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## Attention in Social Anxiety Disorder and Depression: Insights from Evoked Brain Responses

Matt Judah

*University of Arkansas, Fayetteville*

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# Attention in Social Anxiety Disorder and Depression: Insights from Evoked Brain Responses

Matt R. Judah, Ph.D.  
Assistant Professor  
University of Arkansas



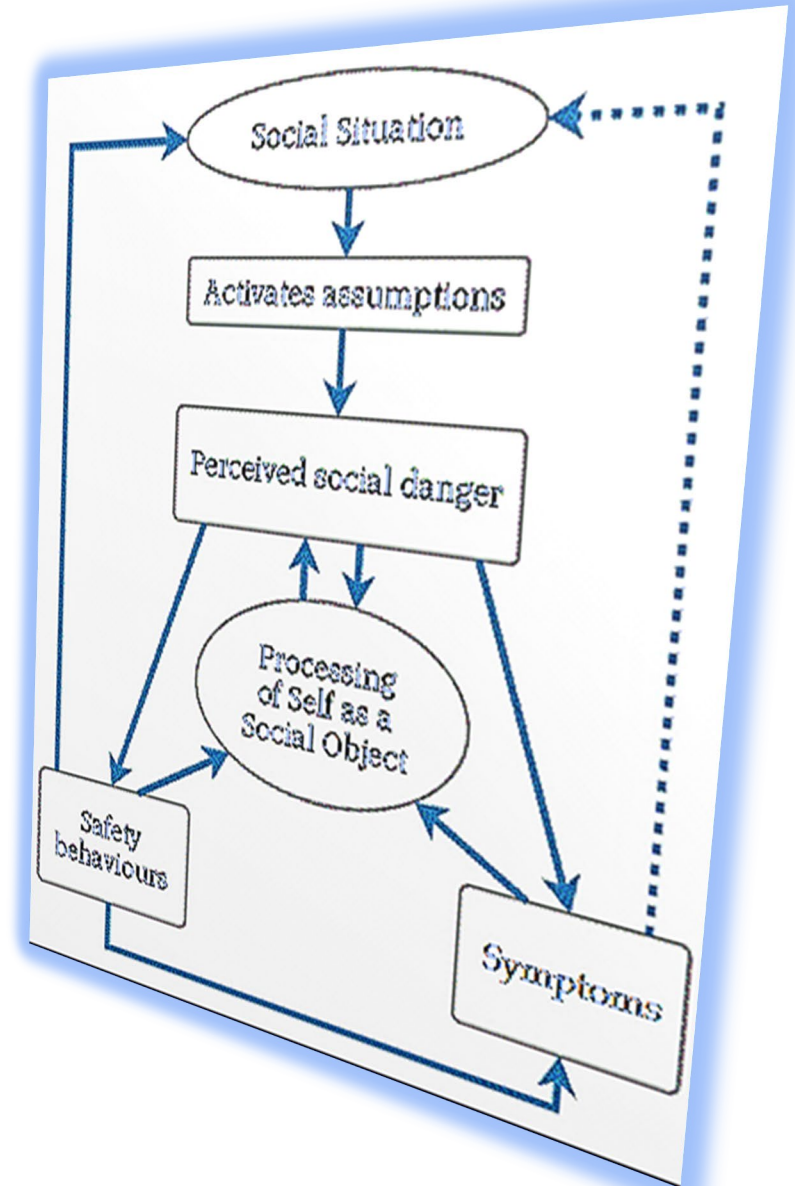
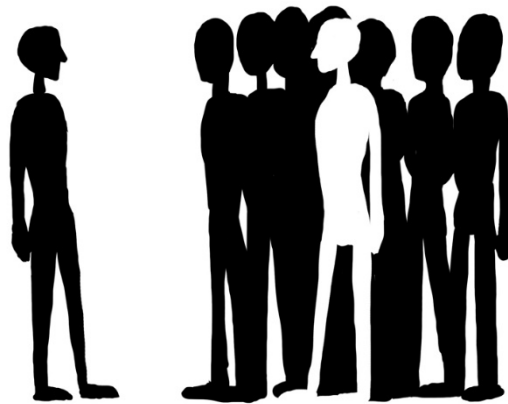




