Differences in Consummatory and not Anticipatory Reward Processing Predict Depressive Symptoms in Young Adult Women

Ty Lees[1,2,3] & Lisa M. Gatzke-Kopp[1,4]

[1] Edna Bennett Pierce Prevention Research Center, The Pennsylvania State University; [2] Center for Depression, Anxiety, and Stress Research, McLean Hospital; [3] Department of Psychiatry, Harvard Medical School; [4] Human Development and Family Studies, The Pennsylvania State University

Background

Depression is often conceptualized as involving alterations in reward processing, with a primary focus on the consumption of reward and a lesser focus on anticipatory reward processes. Notably, these processes have largely been investigated in isolation, and research investigating across the breadth of reward processing in depression is limited. Furthermore, research is often focused on clinical samples, with less evidence relating reward sensitivity to depression severity across the full range of symptom presentation. Finally, it is unclear whether previously reported findings are primarily driven by women, who tend to be over-represented in clinical depression.

Aims

As such, in the present work we aimed to examine:

1. How ERP indices of both anticipatory and consummatory reward predict depressive symptoms; and,
2. If the relationship between these ERP indices and depressive symptoms differed between the sexes.

Methods

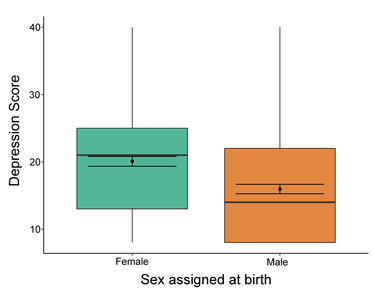
Participants

- Data from n = 309 emerging adults (M_{age} = 18.55, SD_{age} = 0.49) from economically disadvantaged rural regions of PA and NC.
- Approximately 62% of participants were identified as White or Caucasian, 30% as Black or African American, and 8% as Bi/Multi-racial.
- 50.16% of participants were identified as female at birth.

Depressive Symptoms

- Participants self-reported using the PROMIS Emotional Distress – Depressive Symptoms.
- M_{Dep} = 18.00, SD_{Dep} = 8.83, (*Range* = 8 – 40).
- Mean time between self-report and EEG session was 194 days.

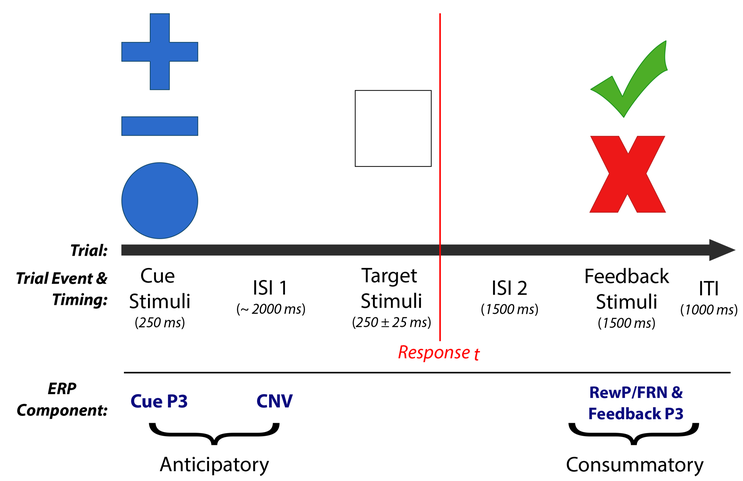
Figure 1: Depression scores split by participant sex assigned at birth.



EEG data collection

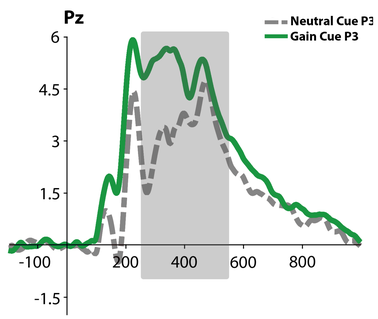
- MID Task; composed of <u>*20 Neutral Cues*</u>; <u>*50 Reward Cues*</u>; 50 Loss Cues.
  - Task forced ~50% negative feedback rate.

