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ORIGINAL PAPER

Penalty contracts: is it all about paying the cash upfront?

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Abstract

We experimentally investigate the relevance of a cash upfront payment for the effort-enhancing effect of penalty contracts. We find that penalty contracts where participants receive the upfront payment physically before working on a real effort task induce more effort than penalty contracts where participants are only informed about the upfront payment. When comparing penalty contracts with economically-equivalent bonus contracts, we find that penalty contracts lead to higher effort provision than bonus contracts, but only if participants physically receive the upfront cash payment in advance. We suggest that the higher salience of the cash upfront payment might be a core driver of the detected framing effect. Our findings emphasize the importance of experimental design choices when studying framed incentive contracts.

Keywords Penalty contract · Contract framing · Loss framing · Cash upfront payment · Laboratory experiment

JEL Classification C91 · J24 · J33 · M52

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1 Introduction

Incentive contracts are commonly used to motivate employees (Prendergast 1999), and research shows that framing may affect their effectiveness. In particular, experimental evidence reveals that negatively framed incentive contracts that penalize poor performance, can induce more effort than economically-equivalent, positively framed incentive contracts rewarding good performance (e.g., Hannan et al. 2005). One explanation for the effort-enhancing effect of negatively framed incentives is loss aversion around a reference point, formalized in prospect theory (Kahneman and Tversky 1979).

However, while some experiments find large and statistically significant framing effects in the laboratory with Hedges' g statistics around 0.50 (e.g., Armantier and Boly 2015; Hannan et al. 2005; Imas et al. 2017; von Bieberstein et al. 2020) other studies report smaller and only marginally significant effects (e.g., Brooks et al. 2012), and still others do not find a statistically significant effect of contract framing on effort at all (e.g., Essl and Jaussi 2017; Grolleau et al. 2016).[1] Similarly, a recent meta-analysis on framed incentive contracts points out a high variability of effect sizes found in laboratory experiments and much smaller effect sizes for field than for lab studies (Ferraro and Tracy 2022). The meta-analysis also documents larger effect sizes in studies where workers get their pay handed out in advance compared to studies that only verbally describe the payment but factually pay it out at the end of the task (0.24 SD vs. 0.08 SD), but the difference is not statistically significant. However, the studies included in this comparison also differ in many other design choices, making it hard to assess the impact of the timing of the payment in isolation.

Thus, the aim of this study is to systematically examine two questions: First, do penalty contracts with cash upfront payment elicit significantly more effort than penalty contracts without cash upfront payment? Second, does the penalty contract have a performance-enhancing effect compared to the bonus contract if the cash payment is physically paid out up front, but not if the payment is only announced and paid later? To answer these questions we conducted a between-subject laboratory experiment with two stages. In both stages, participants work on a real effort task. In stage 1, they receive a fixed wage independent of performance and in stage 2, they work under a framed incentive contract. Depending on the treatment, the incentive contract is either a penalty contract with cash upfront payment, a penalty contract without cash upfront payment, or a bonus contract. All contracts are economically equivalent and participants receive a substantially higher payoff when meeting an announced performance target (15 CHF vs. 5 CHF).[2] Comparing both types of penalty schemes, we find that penalty contracts with cash upfront payment elicit significantly more effort than penalty contracts without cash upfront payment. However, if we control for performance in stage 1, the effect is only significant at the 10-percent level. With respect to the framing of the contract, we find that penalty

[1] An overview of laboratory experiments analyzing the effectiveness of penalty contracts is available in Table 4 in Appendix A.

[2] At the time of the experiment, 1 CHF equaled about 1 US$.

contracts with physical cash upfront payment elicit significantly more effort than economically-equivalent bonus contracts. In contrast, we do not find a statistically significant effort difference between the penalty contract without cash upfront payment and the bonus contract.

There are several potential reasons why the cash upfront payment could be important for producing the effort-enhancing effect of penalty contracts (see the discussion in Sect. 4). Our preferred interpretation is that our results are due to an increase in the salience of the upfront payment, which in turn reinforces the feeling of ownership and induces a greater fear of losing the money. This is in line with a study of Reb and Connolly (2007), who find that people who physically possess a good have a higher monetary valuation for keeping it compared to people who only factually own the good without physical possession.

