Anxiety alters mood sensitivity to outcomes during risky decision-making

Ellen Martin, Jihyun K. Hur, Rachel L. Bedder, Joseph Heffner, Chang-Hao Kao, Gloria W. Feng, & Robb B. Rutledge

Department of Psychology, Yale University

Yale

Email: e.martin@yale.edu

Twitter: @ellenjmartin11

Happiness Quest

https://happinessquest.app

Background

- Mood disorders, such as anxiety and depression, are widespread, estimated to be prevalent among 35% of the general population[1].
- There is considerable overlap in symptoms between anxiety and depression, and both may contribute to mood and decision-making[2].
  - Emerging research using simpler decision-making tasks suggests that anxiety contributes to mood variability by increasing sensitivity to reward prediction errors[3].
- We use computational approaches to a risky decision-making task to examine the impact of depression and anxiety on mood dynamics and decision-making.
- We use a risky decision-making task where there is no certain option, which may better reflect real life decision-making.

Research Questions:

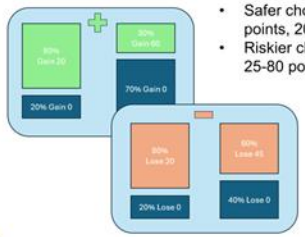
1) How does anxiety impact mood and decision-making in risky decision-making tasks?

2) How do anxiety and depression differ in their impacts on mood and decision-making?

Study Sample

- Smartphone-based risky decision-making task and mental health surveys.
- UK general population sample (2021-2024).
- N = 789
  - At least two complete plays and data from GAD-7 (anxiety) and PHQ-8 (depression) surveys, with age, gender and education.
  - 78% females, 18% males.
  - Median GAD = 6, Median PHQ = 7.
  - Median age = 44.

Task Design



- 14 Gain trials (+)
  - Safer choice: 80% chance of winning 20 points, 20% of winning 0 points.
  - Riskier choice: 10-70% chance of winning 25-80 points.
- 14 Loss trials (-)
  - Safer choice: 80% chance of losing 20 points, 20% of losing 0 points.
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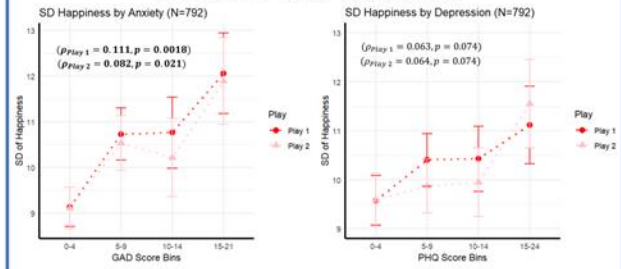
Model Free Results



- Anxiety predicted mood variation accounting for age, gender and education via robust linear regression ($b = 0.127,\ p = 0.015$).
- This effect was similar across plays ($b = 0.109, p = 0.056$).
- Depression did not predict mood variation accounting for age, gender and education in Play 1 ($b = 0.049, p = 0.318$) or Play 2 ($b = 0.070, p = 0.178$).

	Play 1		Play 2	
	GAD---% Risky Choices	PHQ---% Risky Choices	GAD---% Risky Choices	PHQ---% Risky Choices
Gain Trials	-0.040 (p=0.261)	-0.068 (p=0.054)	-0.008 (p=0.832)	-0.062 (p=0.079)
Loss Trials	0.033 (p=0.358)	0.055 (p=0.123)	-0.001 (p=0.969)	0.030 (p=0.392)
Overall	-0.020 (p=0.579)	-0.024 (p=0.503)	-0.011 (p=0.763)	-0.029 (p=0.414)

- No association between anxiety or depression and the percentage of risky choices.

Modeling Strategy

- Modification of existing model[4] to predict happiness.

$$Happiness(t) = \omega_0 + \omega_1 \sum_{j=1}^{t} \tau^{t-j} EV_j + \omega_2 \sum_{j=1}^{t} \tau^{t-j} RPE_j$$

ω_0	τ	EV	RPE
Baseline happiness constant	Decay/forgetting factor	Mean value of the two possible outcomes for the chosen option	Difference between outcome and EV for the chosen option

