



Developing An EEG Assay of Anticipatory and Consummatory Reward Sensitivity in Anhedonia



Yuexiaoxi (Cecilia) Yu*¹, Rebecca M. Todd¹ & Trisha Chakrabarty¹
¹University of British Columbia

*Contact: cecilia.yu@ubc.ca

Introduction

- Impaired reward sensitivity has been shown to be a promising marker in major depressive disorder in that baseline and early treatment related changes in reward sensitivity can predict ultimate treatment response¹.
- Different ERPs components contribute to the anticipatory (cue-P3 and SPN) and consummatory (feedback-P3) stages of reward processing, which also correspond to different forms of anhedonia in clinical population².
- Limited studies have used high temporal resolution EEG/ERP to study anticipatory and consummatory in the same study design.

Objective: Validate current task performance aiming to be used in future clinical studies

Aim 1: Examine whether ERPs amplitudes change as a function of reward magnitudes and valence at anticipatory and consummatory stages.

Aim 2: Exploratory examination of the association of severities in depressive symptoms and reward sensitivity.

Methods

Participant

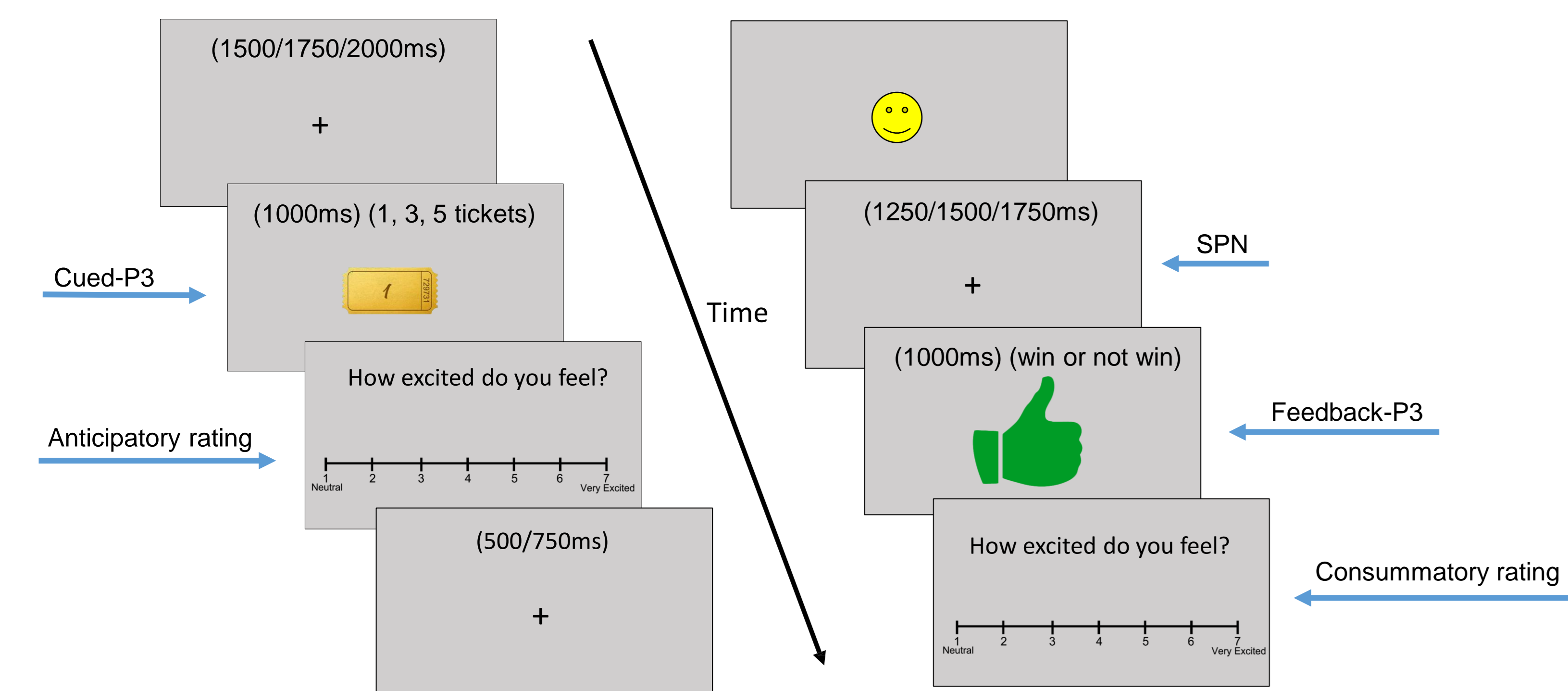
N	33
Age, M (SD)	22.6 (6.0)
% Female	21 (63.6%)
BDI Score	10.4375 (9.0)
GAD Score	4.75 (4.6)

33 participants were recruited through the HSP system and received course for participating in the study.