Up to this point, there are only a few attempts to bring more clarity in the experimental design choices researchers face when studying framed incentive contracts in the lab. One exception searching for systematic differences is de Quidt et al. (2017), who suggest that whether participants can check if they meet a performance target while performing the task, or not, influences the effectiveness of contract framing. However, they did not find causal evidence supporting this conjecture and the authors acknowledge that there are many other differences between the studies they considered in their review of the literature. In addition to the timing of payment, Ferraro and Tracy (2022) also consider the type of payment (piece-rate vs. threshold contract design) in their meta-analysis, identifying comparable effect sizes for both types of payment. In this paper, we experimentally vary the timing of the payment as a driver of differences in the framing effect. While most lab experiments with cash upfront payment find an effort-enhancing effect of penalty contracts as compared to bonus contracts (with the exception of Grolleau et al. (2016), who use a cash upfront payment but do not find a statistically significant framing effect), the results of laboratory studies without cash upfront payment are more mixed with some studies documenting an effort-enhancing effect and others failing to do so (see Table 4 in Appendix A).

2 Experimental design and procedure

In a lab experiment, we examine the importance of physical possession of the upfront payment as a potential driver of framing effects.[3] We conducted two penalty treatments, where participants received 15 CHF upfront and had to pay a penalty of 10 CHF in case of missing the target. In the Penalty Cash treatment, participants were physically paid out their upfront payment in cash prior to the task, whereas in the Penalty No Cash treatment, they were only informed about the upfront payment, but did not physically receive the money until the end of the experiment. As

[3] The ethical standard of the study was approved by the Faculty of Business Administration, Economics and Social Sciences of the University of Bern. The experimental details were pre-registered on the American Economic Association's registry for randomized controlled trials with the unique identifying number: AEARCTR-0005303.

a control treatment, we implemented an economically-equivalent Bonus treatment, where participants were paid out 5 CHF as an upfront payment and when meeting the predefined target, they earned an additional bonus of 10 CHF.

At the beginning of the lab experiment, we assessed individual loss aversion (Gächter et al. 2022). Subjects saw a list of six lotteries and decided for each lottery, whether to accept or reject it. Each lottery had a 50% probability of winning 6 CHF and a 50% probability of losing 2 CHF up to 7 CHF, with the losing price increasing in increments of 1 CHF. At the end of the experiment, one lottery was randomly chosen and paid out. This first part was followed by two stages, where participants worked on a Word Encryption task with Double Randomization (WEDR task) (Benndorf et al. 2019).[4] Participants had to encode words as numbers and could only proceed with the next word if they encoded all letters correctly. Effort was measured as number of solved words. We chose this task for several reasons: it requires no special knowledge or cognitive abilities, learning possibilities are trivial, there is no scope for guessing, and it is gender-neutral (Benndorf et al. 2019). In stage 1, participants worked on the encryption task for 3 min and received a fixed wage of 5 CHF, irrespective of the number of solved words. Participants familiarized themselves with the task and we obtained a measure of baseline performance capturing motivation and ability.

In stage 2, participants had 4 min to encode a maximum of 20 words. Payment was performance-based and tied to an announced target. If participants solved at least 12 words, they received 15 CHF, otherwise their payment was 5 CHF. Solving 12 words corresponds to the 80th performance percentile under piece-rate incentives in a similar experiment (von Bieberstein et al. 2020), such that we chose it as challenging, but feasible target. In our experiment, participants solved on average 10.09 words (S.D.=1.7), and 19% reached the target of 12 words. While working in stage 2, participants could see a display of the number of correctly coded words so far. To keep payment procedures consistent over both stages of the experiment, the fixed wage of 5 CHF in stage 1 was always executed in the same way as the upfront payment in stage 2. This means that participants in the Penalty Cash treatment and the Bonus treatment physically received their fixed wage before working on the real effort task. In the Penalty No Cash treatment, the fixed wage was not distributed in advance, but only at the end of the experiment. Given the differences in the payment procedure of stage 1, we will check in our analysis for performance differences in this stage depending on the treatment (and find none, see Sect. 3). Moreover, to ensure confidentiality and comparability across all treatments, the returned penalty payments and the bonus payments in the treatments with physical possession were administered via envelopes. This way neither the experimenter distributing and collecting the payments, nor any other participant could infer if the target was met.[5]