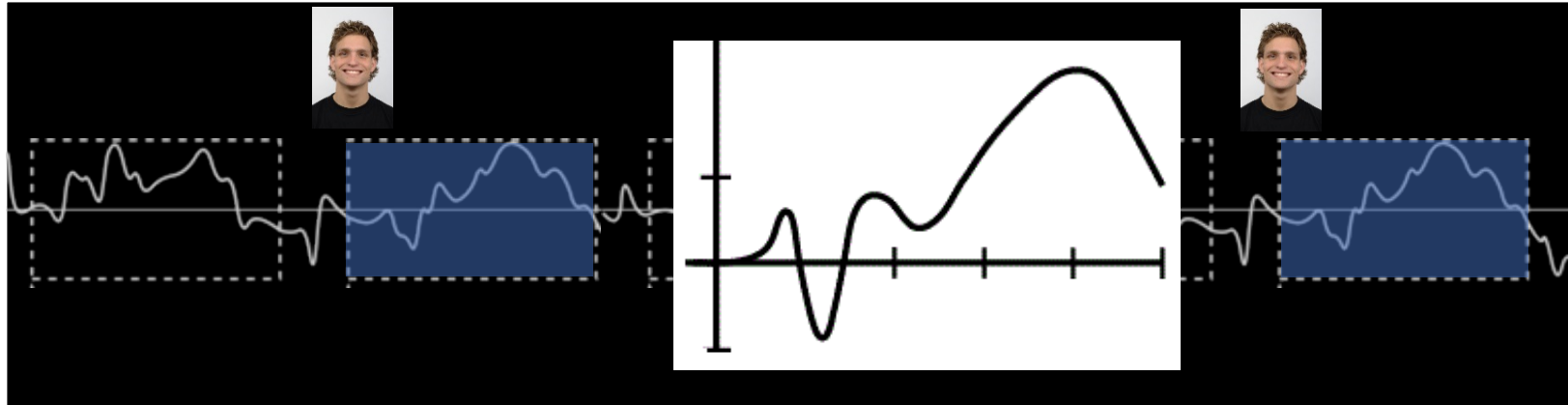
# Models of Social Anxiety Disorder



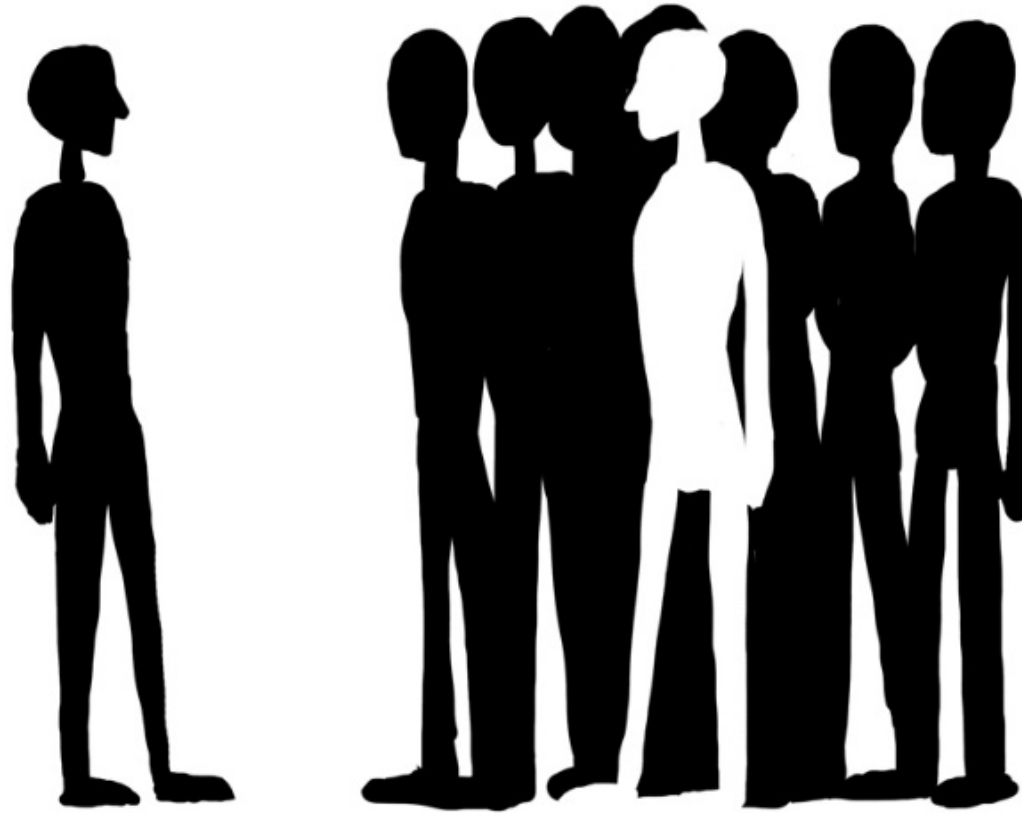
# Theories of Social Anxiety



# Event-related Potentials



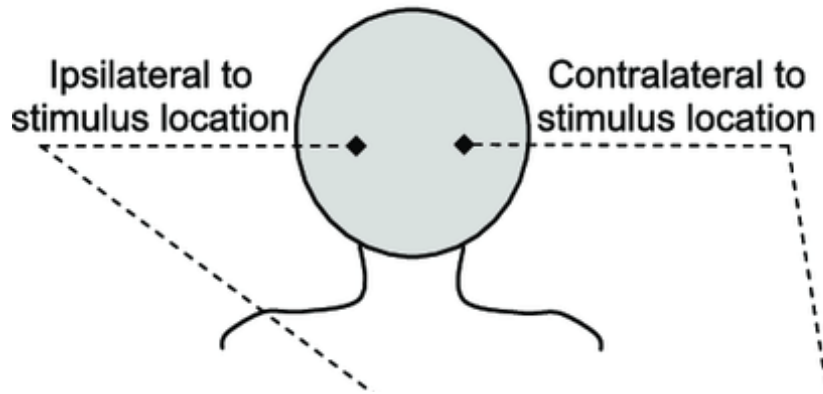
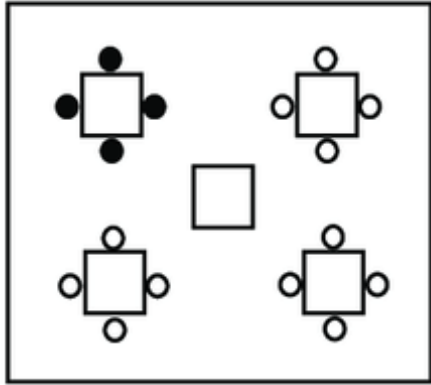
# Social Anxiety and External Threat