Data Analysis

EEG data were pre-processed and epoched to extract different ERP components. Peak-to-peak amplitudes were extracted and compared with a one-way analysis of variance. Questionnaires scores and task ratings and ERP amplitudes were analyzed with Linear regression analysis.

Incentive Delay Reward Sensitivity Task



Cue-P3: centroparietal positivity elicited by reward cues³.

Stimulus preceding negativity (SPN): sustained centroparietal negativity that peaks prior to reward outcome onset⁴.

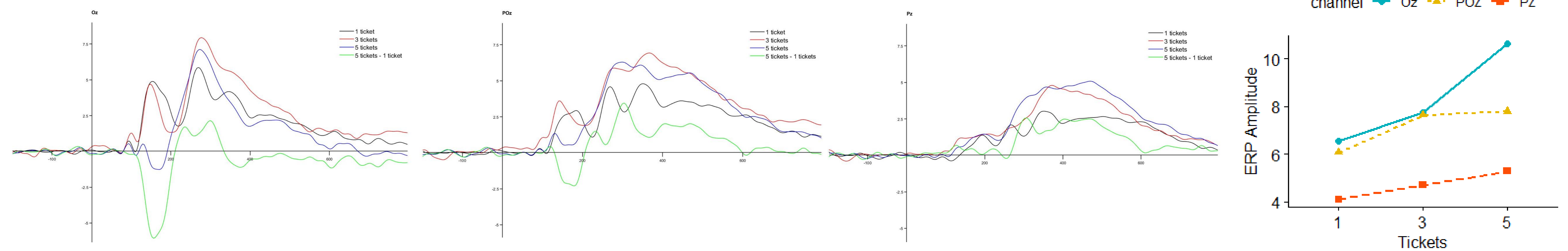
Fb-P3: centroparietal positivity that is elicited by salient reward outcome³.

Self-report scales:

Beck's Depression Inventory (BDI)
Generalized Anxiety Disorder 7-item (GAD-7)
Hypomania Check List (HCL-32)
BIS/BAS
State-Trait Anxiety Inventory (STAI)
Dimensional Anhedonia Rating Scale (DARS)