The experiment was conducted in the Aare-Lab of the University of Bern between December 2019 and February 2020. Subjects were recruited via Sona Systems, and the experiment was computerized using z-Tree (Fischbacher 2007). In total, 195

[4] Experimental instructions including a screenshot of the task are available in Appendix B.

[5] The experimental procedure was not double blind since another experimenter disbursed the outstanding payments at the end of the experiment.

students from various disciplines participated. Based on prior research, we expected a medium sized effect of contract framing on productivity (Cohen's d = 0.50). Thus, with at least 67 participants per treatment, we have 80% power to detect such an effect at a 5% level of significance. The participants were randomly assigned to one of the three treatments, which in turn were randomized over morning, midday, and afternoon sessions. Participants received written instructions for the real effort encryption task and had to answer control questions to ensure that they understood the performance-based incentives in stage 2. Each session lasted about 45 min and average earnings were 17 CHF including a show-up fee of 4 CHF. The experiment concluded with a short questionnaire on demographics.[6]

3 Results

To analyze the effect of physical possession of the base pay on effort provision, we compare the number of correctly solved words across treatments. Table 1 reports descriptive statistics for the number of words solved in stage 2 and the baseline performance measured by the number of words solved in stage 1. First, given the differences in the payment procedure of stage 1, we check for performance differences in this stage depending on the treatment. Baseline performance in stage 1 is similar in all three treatments, ranging from an average of 6.44 to an average of 6.69 correctly solved words. None of the pairwise treatment comparisons for stage 1 is statistically significant (Mann-Whitney rank sum tests, see Table 1 below for p-values).[7] Thus, paying out the cash upfront when working under a fixed wage does not lead to statistically different performance levels across the treatments compared to paying the cash at the end of the experiment.

Looking at performance levels in stage 2 and comparing the two penalty contracts that only differ in terms of the timing of the physical payment reveals a significant difference with the cash upfront payment outperforming the penalty contract without physical upfront payment ($p = 0.025$, Mann-Whitney rank sum test). Results further reveal that participants who worked under a penalty contract with physical upfront payment solved significantly more words than those who worked under a bonus contract ($p = 0.003$). In contrast, participants in the Penalty No Cash treatment did not exert more effort than participants in the Bonus treatment ($p = 0.566$).

In addition to the descriptive results, we conducted an OLS regression analysis. First, we investigate the question of whether the money at stake is paid out in cash upfront is a driver of the effort-enhancing effect under penalty framed incentive contracts. In Specification 1 of Table 2 we regress the number of solved words in the encryption task of stage 2 on the treatment dummy variable Penalty Cash, which is 1 if the individual participated in the Penalty Cash treatment and 0 for participants

[6] Our experiment was always followed by one of two other experiments such that the total session duration was either 60 or 90 min. As expected, neither the number of words solved in stage 1, nor in stage 2 differ statistically significantly between the shorter and longer sessions (stage 1: $p = 0.332$, stage 2: $p = 0.853$; Mann-Whitney rank sum tests, two-sided.)

[7] All statistical tests are two-sided.

