Replication for "Anticipatory Anxiety and Wishful Thinking"

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Abstract

We conduct a direct replication of the paper "Anticipatory Anxiety and Wishful Thinking" by Engelmann et al by translating portions of the project's `STATA` code into `R` both blindly and using their provided code. We find the authors `STATA` code ran smoothly, and we were able to reproduce Table 2 as well as Figures 2, 3, and 4 using `R`. We identify an inconsistency between the reported maximum number of trials per participant in experiment 3 and the provided data. We conduct robustness checks to see if this inconsistency changes the significance or direction of the results, and we conclude that there is no significant differences between our robustness checks and the reported results.

KEYWORDS: Replication, experiment, consistency

JEL CODES: C91, D12, D83, D91.

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1 Introduction

Engelmann et al. (2024) test the hypothesis that people engage in wishful thinking to alleviate anxiety about adverse future outcomes.

They designed and implemented five experiments. In each experiment, they assigned a number of trials to participants about a pattern recognition task, who were asked, with monetary incentives, to identify which of two possible types of pattern was shown on the screen. Depending on the experiment, one of the two patterns was associated with the possibility of an undesirable outcome: an electric shock or a monetary loss. Their underlying assumption was that if participants saw a no-shock pattern, they would increase their subjective belief about the imminent shock or loss. They would be less accurate in their response when seeing a shock pattern and more accurate when seeing a no-shock pattern. Difference between average accuracy for seeing two types of patterns provides implication for the presence of wishful thinking.

In the present report prepared for the Institute for Replication, we examine their raw data files, their data cleaning procedures, and the reproduction of their main results.

In terms of reproducibility, we would like to acknowledge that the original study was successfully reproduced by the data editor's team at the American Economic Review. We also successfully reproduced Engelmann et al. (2024)'s main tables and figures using their codes.

In terms of replication, we write our own version of the code in R to successfully replicate Table 2, Figure 2, Figure 3, and Figure 4 of the paper. Some of these codes are written blindly, while others base themselves heavily on the codes provided in the Stata replication files.

Finally, in terms of sensitivity analysis, we produce a modified version of the regression results for Experiment 3, in Table 2 of the paper. Motivated by a slight discrepancy between the reported number of sessions conducted in experiment 3 in the paper, and the number of sessions found in the raw data files, we run the same regression model for Experiment 3 three separate times, dropping one of the three sessions each time. We do so in case one of these sessions was actually a practice session that was mistakenly included in the regression codes. Reassuringly,

we find no significant difference in the regression outputs of Experiment 3 when either session is dropped, indicating that the results would be robust to such a potential mistake.

2 Data Validity

Unit tests were performed on data primarily using the `testdat` package in `R`[1]. We checked the total number of (unique) participants in each experiment, the total number of trials a participant was subjected to, and the total number of treatment blocks a participant was subjected to.

We found a discrepancy in the number of maximum trials per participant in Experiment 3 as reported in Table 1 of the original paper. In the experimental design, "[p]articpiants completed two parts. In each part they received an endowment of £5 from which they would lose £1 with a probability of one-third if a 'loss pattern' appeared. The part finished when the endowment was exhausted (after 5 losses) or after 32 trials." Thus, there should only be a maximum of 64 trials observed, but nearly all participants record more than 64 trials, and the computed maximum number of trials for a participant in experiment 3 is 96. We could not find any information explaining this discrepancy in the paper or associated replication package.

3 Computational Reproducibility

In this section, we try to reproduce the results using the original `Stata` code provided in the replication package.

We used the replication package from Data and Code for "Anticipatory Anxiety and Wishful Thinking" . The complete cleaning and analysis code is provided in the replication package. The raw data (experiment results) as well as the cleaned data are provided in the folder. We are able to successfully computationally reproduce all the main tables and figures (*i.e.*, Tables A1, A2 and A3) from the raw data using

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[1]This analysis was conducted blindly, in the sense that we did not look for or use any raw data tests in the replication file

the original `Stata` code. Running the entire code from beginning to end took less than 3 minutes. See Table 1 for details.

We note two very minor issues that we ran into. Namely, the .tex files produced by the `Stata` code for Tables 3 and 4 in the paper are missing some rows, when compared with the tables presented in the final paper. Table A2 is missing "Experiment dummies", and "Restrictions" rows. Table A3 is missing "Experiment no." and "Conditions". Another minor inconvenience, Table A1 is missing the labels for each regression. And the last column of Table A1 also fails to be contained in the tabular structure for no obvious reason.

4 Robustness Reproduction and Replication

In this section, we replicate some of the main tables and figures by writing our own version of the codes in `R`. Note that the titles in bold refer to the table/figure in the paper. The hyperlinks refer to the order of tables and figures in our latex report.

Table 2.

- Original Table: Table A1.

- Our Table: 2.

Trying to modify the Stata scripts into R, we obtain identical regression results as those presented in the main table of the paper.

Table 2 - Robustness checks.

- Original Table: Table A1.

- Robustness Check Table: Table 3.

As noted in the Data Validity section, we noticed a discrepancy between the reported number of trials in experiment 3, and the actual number of trials found in the raw data files. More precisely, the paper states that participants of experiment 3 participated in 2 sessions of up to 32 trials each, while the raw data file indicates 3 sessions of 32 trials each. This may be suggestive of one of two things, either: (i) that one of the three sessions indexed by (0,1,2) might be a practice session, or (ii)

that the main table in the paper has a typo, as it fails to indicate that participants in experiment 3 participated in up to 96 trials, rather than up to 64 trials.

