen "RIGHT", then you would obtain 450 tokens while your matched participant would obtain 450 tokens.

Notice that the numbers in the example are just for illustrative purposes. They DO NOT intend to suggest how anyone may choose among the different options.

Please notice that, once all participants have made their choices, chance alone determines whether your role will be Decider or Receiver. Thus, the option you choose will only be considered if chance finally determines that for a decision situation it is your option the one being implemented. In case in the chosen decision situation your choice is not the one being implemented; your choice is simply not considered.

Therefore, in case your choice is not being implemented, your choice can affect in no way neither your payment nor the payments of any other participant.

At no time any participant will know the option chosen by their matched participant.

This is the end of the instructions of this part of the experiment. Do you have any questions? If you have questions, please raise your hand.

Sixth Part:

Make one risky decision

On the screen of your computer, you will see a square in which you can find 100 boxes.

You will earn 5 tokens for each box you will decide to collect. The collection process of boxes is automatic: each second, a collected box changes its color. The collected boxes change color beginning from the left top of the screen and updated accordingly.

Behind one of those 100 boxes is hidden "a bomb" that may destroy all the boxes that have been collected.

The "bomb" can be in either box with equal probability (the probability that a "bomb" is in a particular box is equal to 1/100). **Nevertheless, you do not know behind which box the "bomb" is located.**

Your task for this part is to choose when to stop the collection process of boxes. You can do it by clicking on the button "STOP" whenever you wish.

If you collect the box containing the "bomb," the "bomb" will "explode" and you will not earn any tokens. If you stop the collection process of boxes before collecting the box containing the "bomb," the "bomb" will not explode and you will earn the tokens that have been accumulated so far.

Notice that you will know whether one of the boxes you collected contains the "bomb" only at the very end of the task. If you collect the box containing the "bomb," the "bomb" will explode only at the end of the task: this means that you may collect the box containing the "bomb" without knowing it.

We will begin this step by a training period. The goal of this training period is to show how this task works. Once the training period is finished, the task begins. The training period is only an example: you will not earn any tokens from the training period.

This is the end of the instructions of this part of the experiment. Do you have any questions? If you have questions, please raise your hand.

Seventh Part:

Complete a questionnaire

In this last part of the experiment, we ask you to complete a questionnaire. After completing your questionnaire, you will have to wait for everyone to complete theirs. After that you will be paid.

Your final payment is the addition of your earnings in each part of the experiment and of your show-up fee. We will print a page with your payments and hand it to you. You must take it with you outside the LABEX where a study administrator you use it to give you your final payment.

Please take note once again that 300 tokens in the experiment correspond to 1 CHF. If you have questions, please raise your hand.

Control questions: [not part of the experimental instructions]

Please answer the questions that will appear on your computer screen. The objective is to have complete clarity about the rules in the experiment. When you are done, click okay to proceed to the next screen. The computer will check if the control questions are answered correctly. If they are answered incorrectly you need to try again. Only after all participants in your group have answered these questions correctly can the experiment proceed.

1. Suppose you are ranked on the 7th position, what is your multiplier?

Answer: _______ [120]

2. Suppose you are ranked on the 11th position, what is your multiplier?

Answer: _______ [40]

Suppose that the period that counts for payment is period number 9. Suppose your multiplier is 160, you caught 40 balls, and you clicked 30 times. Suppose also your partner's multiplier is 80, she caught 30 balls, and she clicked 20 times.

3. What is the value of the **first component** of the common pot?

Answer: _______ tokens [6400=160*40]

4. What is the value of the **second component** of the common pot?

Answer: _______ tokens [2400=80*30]

5. What is the value of the **third component** of the common pot?

Answer: _______ tokens [6000=5*40*30]

6. What is the value of the **common pot**?

Answer: _______ tokens [14800=6400+2400+6000]

7. What is the value of half of the **common pot**?

Answer: _______ tokens [14800/2=7400]

8. What is the value of **your expense**?

Answer: _______ tokens [1500=50*30]

9. What is the value of **your earnings**?

Answer: _______ tokens [5900=7400-1500]

10. What is the value of **your partner's earnings**?

Answer: _______ tokens [6400=7400-50*20]