Table 1 Descriptive statistics: Encryption task

		Penalty Cash (n = 64)	Penalty No Cash (n = 67)	Bonus (n = 64)	PC-PNC *p*-value	PC-B *p*-value	PNC-B *p*-value
Performance (Stage 2)	Mean	10.48	9.99	9.80	0.025	0.003	0.566
	S.D.	1.57	1.98	1.54			
Baseline Performance (Stage 1)	Mean	6.69	6.60	6.44	0.841	0.457	0.602
	S.D.	1.39	1.45	1.39			

The table presents means and standard deviations for the Penalty Cash (PC), thePenalty No Cash (PNC), and the Bonus (B) treatments. The last three columns report p-valuesobtained from two-sided Mann-Whitney rank sum tests

in the Penalty No Cash treatment. We also include baseline performance, which is the number of solved words under the fixed wage in stage 1. As expected, participants' baseline performance in stage 1 positively predicts the number of solved words under performance-based incentives. Results show that penalty contracts with physical upfront payment induce more effort than penalty contracts without physical upfront payment. However, compared to the descriptive statistics, the inclusion of baseline performance weakens the significance level of the Penalty Cash coefficient ($p < 0.10$). In Specification 2, we further include loss aversion, which is represented

Table 2 Effect of cash upfront payment on effort under penalty contracts (Baseline category: Penalty No Cash)

	Number of words (1)	Number of words (2)
Penalty Cash	0.423*	0.406*
	(0.233)	(0.242)
Baseline Performance	0.848***	0.855***
	(0.0902)	(0.0912)
Loss Aversion		−0.169
		(0.102)
Female		−0.0954
		(0.241)
Constant	4.393***	4.832***
	(0.637)	(0.664)
N	131	124
R-squared	0.461	0.479

The table presents the results of an OLS regression with robust standard errors in parentheses. The dependent variable is the performance measured as the number of solved words in stage 2. The dummy variable Penalty Cash is 1 if subject participated in the Penalty Cash treatment and 0 for participants in the Penalty No Cash treatment. Loss aversion is represented by the number of rejected lotteries in the loss aversion test. Female indicates whether the participant is female (= 1) or not (= 0). The sample sizes differ, because we excluded 7 participants due to inconsistent lottery choices. *, **, and *** document significance at the 10%, 5%, and 1% levels, respectively

Table 3 Contract framing effect on effort in the encryption task (Baseline category: Bonus)

	Number of words (1)	Number of words (2)
Penalty Cash	0.495**	0.476**
	(0.219)	(0.226)
Penalty No Cash	0.0653	0.0469
	(0.250)	(0.258)
Baseline Performance	0.770***	0.781***
	(0.0711)	(0.0737)
Loss Aversion		−0.106
		(0.0820)
Female		−0.255
		(0.200)
Constant	4.838***	5.197***
	(0.483)	(0.519)
N	195	184
R-squared	0.417	0.423

The table presents the results of an OLS regression with robust standard errors in parentheses. The dependent variable is the performance measured as the number of solved words in stage 2. The dummy variable Penalty Cash is 1 if subject participated in the Penalty Cash treatment and 0 for in the Bonus treatment. The dummy variable Penalty No Cash is 1 if subject participated in the Penalty No Cash treatment and 0 for participants in the Bonus treatment. Loss aversion is represented by the number of rejected lotteries in the loss aversion test. Female indicates whether the participant is female (=1) or not (=0). The sample sizes differ, because we excluded 11 participants due to inconsistent lottery choices. *, **, and *** document significance at the 10%, 5%, and 1% levels, respectively

by the number of rejected lotteries in the loss aversion test, and whether the participant is female, or not. Including these controls does not alter the results.

Since we chose a challenging target, it could be that low performers as measured by their performance in stage 1 have given up pursuing the target irrespective of the treatment.[8] When conducting the regression analysis excluding the lowest ~ 10% or the lowest 20% of the performers,[9] the coefficient for Penalty Cash increases in magnitude and is statistically significant on the 5% level (model 2, coefficient: 0.491, p-value = 0.042 excluding the lowest ~ 10%; coefficient: 0.621, p-value = 0.016, excluding the lowest 20%).

Next, we analyze the effort-enhancing effect of penalty contracts with and without a cash upfront payment compared to the bonus contract. Specifications 1 and 2 of Table 3 report the corresponding estimates. Note that both treatment dummies Penalty Cash and Penalty No Cash are 0 for the Bonus treatment and take on the

[8] We are grateful to an anonymous reviewer for suggesting this analysis.