In our replication of experiment 3 regressions, we find that the regression estimates match those in the main table of the paper when all three sessions of experiment 3 are used (so up to 96 trials per participant). To account for the possibility that one of these three sessions might possibly be a practice session, we run three separate regression specification, ignoring all trials in session 0, session 1, and session 2, respectively. Note that we do this because there is no indication as to which of the three sessions might potentially be a practice session. Noticeably, we conclude that no matter which session is dropped, the sign, magnitude, and statistical significance of the coefficients *do not differ significantly* from those presented in the paper.

Figure 2.

- Original Figure: Figure A1.

- Our Figure: Figure 1.

Figure 2 is replicated line-by-line from `Stata` to `R`. The difference in syntax made the translation not very straightforward. However, once one plot is successfully produced, the others are fairly easy to reproduce.

No discrepancy is observed between the original figure and our figure.

Figure 3.

- Original Figure: Figure A2.

- Our Figure: Figure 2.

Figure 3 was not challenging to blindly replicate. All observations where no penalties are incurred in the experiment are dropped. The density for reported anxiety level $i \in \{1, 2, 3, 4, 5\}$ in the loss environment $\theta \in \{\text{high}, \text{low}\}$ is then the total number of trial blocks (1 trial block is at most 8 trials) where the participant reported anxiety level i and incurred loss environment θ.

Figure 4.

- Original Figure: Figure A3.

- Our Figure: Figure 3.

Figure 4 is constructed similar to Figure 2. Hence it was easy to reproduce. No discrepancy is observed between the original figure and our figure.

5 Conclusion

Regarding the replication, we firstly managed to produced the same output as (Engelmann et al. 2024) presented in the original paper by running their codes in `Stata`. To validate their results in more depth, we managed to replicate table 2 with main results, along with figure 1, figure 2, and figure 3 by reproducing our own version of the code in `R`.

Besides one small and potential discrepancy in the data used to run regressions in Table 2 for Experiment 3, we conclude that the results are easily readable and reproducible.

References

Engelmann, J. B., Lebreton, M., Salem-Garcia, N. A., Schwardmann, P. and van der Weele, J. J.: 2024, Anticipatory anxiety and wishful thinking, *American Economic Review* **114**(4), 926–960.
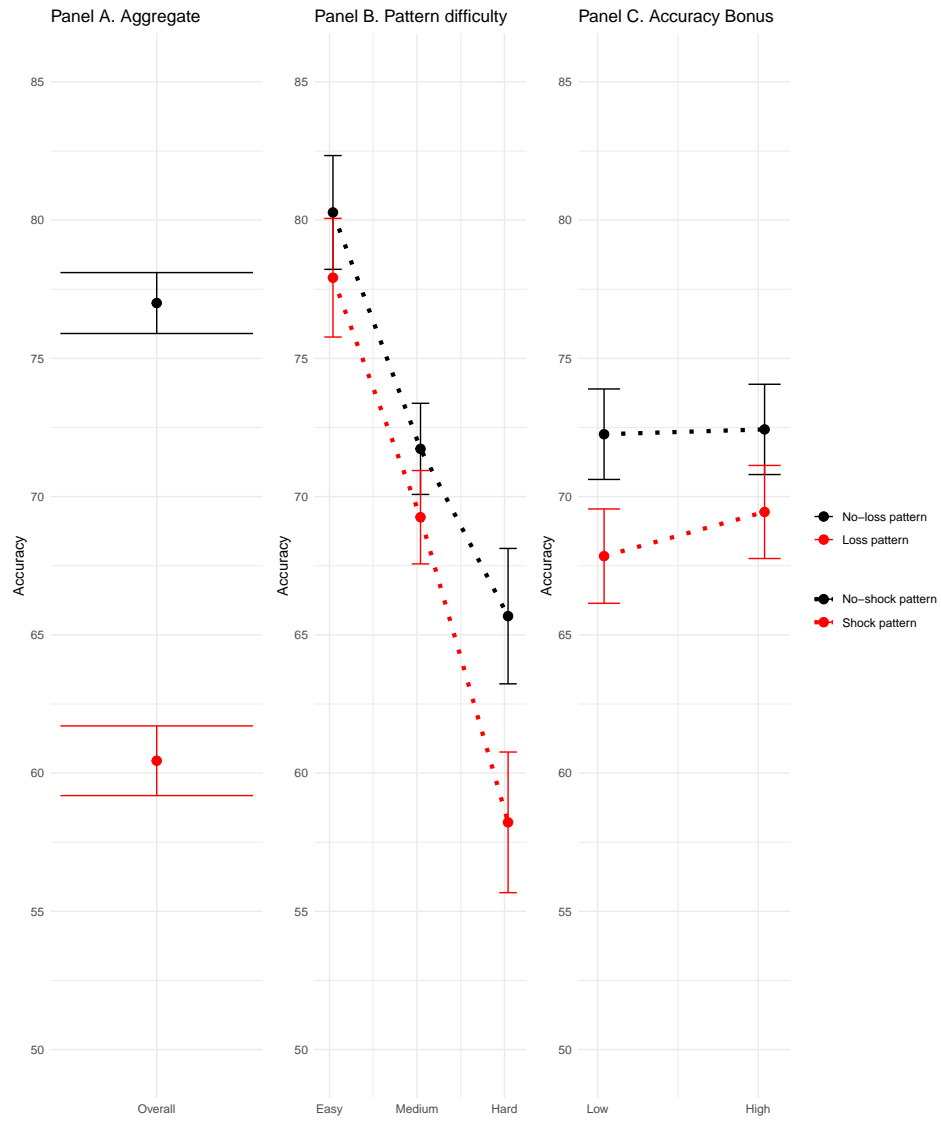
6 Figures