Figure 2: Trial Format of the Monetary Incentive Delay Task

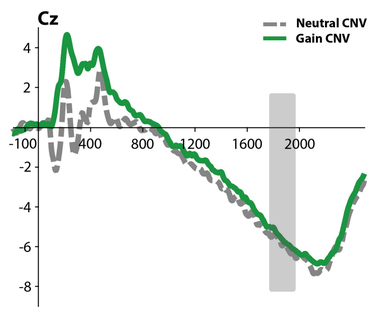


Anticipatory Reward and Depression

Neutral & Gain Cue P3



Neutral & Gain Contingent Negative Variation (CNV)



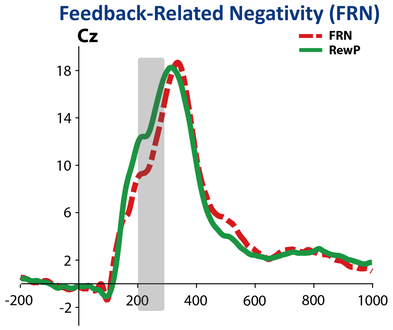
	Cue P3		CNV	
Fixed Effects	***b (SE)***	***t***	***b (SE)***	***t***
Intercept	20.21	25.48***	19.94	23.84***
Age	0.54	0.45	0.54	0.43
Gel Volume	-0.07	-1.24	-0.07	-1.21
Sex (Male)	-3.63	-3.27**	-3.45	-2.93**
Neutral Cue Amp	0.01	0.05	0.24	1.32
Gain Cue Amp	-0.19	-0.76	-0.06	-0.28
Sex × Neutral Cue Amp	-0.24	-0.80	-0.46	-1.67†
Sex × Gain Cue Amp	0.36	1.04	0.20	0.72
Random Effects	***Estimate***	***Residual***	***Estimate***	***Residual***
Intercept	7.98	3.00	8.07	3.03

Note: Amp = Amplitude; †p < .1; **p < .01; ***p < .001

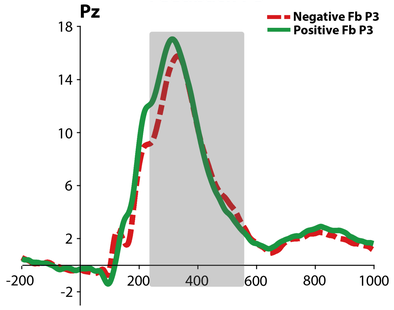
On average ERP indices of ***anticipatory reward did not predict self-reported depression scores*** for both male and female participants.

Consummatory Reward and Depression

Reward Positivity (RewP) & Feedback-Related Negativity (FRN)

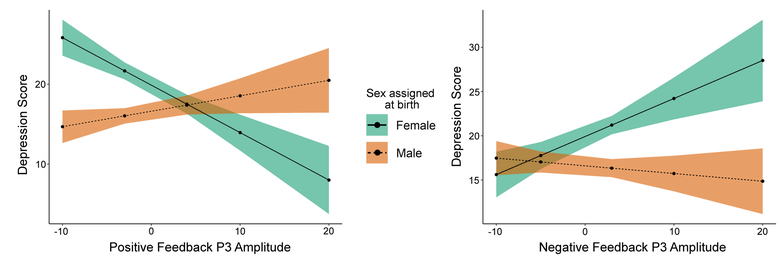


Positive & Negative Feedback P3



	RewP & FRN		Feedback P3	
Fixed Effects	***b (SE)***	***t***	***b (SE)***	***t***
Intercept	19.83	23.51***	19.89	23.13***
Age	1.25	0.95	0.88	0.68
Gel Volume	-0.09	-1.44	-0.10	-1.58
Sex (Male)	-3.52	-2.98**	-3.22	-2.68**
Positive FB Amp	-0.13	-0.74	-0.59	-2.84**
Negative FB Amp	0.05	0.29	0.43	1.85†
Sex × Positive FB Amp	0.05	0.21	0.79	2.76**
Sex × Negative FB Amp	0.02	0.07	-0.52	-1.78†
Random Effects	***Estimate***	***Residual***	***Estimate***	***Residual***
Intercept	8.04	3.02	7.93	2.98

Note: Amp = Amplitude; FB = Feedback; †p < .1; **p < .01; ***p < .001



Feedback P3 amplitude for both positive and negative conditions was associated with ***depression scores for ONLY female participants.***

Conclusions

Altered reward processing in depression appears to be confined to consummatory processes and ***may be sex specific,*** such that among female participants:

- Greater depression scores were associated with <u>*reduced responsivity to positive feedback and increased responsivity to negative feedback.*</u>
- Future research should consider how symptom dimensions may differ between the sexes e.g., hostility in male participants.

Acknowledgement: The funding for this project was provided by the National Institute of Health (UH3 OD023332)