

Investigation of reward learning and feedback sensitivity in non-clinical participants with a history of early life stress.

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Supplementary Material

Supplementary Methods – Directly rewarded PRT in a control population.

An additional cohort of 81 participants were recruited to assess the online PRT using direct monetary compensation.

Participants

Eligibility Criteria were: aged 18 – 45 years, fluent in English, resident in the UK, normal or corrected-to-normal vision (self-report), no current or previous diagnosed mental health condition (self-report), reported using a macOS or windows 10 operating system, not taken part in previous prolific studies from the same researcher (i.e., a prolific blacklist was employed) and scored > 65% “correct” on a different reward learning task (the reward learning assay, not discussed here).

Procedure

All participants completed a different reward learning task (the reward learning assay) over five consecutive days. On the final day, participants also completed the Probabilistic Reward Task (PRT)[1], Snaitth-Hamilton Pleasure Scale (SHAPS)[2] and Beck Depression Inventory (BDI; suicide question removed)[3].

Probabilistic Reward Task

The PRT (Pizzagalli et al., 2005) available on the Millisecond test library was employed (using Inquisit v6). The only change made to the task was the monetary amount of reward: participants were informed that they could win up to £5 on this task. Specifically, they were informed that if a correct response is rewarded they will earn four pence.

Analysis

Only participants with a minimal BDI score (<13) and normal SHAPS score (≤ 2) were included in final analysis. The output variables logB and logD were calculated as described elsewhere [1]. Data were both analysed across all blocks for a variable using Friedman tests due to the non-normality of data with response bias data also being compared against a hypothetical mean of zero for each block using Wilcoxon signed rank tests.

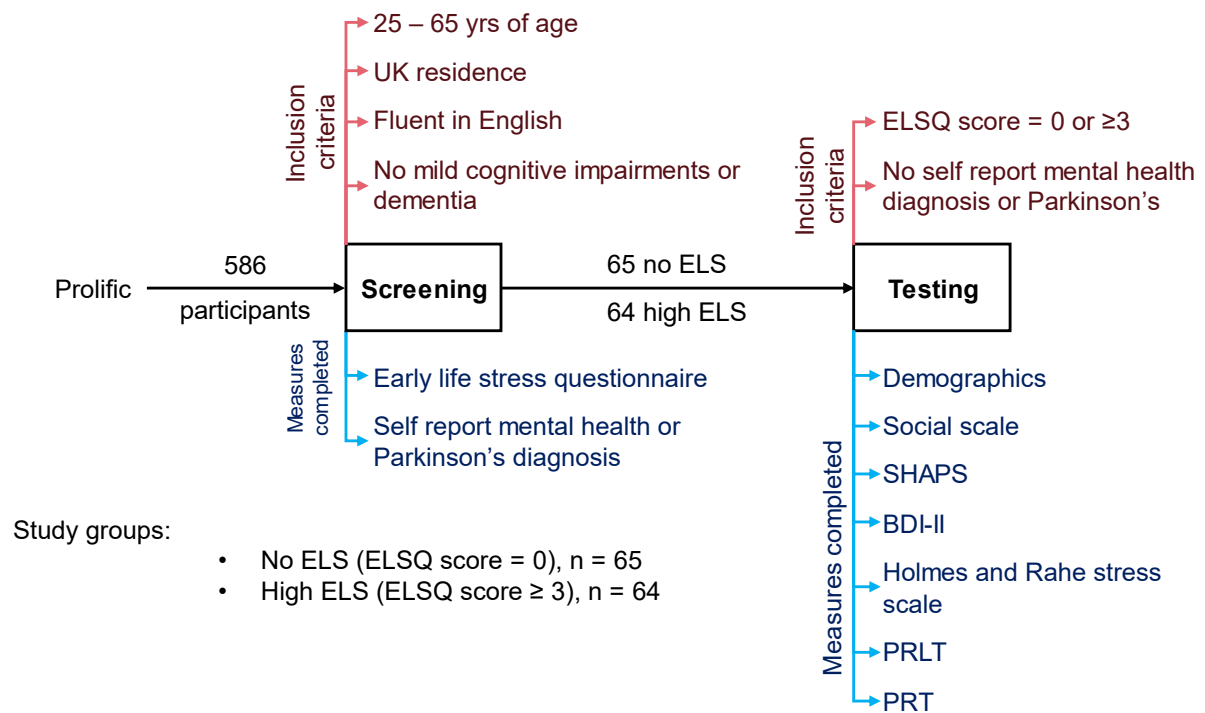


Fig S1 Study overview. Participants were screened by ELSQ score and then formed into two study groups: no ELS and high ELS.