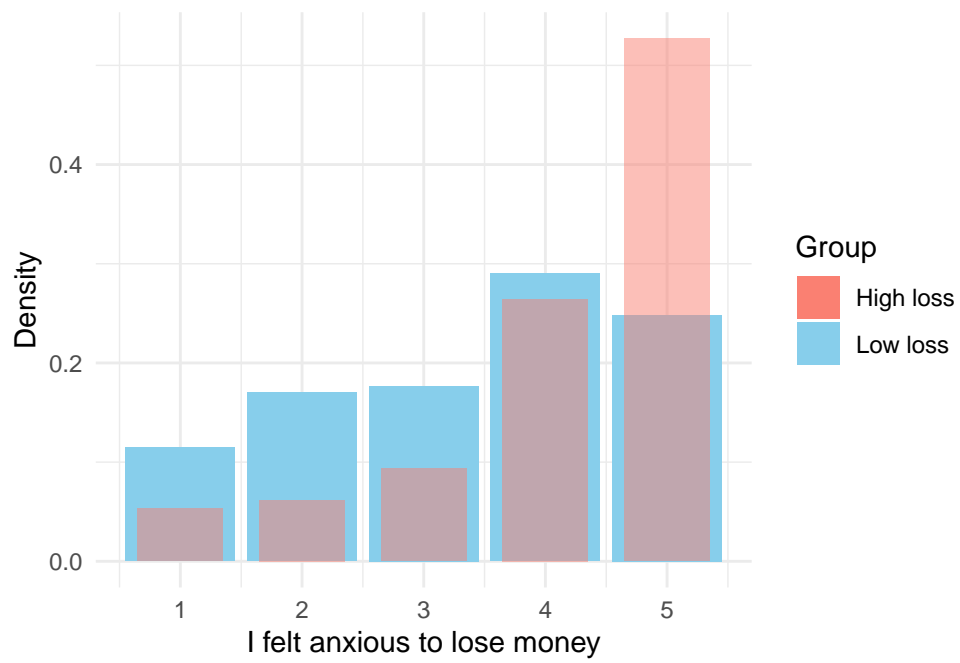Figure 1: Electric Shocks and Accuracy in Experiment 1 - REPRODUCED
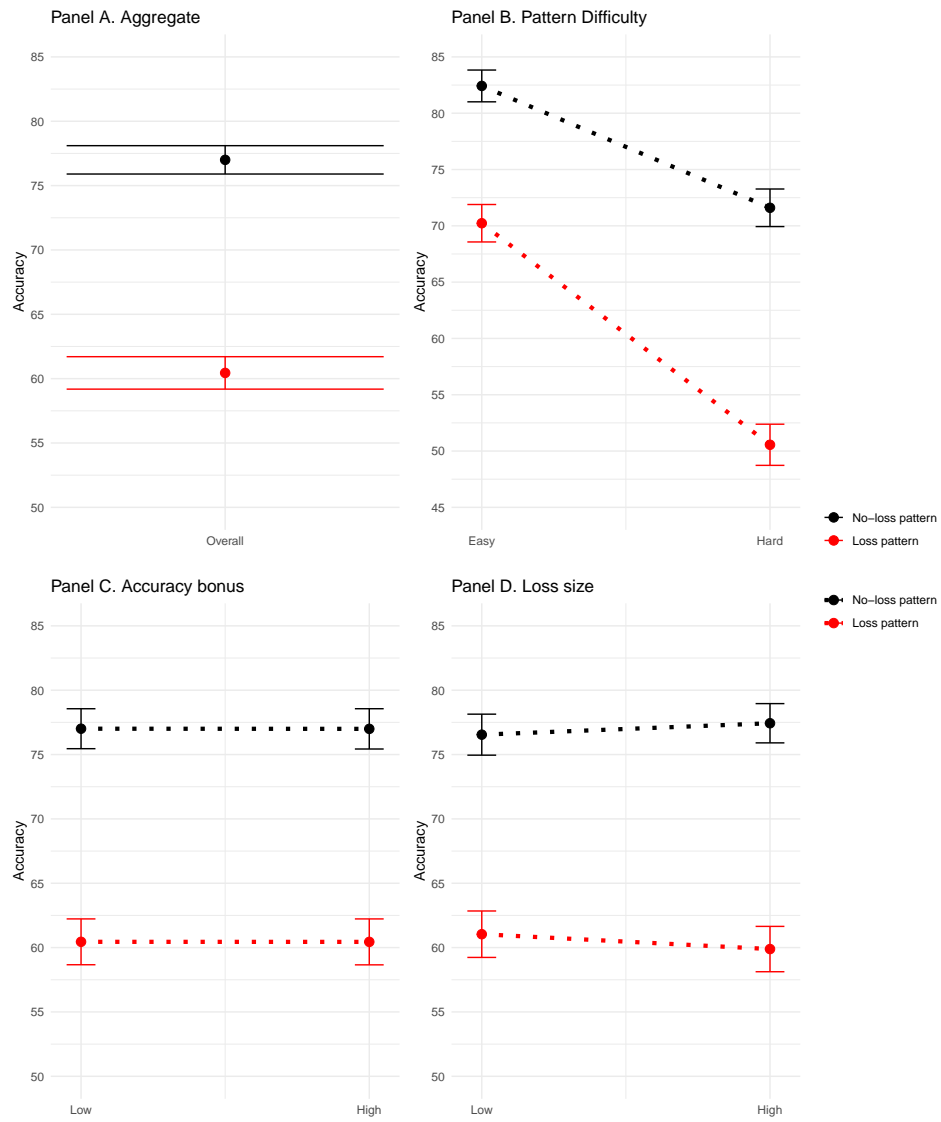
Figure 2: Manipulation Check - REPRODUCED