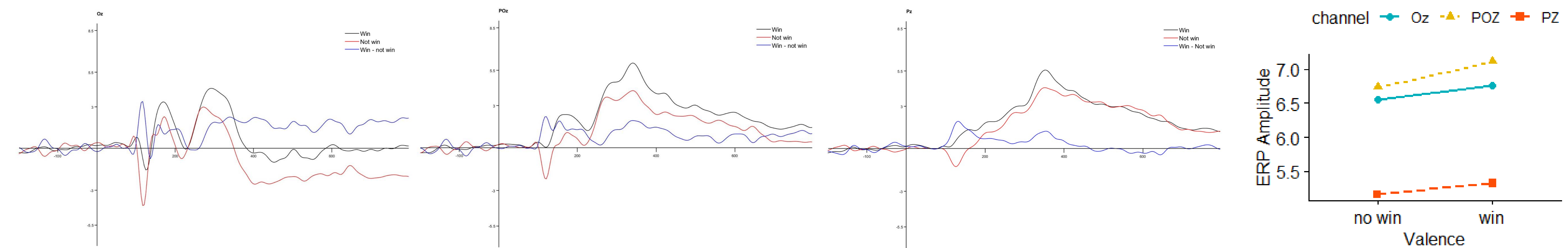
Results

EEG/ERP — Cue-P3



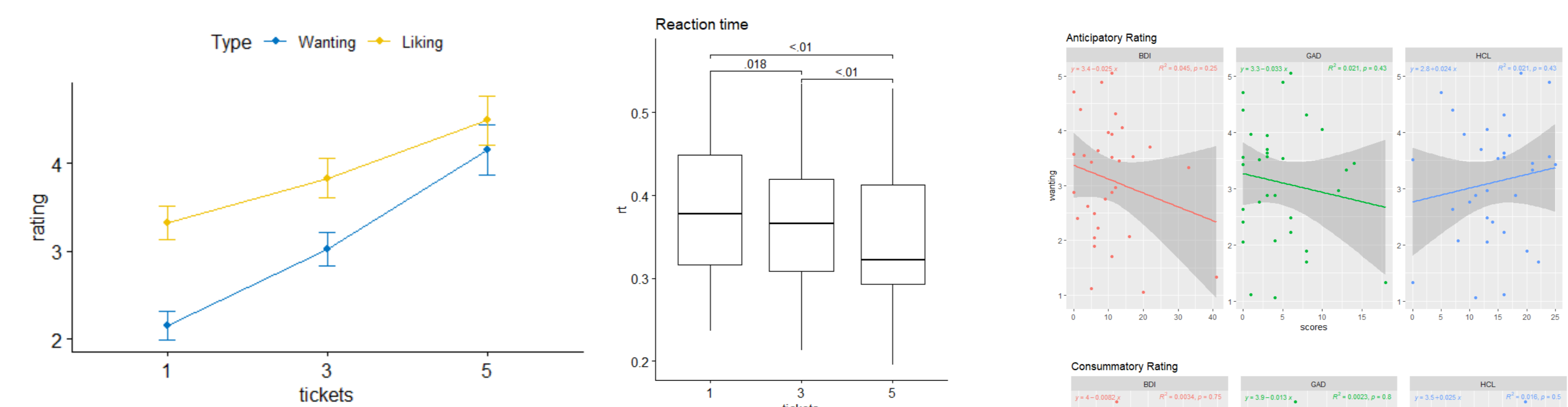
Cue-P3 in channel Oz differed significantly for 5 tickets ($p=.01, f=4.30$) compare with 1 tickets. POz ($p=.11, f=2.28$) and Pz did not differ significantly ($p=.36, f=1.02$)

EEG/ERP — Feedback-P3



Feedback-P3 did not differ significantly in Oz ($p=.89, f=0.019$), POz ($p=.0761, f=.1$) or Pz ($p=.87, f=0.028$)

Behavioural Ratings and Self-Reported Scores



Higher reward rating > Low reward rating ($p < .001$)
Anticipatory rating < Consummatory rating ($p < .001$)

BDI, GAD, HCL scores did not show significant correlation in anticipatory or consummatory ratings

Discussion

- Higher reward magnitudes increased ERP amplitudes in channel Oz, and an upward, although not significant, trend in nearby channels.
- ERP amplitudes were not different in win and not win condition.
- In general population, reward sensitivity did not show significant correlation with self-reported BDI, GAD and HCL scores.

Limitations

- Further research with a larger is needed.
- Possible confounders caused by visual stimuli are observed in earlier visual ERPs (N170).

Further direction

- Analysis in other channel locations need to be conducted.
- Adjusted paradigm without the confounding stimuli were implanted and testing.
- Analysis on other channel locations and exploratory analysis of self-reported scores and ERP amplitudes need to be conducted.

1. Allen, T. A., Lam, R. W., Milev, R., Rizvi, S. J., Frey, B. N., MacQueen, G. M., Müller, D. J., Uher, R., Kennedy, S. H., & Quilty, L. C. (2019). Early change in reward and punishment sensitivity as a predictor of response to antidepressant treatment for major depressive disorder: A CAN-BIND-1 report. *Psychological Medicine*, 49(10), 1629–1638. 2. Keren, H., O'Callaghan, G., Vidal-Ribas, P., Buzzelli, G. A., Brotman, M. A., Leibenluft, E., Pan, P. M., Meffert, L., Kaiser, A., Wolke, S., Pine, D. S., & Stringaris, A. (2018). Reward processing in depression: A conceptual and meta-analytic review across fMRI and EEG studies. *American Journal of Psychiatry*, 175(11), 1111–1120. 3. McCabe, C., Mishor, Z., Cowen, P. J., & Harmer, C. J. (2010). Diminished Neural Processing of Aversive and Rewarding Stimuli During Selective Serotonin Reuptake Inhibitor Treatment. *Biological Psychiatry*, 67(5), 439–445. 4. Umemoto, A., & Holroyd, C. B. (2017). Neural mechanisms of reward processing associated with depression-related personality traits. *Clinical Neurophysiology*, 128(7), 1184–1196. 5. Beck, A. T., Steer, R. A., & Carbin, M. C. (1988). PSYCHOMETRIC PROPERTIES OF THE BECK DEPRESSION INVENTORY: TWENTY-FIVE YEARS OF EVALUATION. In *Clinical Psychology Review* (Vol. 8), 6. Gard DE, Gard MG, King AM, John OP (2006) Anticipatory and consummatory components of the experience of pleasure: A scale development study. *J Res Per* 40: 1086–1102. 7. van den Berg, I., Franken, I. H. A., Muris, P., Deyoung, C. G., Elliot, A., & Smillie, L. D. (2010). A new scale for measuring reward responsiveness. *Article*, 1(1).