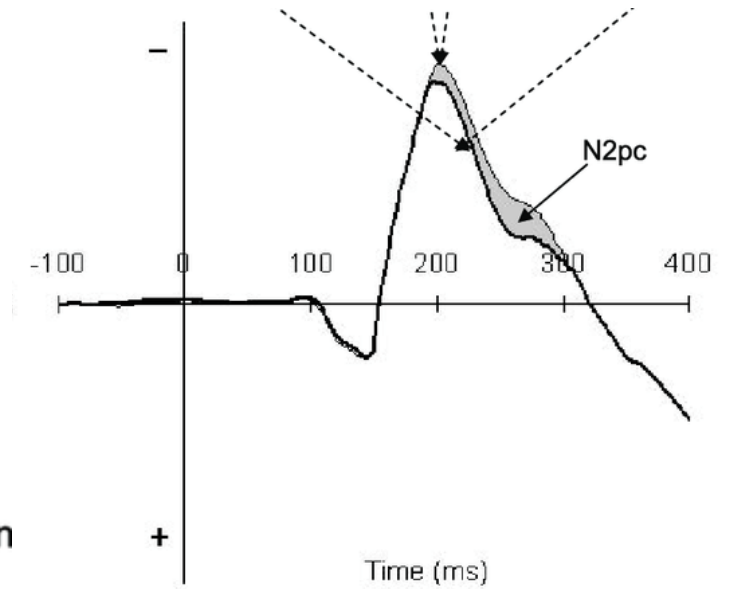
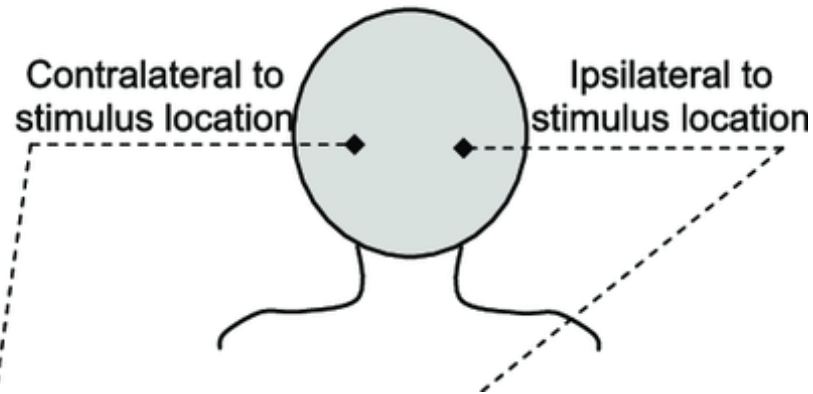
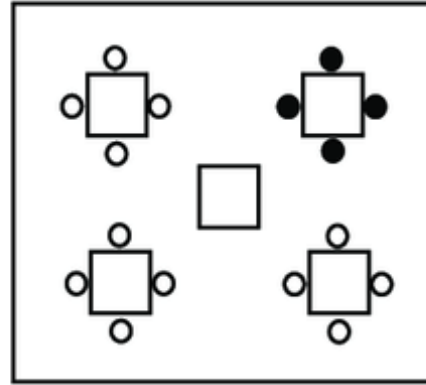