Figure 3: Monetary Losses and Accuracy in Experiment 2 - REPRODUCED

7 Tables

Table 1: Replication Package Contents and Reproducibility

Replication Package Item	Fully	Partial	No
Raw data provided	✓		
Analysis data provided	✓		
Cleaning code provided	✓		
Analysis code provided	✓		
Reproducible from raw data	✓		
Reproducible from analysis data	✓		

Notes: This table summarizes the replication package contents contained in Engelmann et al. (2024).

	Experiment 1a	Experiment 1b	Experiment 2a	Experiment 2b	Experiment 3a	Experiment 3b	Experiment 4a	Experiment 4b
Constant	80.748***	79.700***	85.820***	81.653***	87.663***	87.056***	89.534***	88.978***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Shock/Loss pattern	−4.111***	−2.014	−16.539***	−8.248**	−4.266***	−3.052***	−8.452***	−7.339***
	(0.001)	(0.123)	(0.000)	(0.009)	(0.000)	(0.000)	(0.000)	(0.000)
High accuracy bonus (HAB)	0.785	0.313	−0.588	−1.081	0.630	0.685	1.732**	1.050
	(0.186)	(0.411)	(0.245)	(0.160)	(0.092)	(0.127)	(0.003)	(0.110)
Difficult pattern (DP)	−8.602***	−7.318***	−15.681***	−11.044***	−20.546***	−19.387***	−7.064***	−6.466***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Shock/Loss pattern × HAB		0.944		0.994		−0.110		1.363
		(0.299)		(0.287)		(0.450)		(0.152)
Shock/Loss pattern × DP		−2.569**		−9.200***		−2.317**		−1.196**
		(0.010)		(0.000)		(0.005)		(0.009)
Loss Size (LS)			−0.617	0.776				
			(0.248)	(0.266)				
Shock/Loss pattern × LS				−2.784				
				(0.068)				
Num. obs.	720	720	3415	3415	3408	3408	6502	6502
R² (full model)	0.261	0.266	0.134	0.140	0.236	0.236	0.109	0.110
R² (proj model)								
Adj. R² (full model)	0.258	0.261	0.133	0.139	0.235	0.235	0.109	0.110
Adj. R² (proj model)								

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$

P-values are in parentheses.

Table 2: Replication of Table A1 from Engelmann et al. (2024)

Notes: Column ordering of this table corresponds directly with the column ordering of the original table (or Table A1 in our appendix). The coefficient of interest is attached to 'Shock/Loss pattern'.

Table 3: Replication of Experiment 3 Regressions, dropping Sessions 0, 1 and 2, respectively

	Exp 3a (no drop)	Exp 3b (no drop)	Exp 3a (drop 0)	Exp 3b (drop 0)	Exp 3a (drop 1)	Exp 3b (drop 1)	Exp 3a (drop 2)	Exp 3b (drop 2)
Constant	88.355***	87.951***	88.758***	88.570***	87.382***	87.255***	88.929***	88.029***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Shock/Loss pattern	−4.498***	−3.696***	−5.303***	−4.930***	−3.775***	−3.524***	−4.419***	−2.633**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.006)
High accuracy bonus (HAB)	0.511	0.246	0.401	−0.053	1.290*	0.623	−0.161	0.164
	(0.150)	(0.351)	(0.254)	(0.473)	(0.014)	(0.213)	(0.396)	(0.423)
Difficult pattern (DP)	−20.855***	−19.768***	−20.846***	−20.005***	−20.792***	−19.866***	−20.926***	−19.427***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Shock/Loss pattern × HAB		0.526		0.899		1.323		−0.645
		(0.292)		(0.213)		(0.136)		(0.302)
Shock/Loss pattern × DP		−2.157*		−1.667		−1.838		−2.976**
		(0.013)		(0.071)		(0.063)		(0.005)
Num. obs.	9786	9786	6516	6516	6538	6538	6518	6518
R² (full model)	0.127	0.127	0.127	0.128	0.125	0.126	0.129	0.130
R² (proj model)								
Adj. R² (full model)	0.127	0.127	0.127	0.127	0.125	0.125	0.129	0.129
Adj. R² (proj model)								

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$

P-values are in parentheses.