References

1. Necho, M., Tsehay, M., Birkie, M., Biset, G., & Tadesse, E. (2021). *Int. J. Soc. Psychiatry*
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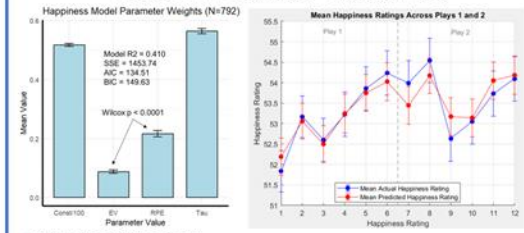
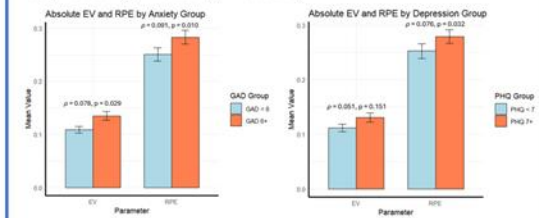
Model Based Results

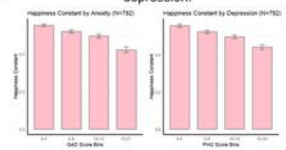


- RPE greater than EV[4].
- SSE was correlated with anxiety ($\rho = 0.156, p < 0.0001$) and depression ($\rho = 0.114$, p = 0.0014).



- Mood variation was significantly correlated with absolute RPE ($\rho = 0.688, p < 0.0001$), and absolute EV ($\rho = 0.647, p < 0.0001$).
- Anxiety predicted mood variation, beyond happiness model parameters ($b = 0.096, SE = 0.031, z = 3.11, p = 0.0019$).
- Depression did not predict mood variation ($b = 0.025, SE = 0.025, z = 1.01, p = 0.312$).

Lower baseline happiness with anxiety and depression.



Conclusions

Anxiety was associated with increased variation in mood ratings.

Risky decision-making behavior did not appear to be impacted by anxiety or depression.

Anxiety appears to be associated with increased sensitivity to absolute EV and RPE, which may drive mood variation.

Alternate models may help to capture the distinct effects of anxiety and depression on mood.

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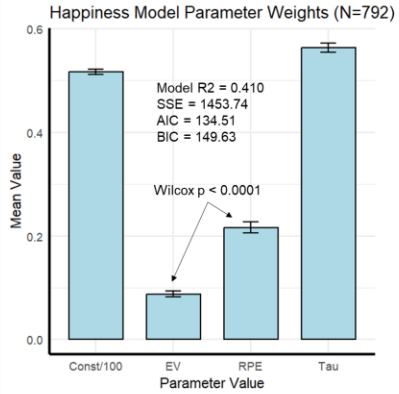

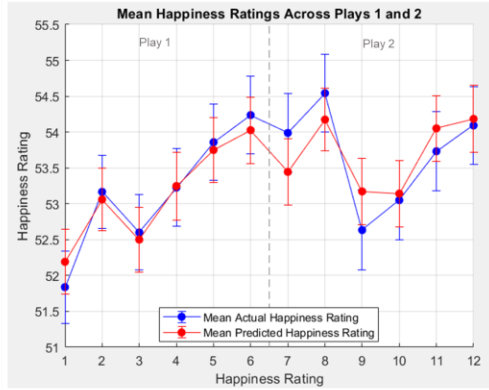

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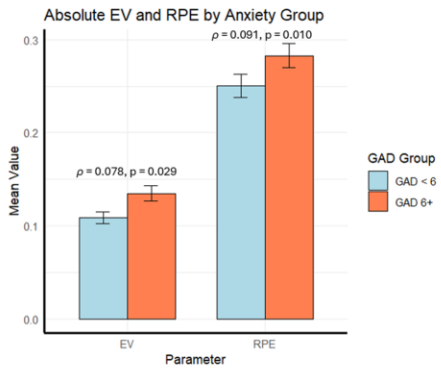

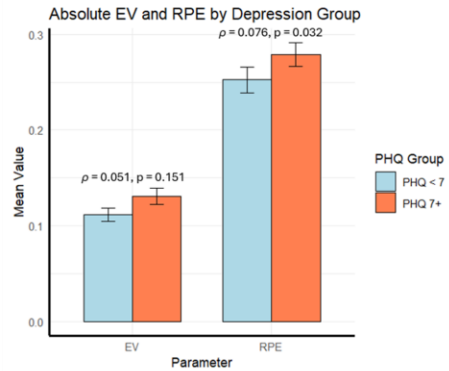

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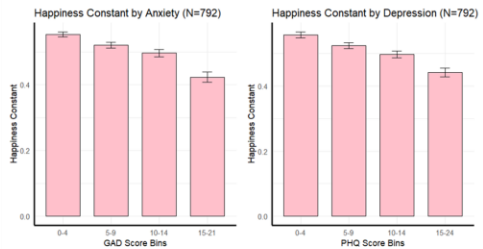

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