# Social Anxiety and External Threat

**A**

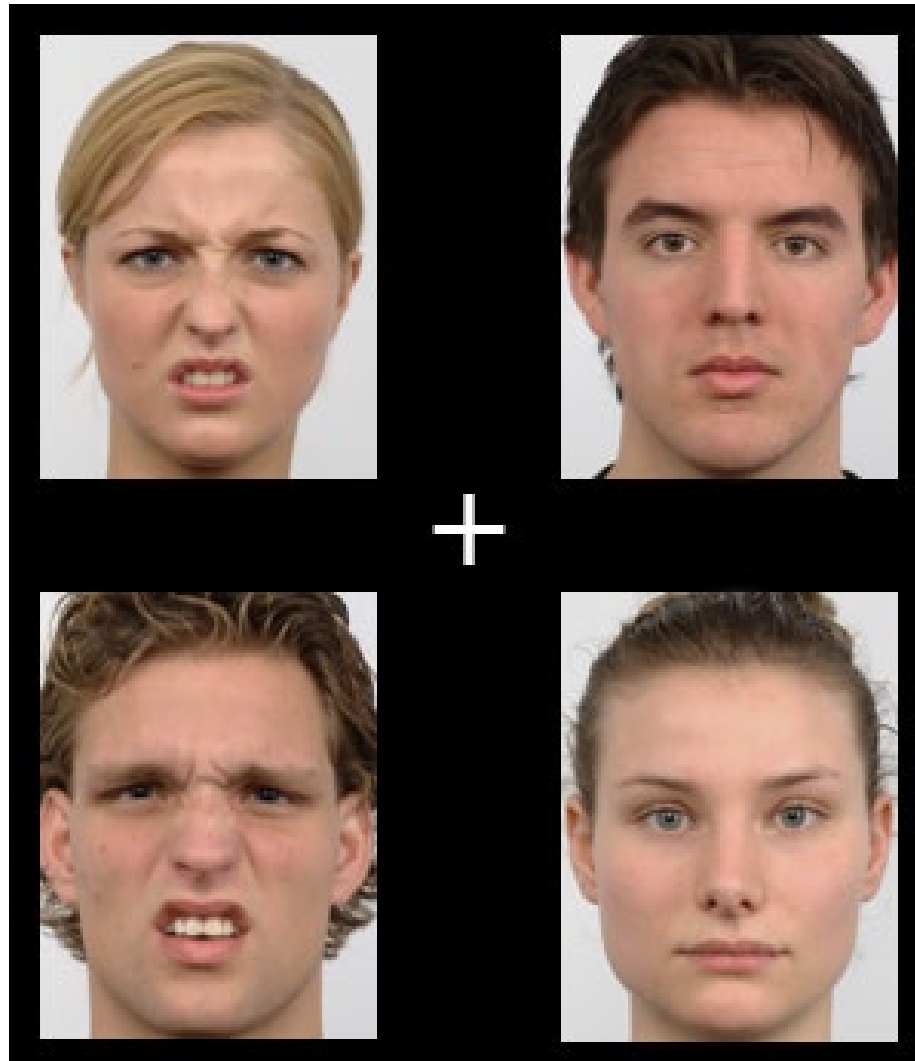


**B**

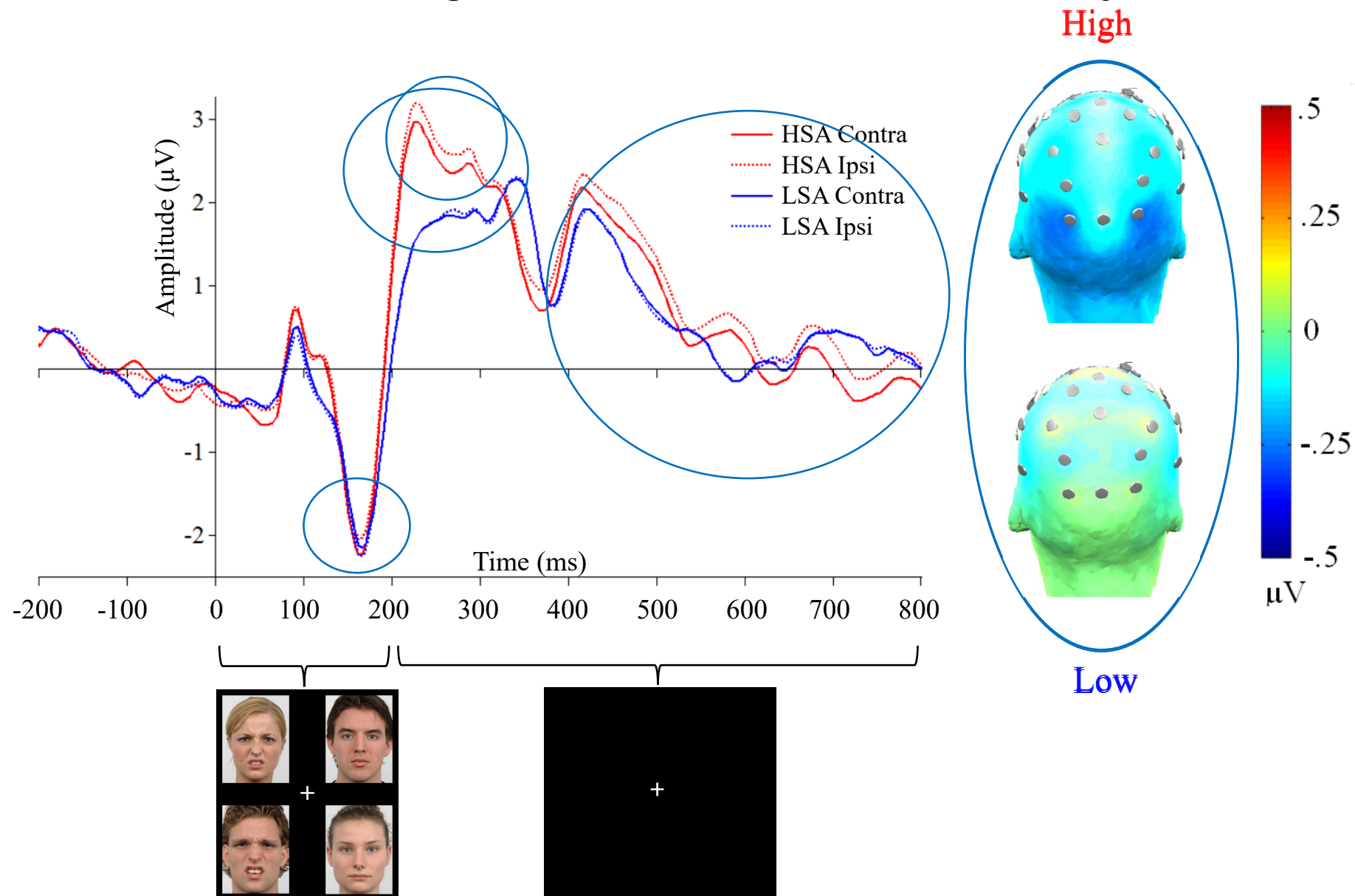


Contralateral to the stimulus location —  
Ipsilateral to the stimulus location —