Notes. In this table, we run robustness checks for the "experiment 3" column of Table 2 in Engelmann et al. (2024) (both columns (5) and (6) in the original table). The 'Exp 3a' columns do not include interaction terms whereas the 'Exp 3b' columns include interactions. The coefficient of interest is attached to 'Shock/Loss pattern'.

8 Original Tables and Figures

Here, we directly produce the main tables and figures from the original paper by running the Stata code files provided in the Replication Package. For each main Table and Figure, we note any discrepancy from the published paper.

Table A1: Table 2 - OLS Regressions of Accuracy Levels on Treatment across Experiments

	(1) Accuracy	(2) Accuracy	(3) Accuracy	(4) Accuracy	(5) Accuracy	(6) Accuracy	(7) Accuracy	(8) Accuracy
Shock/Loss Pattern	-4.111	-2.014	-16.54	-8.248	-4.266	-3.052	-8.452	-7.339
	(1.264)	(1.736)	(1.605)	(3.489)	(0.766)	(0.865)	(1.044)	(1.314)
High accuracy bonus (HAB)	0.785	0.313	-0.588	-1.081	0.630	0.685	1.732	1.050
	(0.878)	(1.387)	(0.851)	(1.089)	(0.474)	(0.601)	(0.628)	(0.856)
Difficult pattern (DP)	-8.602	-7.318	-15.68	-11.04	-20.55	-19.39	-7.064	-6.466
	(0.634)	(0.795)	(1.019)	(1.114)	(0.668)	(0.794)	(0.270)	(0.361)
Shock/Loss pattern x HAB		0.944		0.994		-0.110		1.363
		(1.787)		(1.771)		(0.881)		(1.325)
Shock/Loss pattern x DP		-2.569		-9.200		-2.317		-1.196
		(1.102)		(1.701)		(0.892)		(0.504)
Loss Size (LS)			-0.617	0.776				
			(0.906)	(1.245)				
Shock/Loss pattern x LS				-2.784				
				(1.869)				
Constant	80.75	79.70	85.82	81.65	87.66	87.06	89.53	88.98
	(1.106)	(1.287)	(1.964)	(2.310)	(0.791)	(0.829)	(0.734)	(0.800)
Observations	720	720	3415	3415	3408	3408	6502	6502
R^2	0.261	0.266	0.134	0.140	0.236	0.236	0.109	0.110

Standard errors in parentheses are clustered at the individual level. To see p-values and significance for each coefficient, see Table 2.

Table A2: Table 3 - Emotional and Cognitive Covariates of Wishful Thinking

	(1) Wishful Thinking	(2) Wishful Thinking	(3) Wishful Thinking	(4) Wishful Thinking
Concentration	-2.899	-3.457	-3.979	-4.987
	(0.958)	(1.220)	(1.071)	(1.342)
Defensive pessimism	-0.608	-1.072	-0.911	-1.503
	(0.399)	(0.609)	(0.425)	(0.678)
Anxiety		1.550		1.950
		(0.825)		(0.890)
Constant	32.87	31.78	38.59	38.81
	(4.942)	(6.390)	(5.590)	(7.326)
Observations	1050	625	744	422
R^2	0.066	0.053	0.086	0.076

Standard errors in parentheses

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Table A3: Table 4 - Regressions of Cognitive Effort on Accuracy Bonus

	(1) Correct	(2) Correct	(3) Correct	(4) Correct	(5) Response time	(6) Concentration	(7) concentration2	(8) concentration4
High accuracy bonus (HAB)	-0.0110	0.905	1.610	1.152	0.0433	0.159	0.145	0.204
	(0.821)	(0.905)	(0.574)	(0.690)	(0.0125)	(0.0179)	(0.0340)	(0.0229)
Observations	11396	7072	21114	13024	18468	34133	18468	34138
R^2	0.027	0.030	0.033	0.044	0.004	0.012	0.007	0.013