Component	Explained variance (%)	No ELS	High ELS	Test statistic	P value
1	94.6	4.32 ± 0.24	5.65 ± 0.25	t ₁₂₇ = -3.86	0.0002
2	3.4	-0.19 ± 0.21	0.20 ± 0.24	t ₁₂₇ = -1.22	0.226
3	2.0	0.21 ± 0.15	-0.22 ± 0.18	t ₁₂₇ = 1.79	0.076

Table S1 Principal component analysis of social scale, SHAPS and BDI-II scores. The mean ± standard error are shown for each group with the relevant statistical comparison.

	Principle component		
	1	2	3
Social scale	-0.07	-0.40	0.91
BDI-II	0.98	-0.18	-0.003
SHAPS	0.17	0.90	0.40

Table S2 Principal component analysis component loadings.

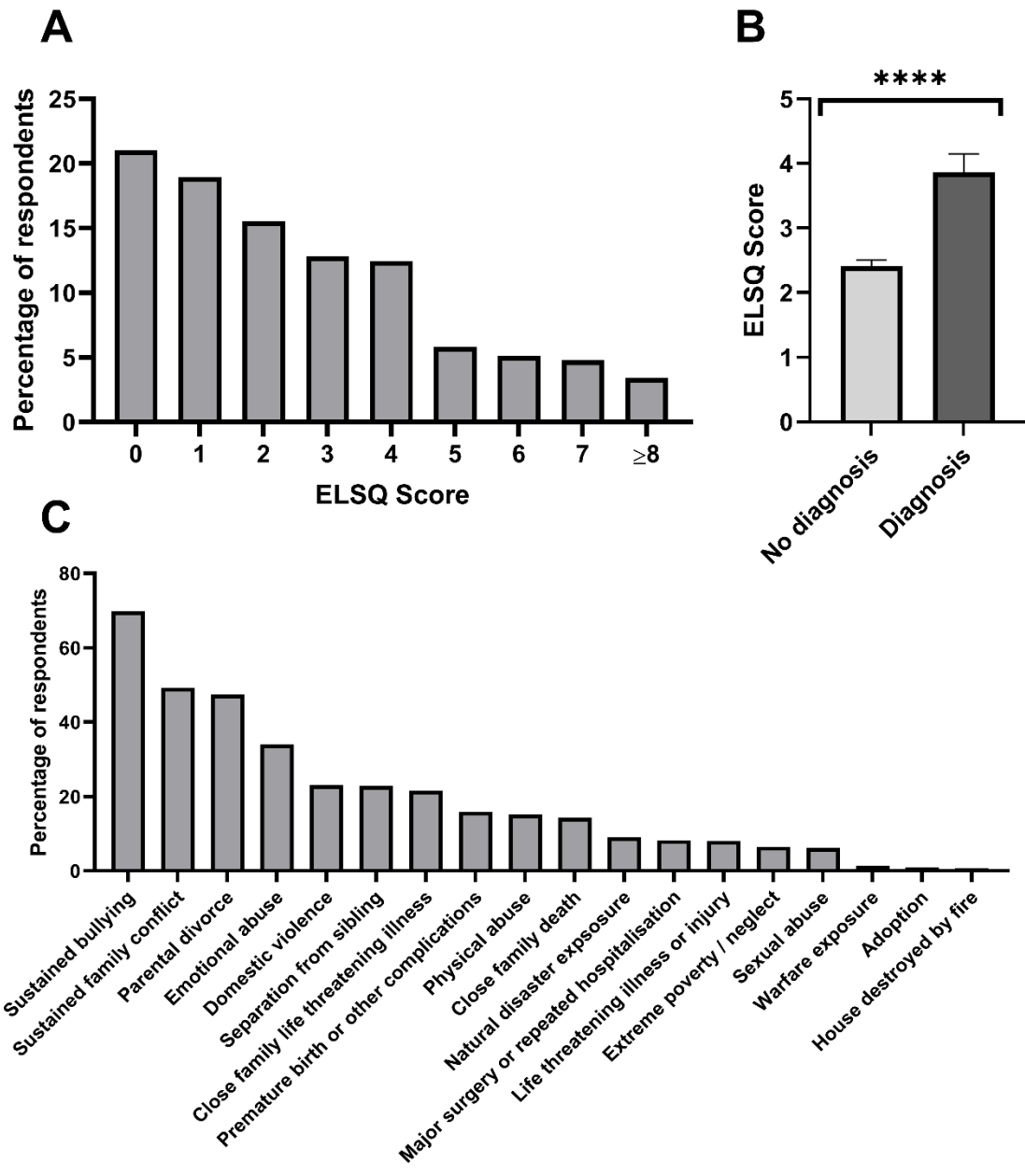


Fig S2 Early life stress in an online study population. (A) ELSQ scores in the study population. **(B)** Mental health disorder / Parkinson’s self-report diagnosis by ELSQ score (Mann-Whitney, $U = 15725$, $p < 0.0001$). $N = 586$ participants. **(C)** ELSQ scores in the study population split by modality of adverse childhood experience.