[9] The lowest ~ 10% of all performers solved between 2 and 4 tasks in stage 1. The lowest 20% of all performers solved between 2 and 5 tasks in stage 1.

value 1 if the participant worked under a penalty contract with a cash upfront payment or without a cash upfront payment, respectively. In line with the descriptive statistics, the results show that when a cash upfront payment is in place, penalty contracts induce significantly more effort than economically-equivalent bonus contracts.

The exclusion of the lowest ~ 10% or lowest 20% of performers for this analysis leads to an increase in magnitude of the treatment effect and shows a (highly) statistically significant difference comparing the Penalty Cash to the Bonus treatment (model 2, coefficient: 0.513, p-value = 0.033, excluding the lowest ~ 10%; coefficient: 0.748, p-value = 0.003, excluding the lowest 20%). In contrast, the exclusion of low performers has no effect on the significance levels when comparing the Penalty No Cash to the Bonus treatment. In sum, without the cash upfront payment, there is no effort-enhancing effect of the penalty contract compared to the bonus contract. We therefore conclude that in our experiment cash upfront payment is crucial for enhancing effort under penalty contracts.

4 Discussion and conclusion

Experimental evidence on the effectiveness of penalty contracts is ambiguous (see Table 4 in Appendix A). A closer look at the literature reveals that existing studies differ considerably in their design choices. We contribute to the ongoing debate about the differing methods by examining the relevance of the cash upfront payment as a driver of contract framing effects. First, we compare effort provision when working under two penalty contracts that only differ in terms of the timing of the physical payment. In the Penalty Cash treatment, participants solved significantly more tasks as compared to the Penalty No Cash treatment. Second, we find that in comparison to the Bonus treatment, the Penalty Cash treatment leads to significantly higher effort provision, but not the Penalty No Cash treatment. Based on our findings, we conclude that the effort-enhancing effect of penalty contracts is considerably driven by a cash upfront payment handed out prior to working on the task.

There are several potential reasons as to why the cash handout in the Penalty Cash treatment fosters higher effort provision. First, one potential driver of the effort-enhancing effect of the cash payment could be positive reciprocity (Falk and Fischbacher 2006; Rabin 1993). If people regard the cash upfront payment as a kind action of the experimenter, they might return more effort. Therefore, one possibility is that positive reciprocity in response to receiving an upfront cash payment induces higher effort irrespective of any fear of losing the money. To analyze this possibility, we use stage 1 of the experiment and examine the effect of upfront cash payments on effort under a fixed wage. Pairwise comparisons of the effort in stage 1 reveal that there are no statistically significant differences in baseline performance across the treatments (see Table 1 in the Results Section). This suggests that the effort-enhancing effect of the physical upfront payment under penalty contracts is likely

not due to a positive reciprocation of the cash upfront payment. Second, handing out the cash upfront could affect participants' beliefs that it is highly likely or the norm to reach the target. However, while we cannot rule out this possibility, we believe that it is rather unlikely, given that participants got well acquainted with the task in stage 1 and received feedback about their own performance, allowing them to use this knowledge in their assessment of stage 2. Finally, a more likely driver behind our results could be that holding the cash upfront payment in one's hands increased its salience and in turn induced a stronger feeling of ownership. Reb and Connolly (2007) experimentally examined the effect of physical possession of a good in contrast to factual ownership on participants' subjective feeling of ownership. They concluded that the endowment effect (Thaler 1980), which states that people tend to value a good more highly when they own it, results from perceived ownership induced by physical possession. Physical possession could thus induce a stronger shift of the reference point (Kahneman and Tversky 1979) and therefore, given loss aversion, foster effort provision.[10] Following this argumentation, our results might be due to an increase in the salience of the upfront payment, which in turn reinforces the feeling of ownership, shifts the reference point, and thus induces a greater fear of losing the money. Alternatively, physical possession could also change the salience of an otherwise identical shift of the reference point. For instance, in the study of mixed feelings, Kahneman (1992) argues that people can have multiple reference points at a given point in time and salience is one factor determining which of these reference points receives a higher weight for the perceptions of the decision maker. Further research is warranted to provide a deeper understanding of the underlying mechanisms.