Standard errors in parentheses
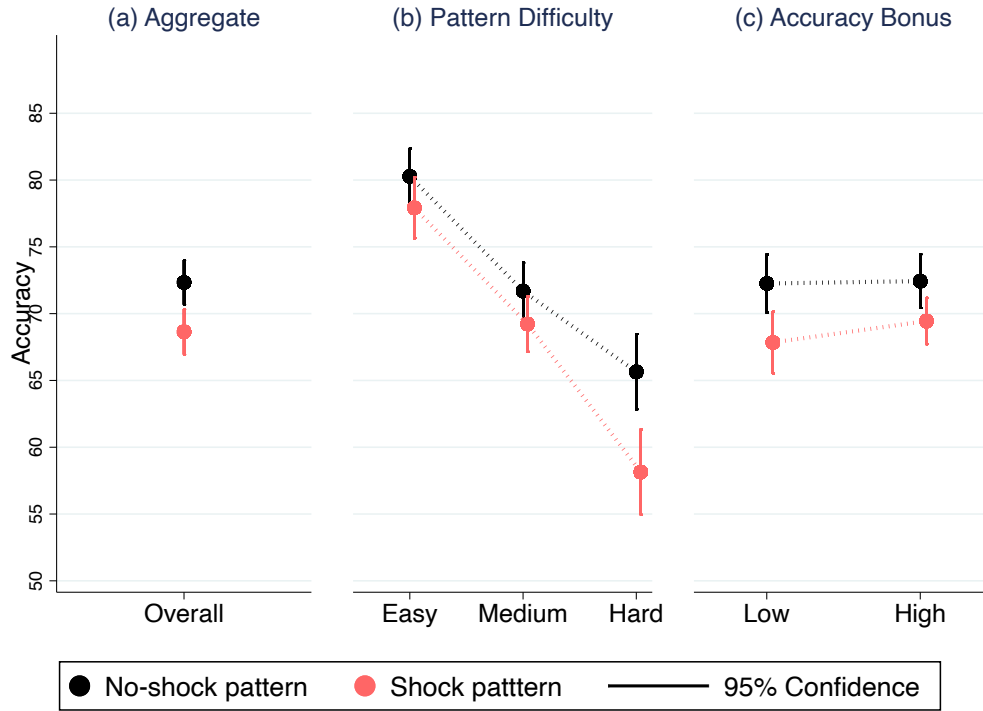
Figure A1: Figure 2 - Electric Shocks and Accuracy in Experiment 1
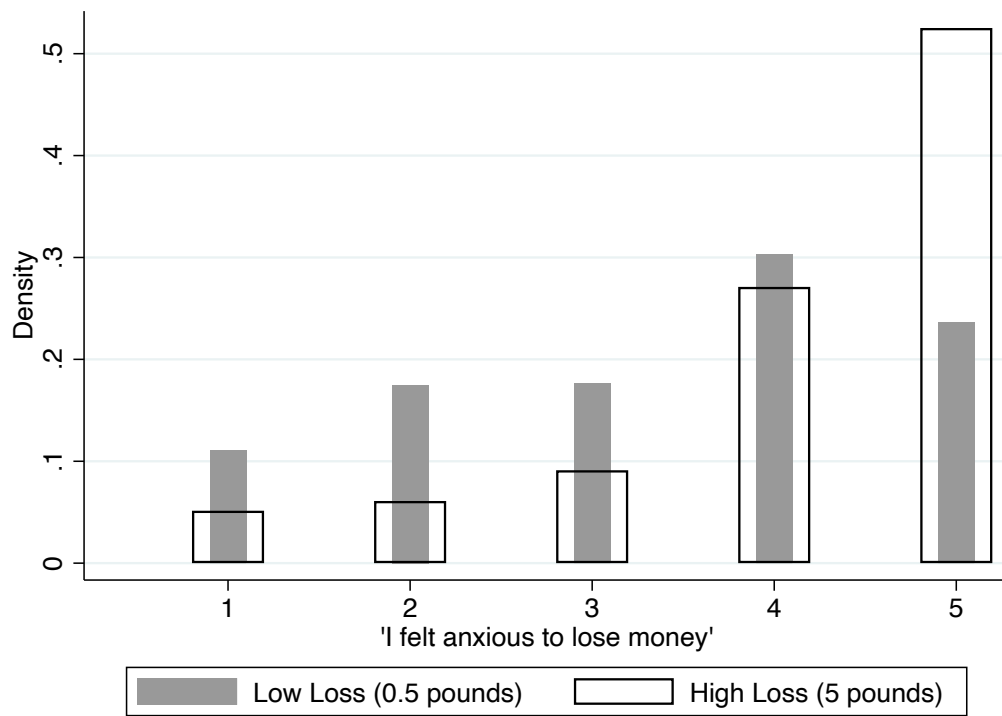
Figure A2: Figure 3. Manipulation Check
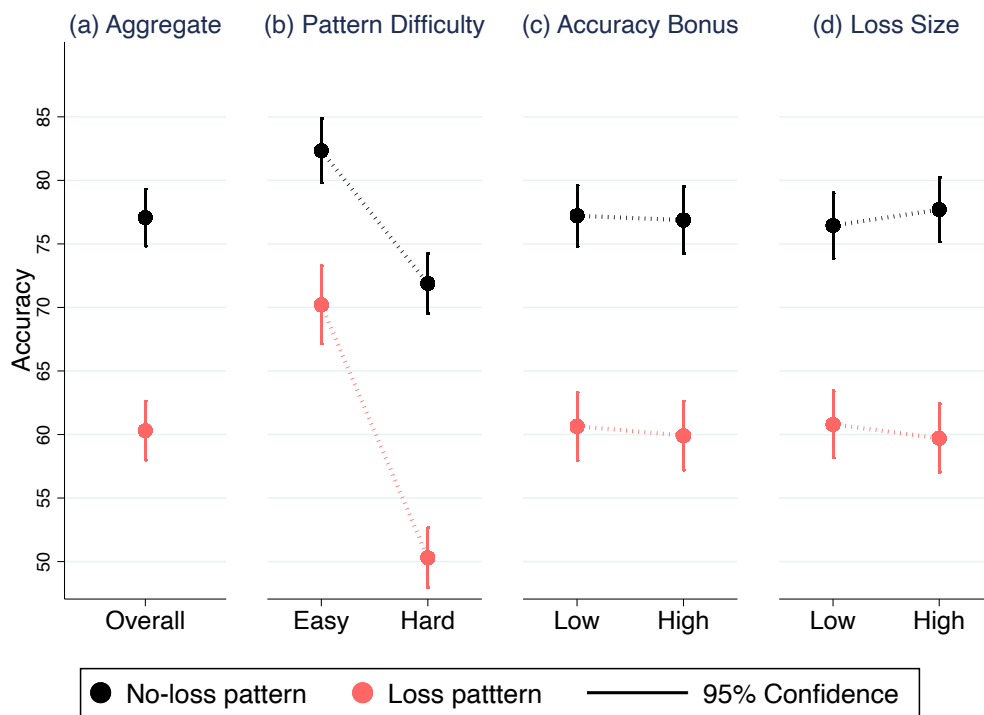