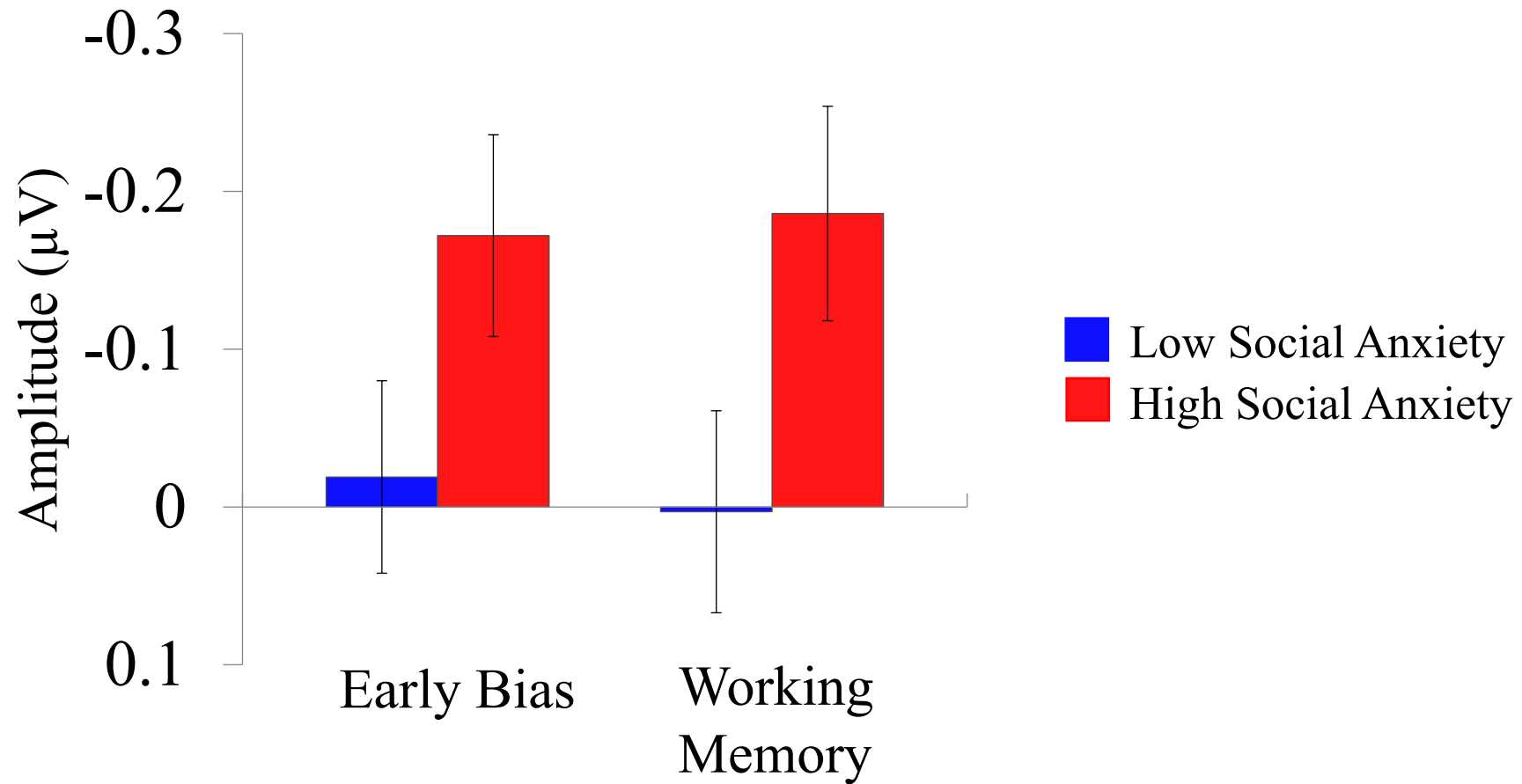
# Social Anxiety and External Threat



# Biases for Disgust Faces in Social Anxiety



# Biases for Disgust Faces in