Furthermore, future research could deepen our understanding of the driving factors behind framing effects and could broaden our understanding of the interplay with different factors. For example, Czibor et al. (2022) find that penalty contracts do not lead to an increase in performance, but they observe an increase in theft, suggesting that there are important behavioral spillover effects of framed contracts. This could further be extended to the interplay between supervisor remuneration and employee engagement (e.g., Hendriks et al. 2022 for CEO compensation and employee effort). In addition, the threat of employees having to actually pay back money could have an effect on the social sustainability of the firm (Tipu 2022), that future research could investigate. Related to our design choices, we believe that the implemented real effort task (Benndorf et al. 2019), as well as the choice and parametrization of the incentive contracts conditioning a substantial fraction of the maximum payoff on a challenging, yet achievable, performance target might be conductive to inducing a relatively large framing effect. Learning more about framing

[10] Prior lab experiments show that reference points can be systematically shifted (e.g., Abeler et al. 2011; Hack and von Bieberstein 2015). Although these shifts are often due to varying expectations, de Quidt (2018) showed that a model combining status quo and expectations-based reference points can produce framing effects.

effects in different tasks or with different targets could prove to be an important avenue for future research.

Our findings emphasize the importance of experimental design choices when studying framed incentive contracts. With respect to the implementation of framing experiments in the laboratory our contribution is the following: In order to use scare resources efficiently, we recommend including cash upfront payments when aiming for eliciting a contract framing effect or analyzing its consequences. Our findings suggest physical possession of the money as a simple and valid tool to successfully induce framing effects in a laboratory setting.

Appendix A

Table 4 Overview of laboratory and online experiments on contract framing

Study	Cash upfront	Penalty effect	Effect size Hedge's g	Country	Subjects	Lab / online	N B, P	Task	Fixed pay	Variable pay B, P	Target
Ferraro and Tracy 2022	Yes	Yes	0.12	US	Students	Lab	268, 268	Counting numbers	None	$ 0.25	No
Goldsmith and Dhar 2013	Yes	Yes	0.68	US	Students	Lab	31, 31	Anagrams	None	$ 0.25	No
Grolleau et al. 2016	Yes	No	0.03	France	Students	Lab	150, 150	Finding numbers	None	€ 1.50 per task	No
Hannan et al. 2005	Yes	Yes	0.54	US	Students	Lab	35, 33	Chosen effort	$ 20	$ 10	Yes
Hochman et al. 2014 (Exp. 2 A)	Yes	Yes	0.81	Israel	Students	Online	25, 25	Answering questionnaires	None	7 or 9 NIS	No
Imas et al. 2017	Yes	Yes	0.49	US	Students	Lab	40, 43	Slider task	None	T-shirt (cost $ 9)	Yes
von Bieberstein et al. 2020	Yes	Yes	0.54	Germany	Students	Lab	33, 34	Encrypting letters	€ 10	€ 0.50 per task	No
Armantier and Boly 2015	No	Yes	0.46	Canada	Students	Lab	58, 56	Grading exams	C$ 2.08	C$ 6.25/10.42/18.75	Yes
Brooks et al. 2012	No	No	0.26	Switzerland	Students	Lab	72, 73	Chosen effort	CHF 20	CHF 5	Yes
Brooks et al. 2017	No	Yes	n/a	Germany	Students	Online	50/50/54/39	Counting numbers	€ 0/5/15/50	€ 1 beyond the threshold	Yes
Church et al. 2008	No	Yes	n/a	Canada	Students	Lab	36, 32	Encrypting symbols	$ 10	$ 10	Yes
DellaVigna and Pope 2018	No	No	− 0.07	US	MTurkers	Online	545, 532	Pressing a-b keys	$ 1	$ 0.4	Yes

Table 4 (continued)