Figure A3: Figure 4. Monetary Losses and Accuracy in Experiment 2
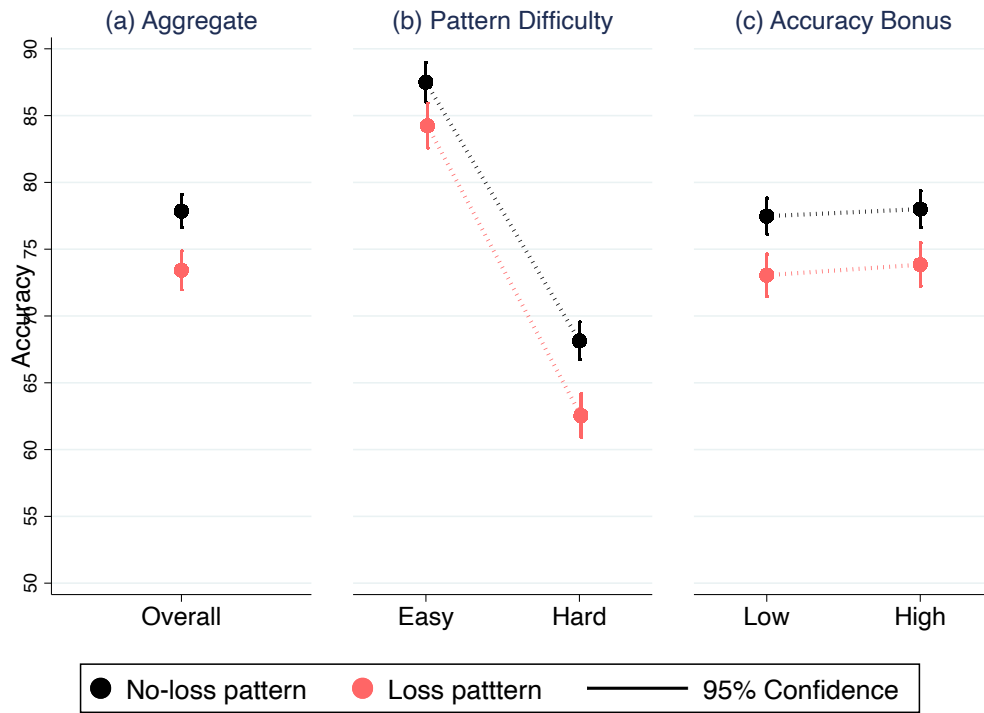
Figure A4: Figure 5 (i). Accuracy in the Multiple Gabor and Dot-Counting Tasks in Experiments 3 and 4
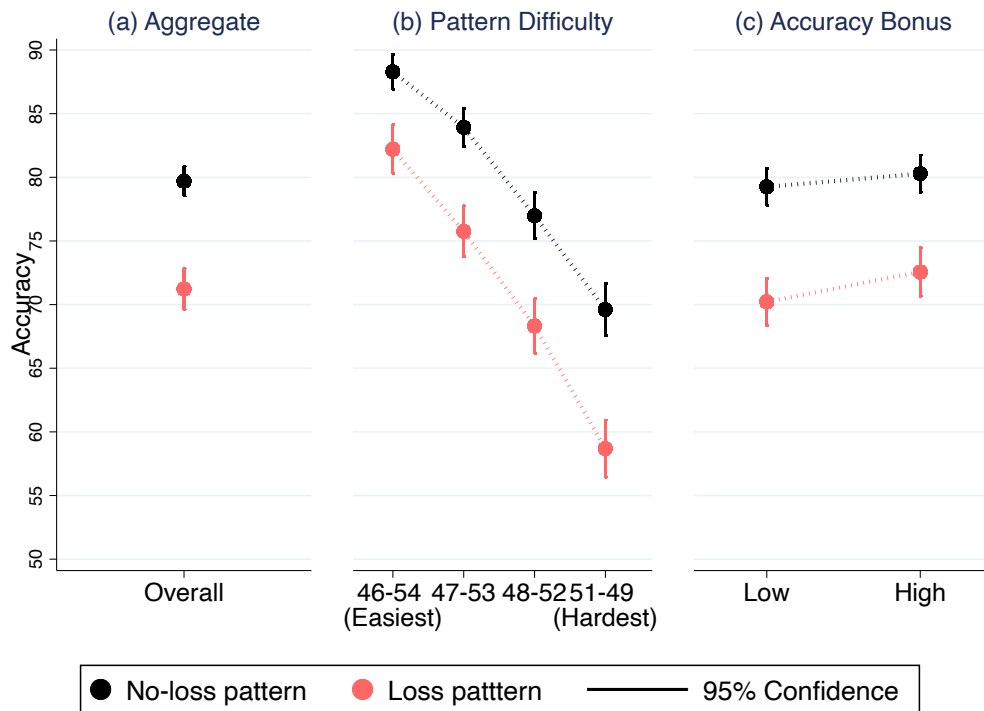