Social Anxiety

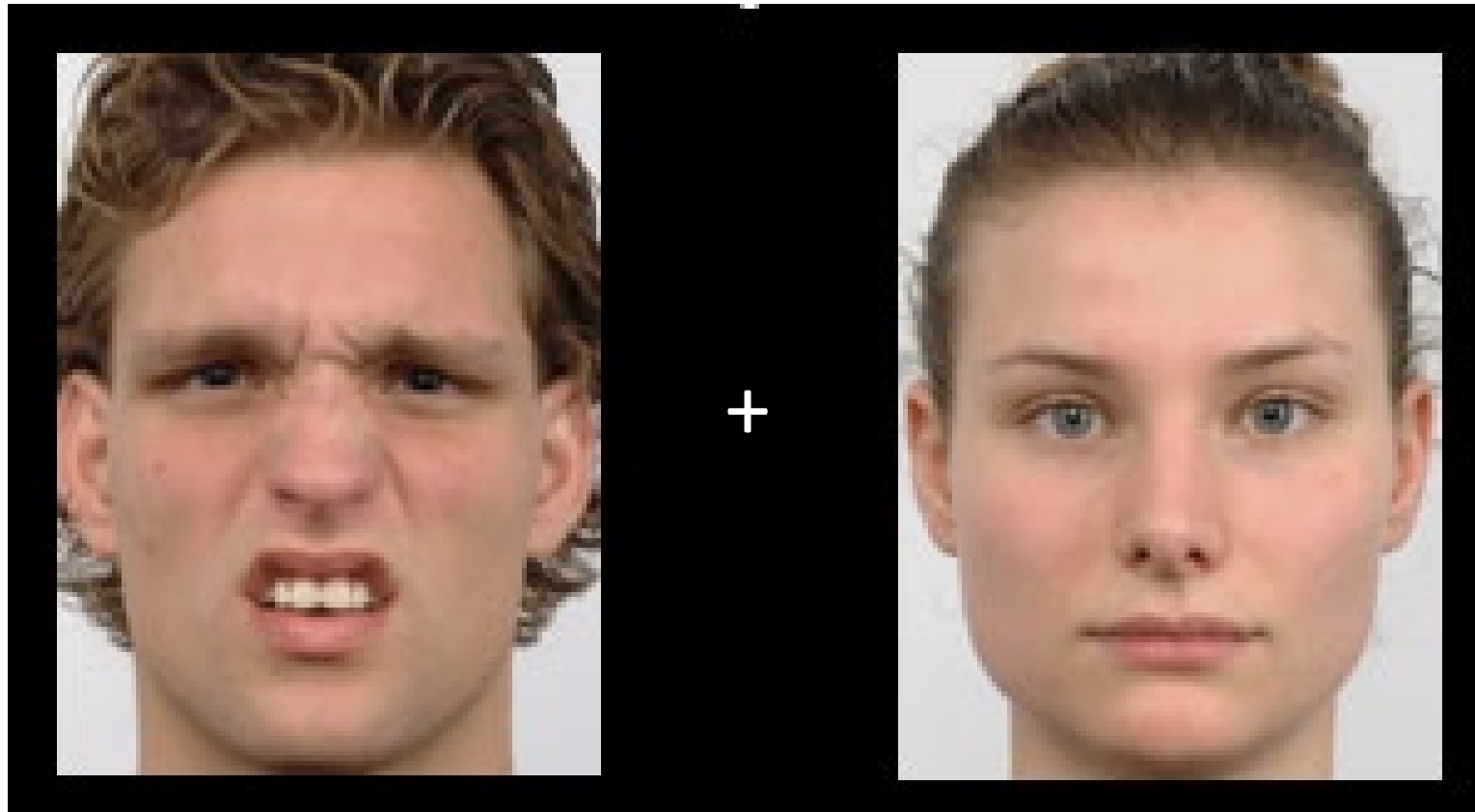


# Effects of Social Worry



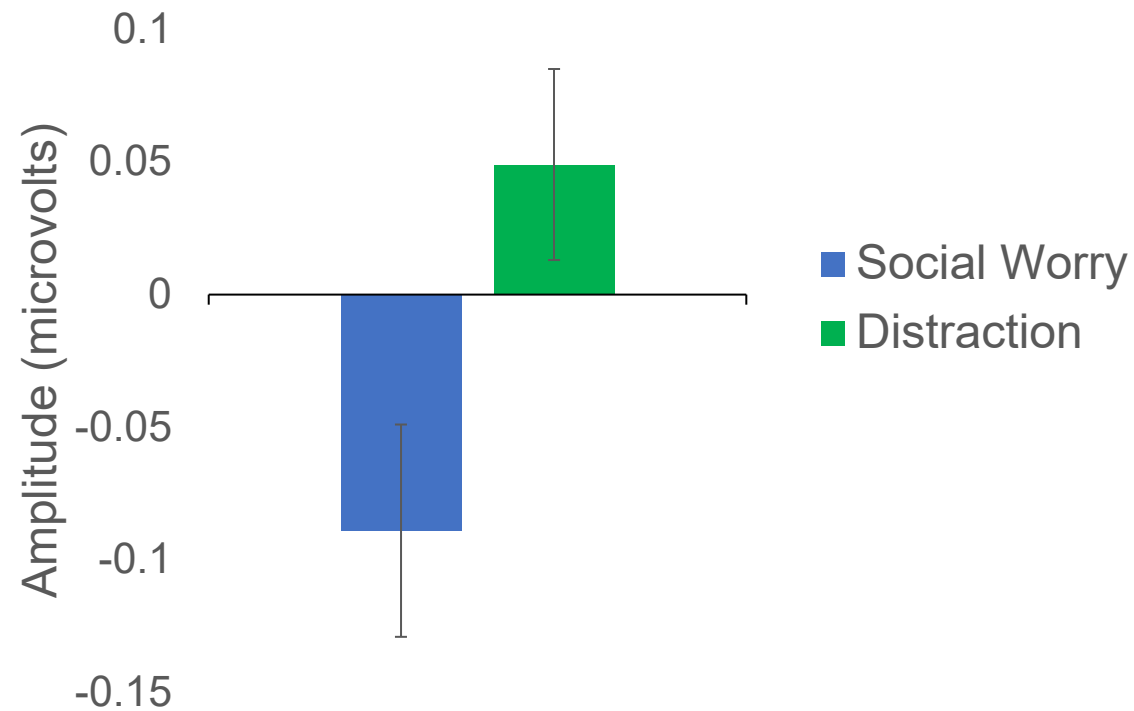


# Effects of Social Worry