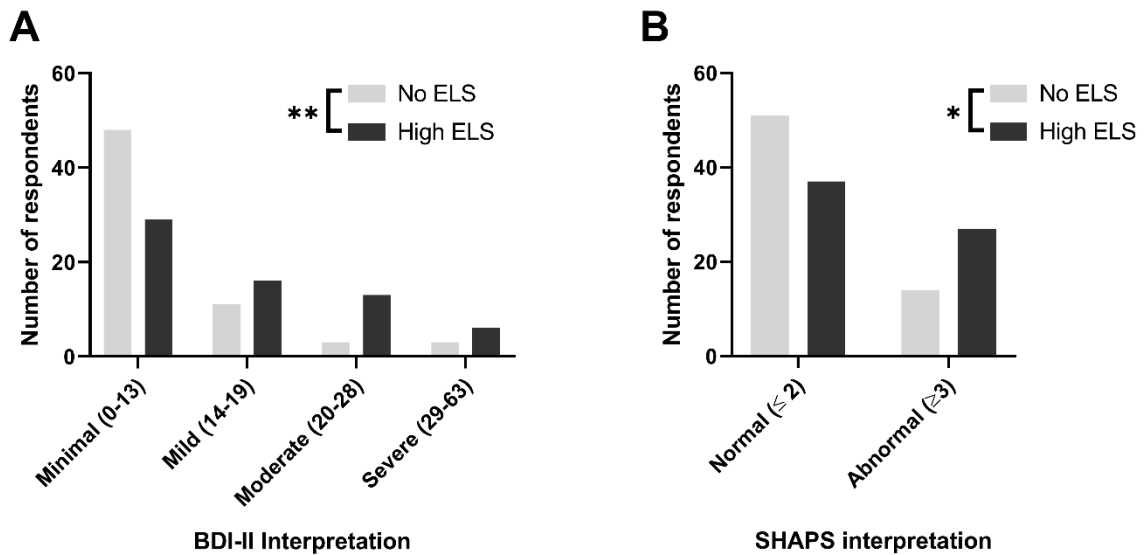


Fig S3 Interpretation of BDI-II and SHAPS scores in the no and high ELS populations. Scores were interpreted following Beck et al., 1996 and Snaith et al., 1995. (A) BDI-II split by severity of depression (χ^2 , $\chi^2(3) = 12.9$, $p = 0.005$) and (B) SHAPS split by normal or abnormal hedonic responses (χ^2 , $\chi^2(1) = 6.3$, $p = 0.012$). N = 129 participants (65 no ELS, 64 high ELS).

Current trial	Previous trial	No ELS	High ELS	Test statistic	p
Lean	Rich - rewarded	16.8 ± 2.1	18.4 ± 2.2	U = 1966	0.59
Lean	Rich - not rewarded	16.1 ± 1.8	18.6 ± 1.8	U = 1744	0.11
Lean	Lean - rewarded	19.3 ± 2.1	20.5 ± 2.0	U = 1928	0.47
Lean	Lean - not rewarded	16.8 ± 1.6	21.2 ± 1.8	U = 1928	0.097
Rich	Rich - rewarded	13.1 ± 1.5	18.3 ± 2.1	U = 1697.5	0.071
Rich	Rich - not rewarded	14.2 ± 1.6	20.0 ± 2.1	U = 1597.5	0.023
Rich	Lean - rewarded	13.1 ± 1.4	15.5 ± 1.7	U = 1814	0.330
Rich	Lean - not rewarded	14.2 ± 1.4	19.6 ± 1.9	U = 1644.5	0.040

Table S3 Miss-rates, the chance of mis-categorising a stimulus, by previous trial. Data is shown as mean ± standard error and significant p-values are shown in bold.

Measure	Control population (n = 56)
Sex (% Male)	51.8
Age (years)	31 ± 1.1
Employment (% full time)	48.2
Student status (% student)	28.6
BDI	4.1 ± 0.3
SHAPS	0.30 ± 0.09
SHAPS-C	20.7 ± 0.6

Table S4. Demographic and self-report measures in the directly rewarded PRT control population.

Values are shown for each group as mean ± standard error where appropriate.