Study	Cash upfront	Penalty effect	Effect size Hedge's g	Country	Subjects	Lab / online	N B, P	Task	Fixed pay	Variable pay B, P	Target
de Quidt et al. 2017	No	No	− 0.08 / 0.09	US	MTurkers	Online	292, 287 / 137, 137	Encrypting letters	$ 0.50	$ 1.50	Yes
de Quidt 2018	No	Yes	~0.5	US	MTurker	Online	153–193, 151–191	Transcribing text strings	$ 0.5 – $ 2	$ 1.5 – $ 3	Yes
Essl and Jaussi 2017	No	No	− 0.30	Switzerland	Students	Lab	34, 30	Counting numbers	None	CHF 0.4 / 0.6	No
Goldsmith and Dhar 2013	No	Yes	0.26	US	MTurker	Online	134, 134	Anagrams	$ 0.5	$ 0.02	No
Liu and Zhang 2015	No	No	− 0.24	US	Students	Lab	31, 34	Symbol decoding task	$ 10	$ 5	Yes

The table presents details of the experimental designs of previous lab and online studies. B = Bonus, P = Penalty, C$ = Canadian Dollar, FCFA=CFA Franc, e=Euro, NIS=New Israeli Shekel, CHF=Swiss Franc, US Dollar

Appendix B: Experimental instructions

General Instructions

Welcome.

Please read the instructions carefully. All participants receive the same information:

- In this experiment, you will be paid in cash according to your decisions.
- All decisions, answers, and payments are anonymous, i.e. no participant will know the amount of money the other participants receive.
- The experiment consists of 4 parts and a questionnaire.
- You are not allowed to communicate with other participants, use a mobile phone, or start any computer application. If you violate these rules, you will be excluded from the experiment and the payments.
- If you have any questions, please raise your hand. An experimenter will then come to you and answer your question.

Thank you very much for participating and have fun!

Please read the instructions for part 1 of the experiment on your computer screen.

Instructions Part 1
(on screen)

In part 1 of the experiment, we offer you six lotteries. You can **decide** in each case whether you want to **participate in the lottery** that is offered **or not**.

At the end of the experiment, one of the six lotteries will be randomly selected and paid out.

Your decisions:

You decide for each lottery whether **you want to participate ("Yes")** or whether **you do not want to participate ("No").**
If you do **not** participate in the lottery, you will **not receive any money from the lottery.**

Payment:

At the end of the experiment, a random generator is initially used to determine which of the six lotteries will be paid out.

To determine your payment in case of participation in this lottery, a virtual coin is tossed at the end of the experiment. If it is heads, you **win** CHF 6. If it is tails, you **lose** CHF 2 to 7, depending on the lottery.

If you make a win, it will be added to your payment at the end of the experiment.

If you make a loss, it will be deducted from your payment of the other parts at the end of the experiment.

If you have no further questions, please press “OK” to get to the lotteries.

Part 1

Below you find 6 lotteries.
For each lottery, you can decide whether you want to participate in the lottery offered ("Yes") or not ("No").

Lottery number	Lottery	Your choice
1	With a 50% probability, you win 6 CHF and with a 50% probability, you lose 2 CHF.	○ Yes ○ No
2	With a 50% probability, you win 6 CHF and with a 50% probability, you lose 3 CHF.	○ Yes ○ No
3	With a 50% probability, you win 6 CHF and with a 50% probability, you lose 4 CHF.	○ Yes ○ No
4	With a 50% probability, you win 6 CHF and with a 50% probability, you lose 5 CHF.	○ Yes ○ No
5	With a 50% probability, you win 6 CHF and with a 50% probability, you lose 6 CHF.	○ Yes ○ No
6	With a 50% probability, you win 6 CHF and with a 50% probability, you lose 7 CHF.	○ Yes ○ No

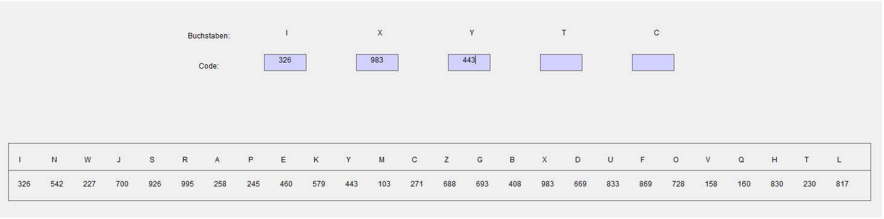
When you have made your decisions, please confirm your entries by pressing “OK”. Once you have pressed “OK”, you can no longer change your decision.