# Effects of Social Worry

Bias toward neutral

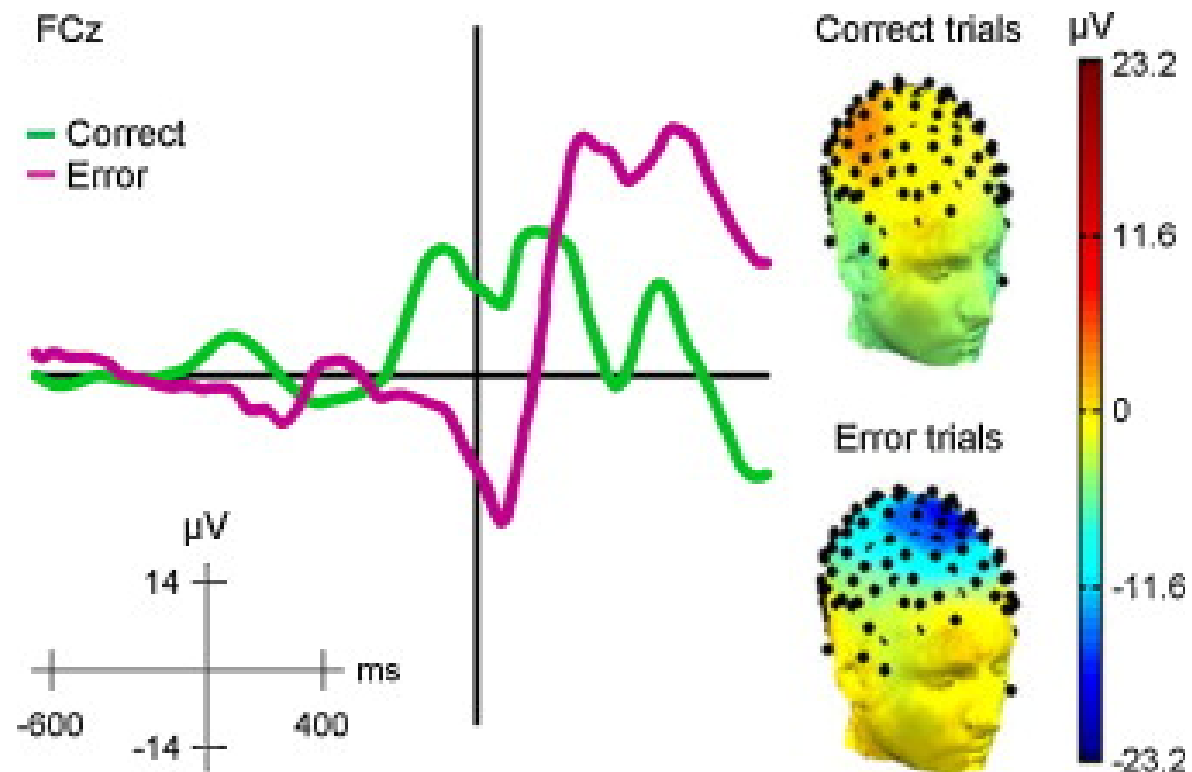


Bias toward disgust

# Social Anxiety and Self-focus