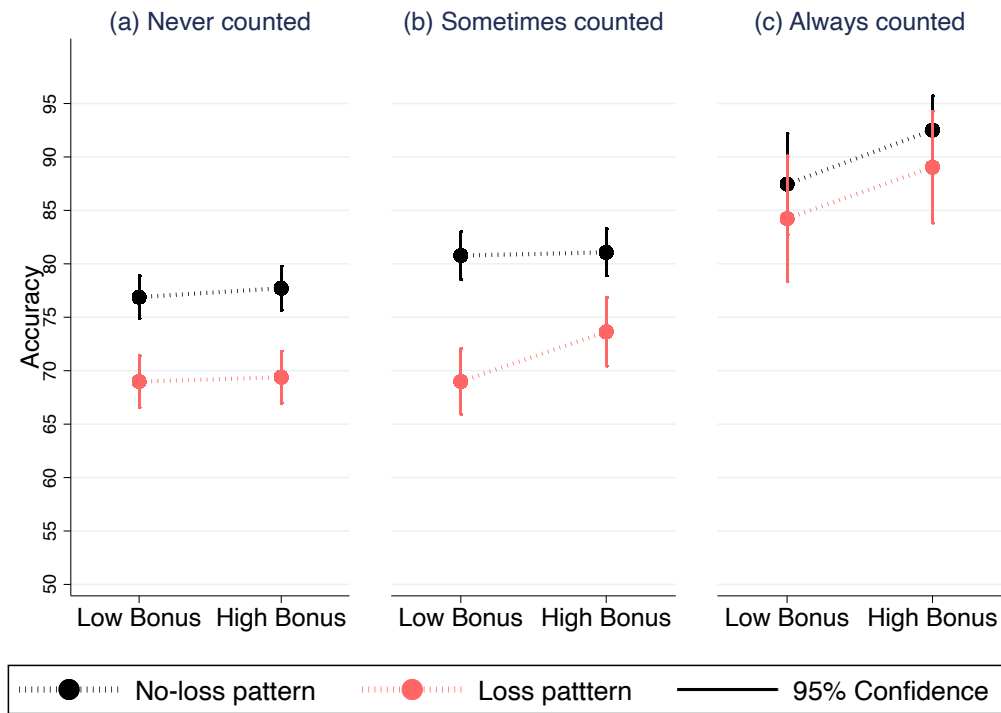Figure A5: Figure 5 (ii). Accuracy in the Multiple Gabor and Dot-Counting Tasks in Experiments 3 and 4
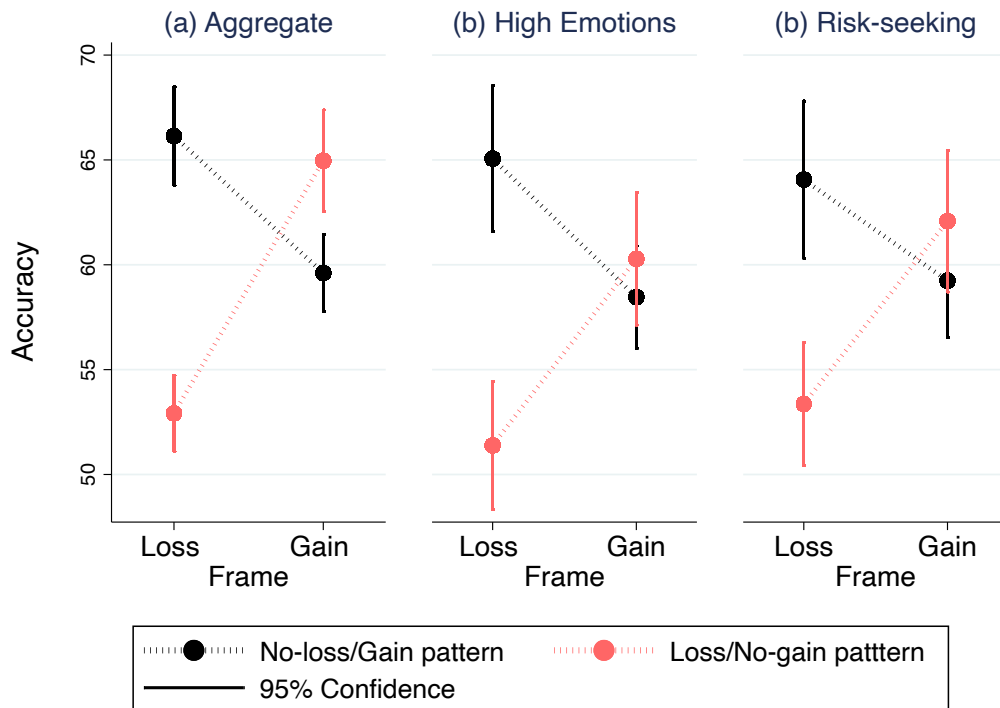
Figure A6: Figure 6. Accuracy in the Dot-Counting Task

Figure A7: Figure 7. Accuracy in the Gain Frame and Loss Frame