Part 2

In part 2, we ask you to encode capital letters in 3-digit numbers. You have 3 minutes and receive 5 CHF.

- Each task consists of 5 capital letters to be coded.
- Coding means that a 3-digit number must be assigned to each of the 5 capital letters.
- An encryption code indicates the numbers to be assigned to the respective letters.
- You can find the encryption code in a table below the letters to be coded.

This task is an example:



- In this task, the participant has to code the 5 letters: "I", "X", "Y", "T", and "C". The solution can be taken directly from the encryption code:
  - The correct number for "I" is 326 (see participant's entry in the example).
  - The correct number for "X" is 983 (see participant's entry in the example).
  - The correct number for "Y" is 443 (see participant's entry in the example).
  - The correct number for "T" is 230.
  - The correct number for "C" is 271.
- To make an entry, please click in the blue field below the respective letter.
- With the tab key, you can switch from one entry field to the next.
- When you have completed a task, i.e. when you have coded all 5 letters into 3-digit numbers, please click the “OK” button.
- Only after you have clicked the “OK” button, you will learn whether you solved the task correctly.
- If you solved the task correctly, you can start with the next task. Please note that a new encryption code is generated for each task.
- If you solved the task incorrectly, you will be asked to solve the task again.

If you have any question, please raise your hand. The experimenter will come to you and help.

If you have no further questions, please click "Next" on your computer screen.

Part 3

In part 3, you will complete the same exercise as in part 2.

- You receive a total of **20 tasks**.
- You have **exactly 4 minutes** to complete the tasks.
- They are the same type of task you did in part 2.
- Again, each task consists of 5 capital letters to be coded. In each task, a 3-digit number must be assigned to each of the 5 letters. The input mask and the general conditions correspond to those of part 2 (see the instructions for part 2).
- In contrast to part 2, your payment in part 3 depends partly on how many tasks you complete.

Your payment

- You receive **5 CHF**.
- If you complete **at least 12 tasks**, you will receive an **additional 10 CHF,** and **your payment is 15 CHF**.
- If you complete **fewer than 12 tasks**, you will **not receive any additional payment**.

Examples:

- If you complete **between 12 and 20 tasks**, you will receive **additional 10 CHF** on top of your 5 CHF.
- If you complete **between 0 and 11 tasks**, you will **not** receive **an additional payment** on top of your 5 CHF.

Please answer 2 comprehension questions on the screen. Afterwards, you receive 5 CHF from the experimenter, and you can start part 3.

If you have no further questions, please click "Next" on your computer screen.

Part 3

In part 3, you will complete the same exercise as in part 2.

- You receive a total of **20 tasks**.
- You have **exactly 4 minutes** to complete the tasks.
- They are the same type of task you did in part 2.
- Again, each task consists of 5 capital letters to be coded. In each task, a 3-digit number must be assigned to each of the 5 letters. The input mask and the general conditions correspond to those of part 2 (see the instructions for part 2).
- In contrast to part 2, your payment in part 3 depends partly on how many tasks you complete.

Your payment

- You receive **15 CHF**.
- If you complete **at least 12 tasks**, you can **keep the 15 CHF**.
- If you complete **fewer than 12 tasks**, you must **pay back 10 CHF and your payment is 5 CHF**.

Examples:

- If you complete **between 12 and 20 tasks**, you **keep your 15 CHF**.
- If you complete **between 0 and 11 tasks**, you have to **pay back 10 CHF** of your **15 CHF** and **keep 5 CHF**.

Please answer 2 comprehension questions on the screen. Afterwards, [in Penalty Cash: you receive 15 CHF from the experimenter and] you can start with part 3.

If you have no further questions, please click "Next" on your computer screen.

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Data availability The datasets generated by the experimental research and analyzed in the current study are available onrequest.

Declarations

Conflict of interest The authors state that there was no conflict of interest or competing interests at any time.

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