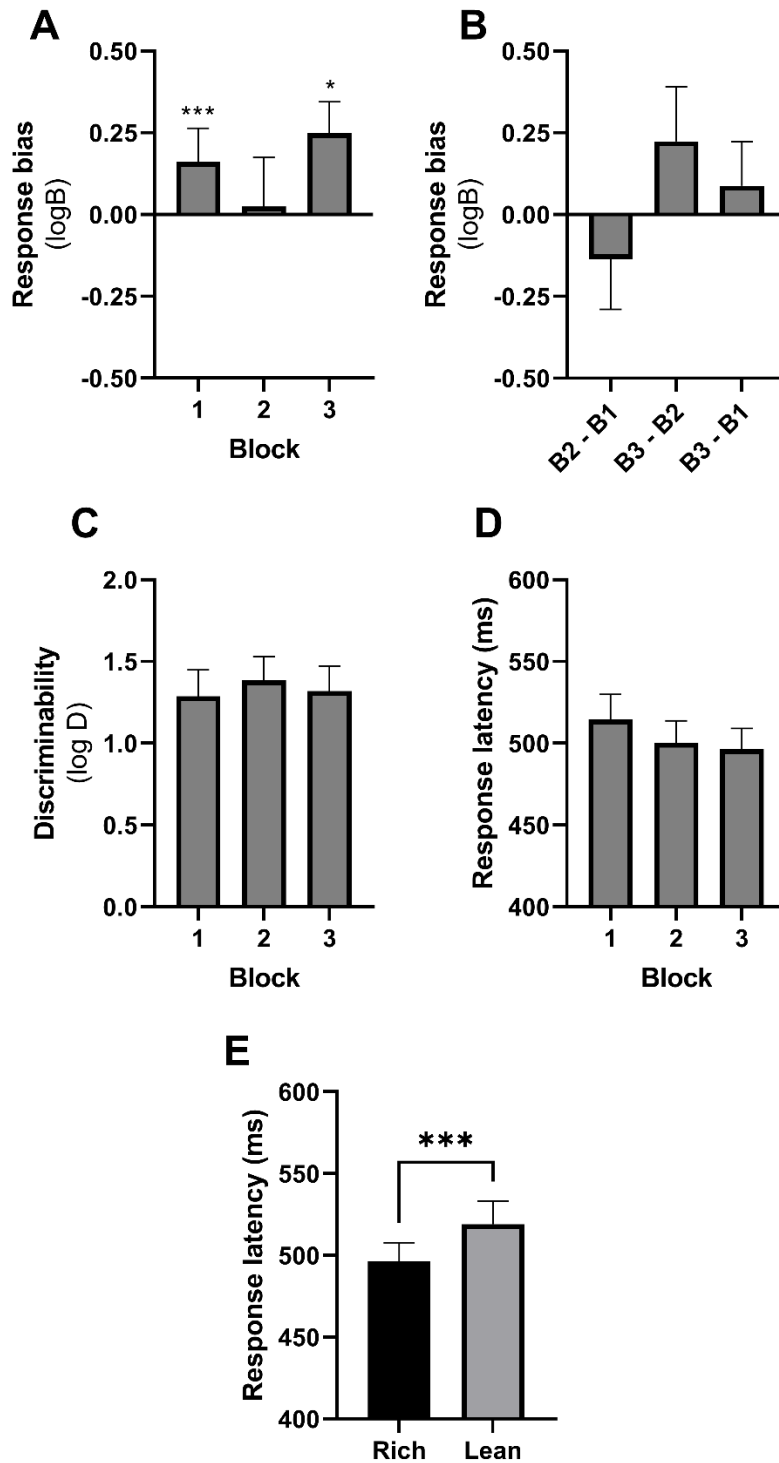


Fig S4. Direct monetary reward in the PRT using a control population led to a reward induced bias. (A) While no overall effect of block was observed, a response bias was observed in blocks 1 and 3 (Wilcoxon signed ranks test, block 1: $W = 1087.5$, $p = 0.001$, block 3: $W = 916.5$, $p = 0.038$). (B) There was little evidence for response bias strengthening across blocks. Discriminability (C) and response latency (D) did not appear to change over the course of a session. (E) Participants were faster to respond to the rich stimulus than lean (Wilcoxon matched pairs signed ranks test, $W = 814$, $p = 0.0007$). $N = 56$ participants.

References

1. Pizzagalli DA, Jahn AL, O'Shea JP. Toward an objective characterization of an anhedonic phenotype: A signal-detection approach. *Biol Psychiatry*. 2005;57: 319–327. doi:10.1016/j.biopsych.2004.11.026
2. Snaith RP, Hamilton M, Morley S, Humayan A, Hargreaves D, Trigwell P. A scale for the assessment of hedonic tone the Snaith-Hamilton Pleasure Scale. *Br J Psychiatry*. 1995;167: 99–103. doi:10.1192/bjp.167.1.99
3. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Archives of General Psychiatry*. US: American Medical Association; 1961. pp. 561–571. doi:10.1001/archpsyc.1961.01710120031004
4. Beck A, Steer R, Brown G. *Beck Depression Inventory*. Second Edition. San Antonio, TX; 1996.