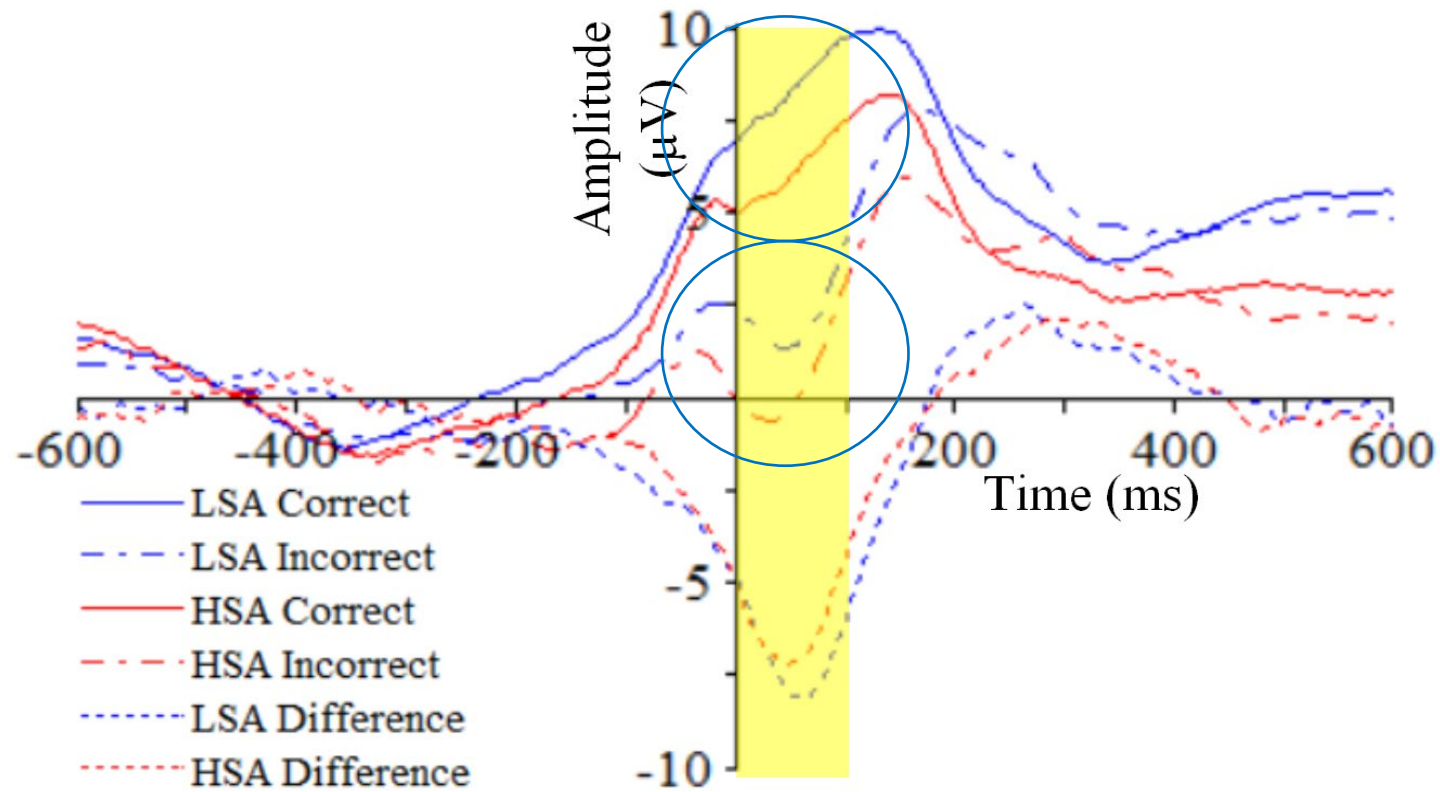


# Self-monitoring



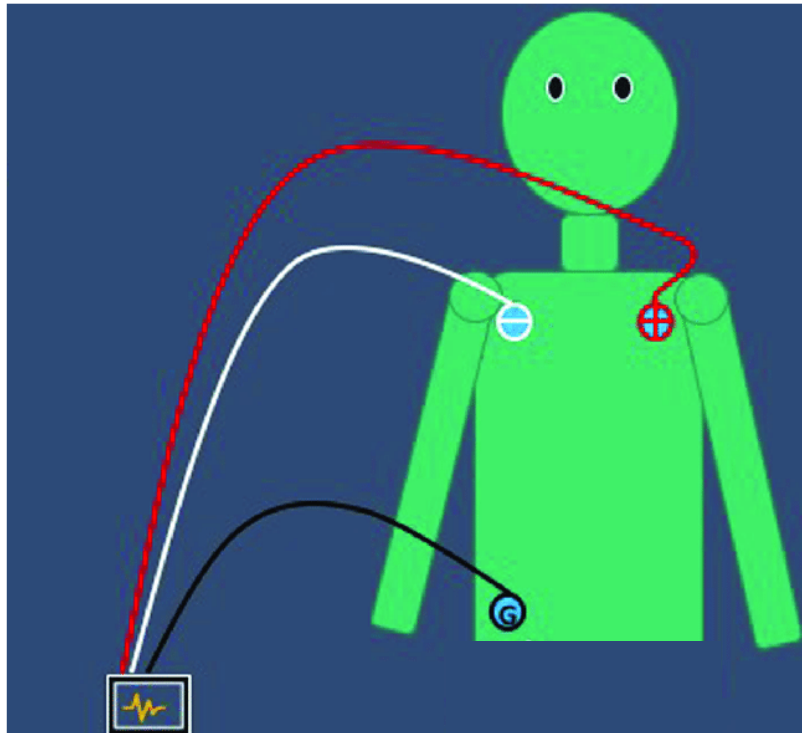
(Hajcak, 2012; Debener et al., 2005)

# Oops even when no mistake

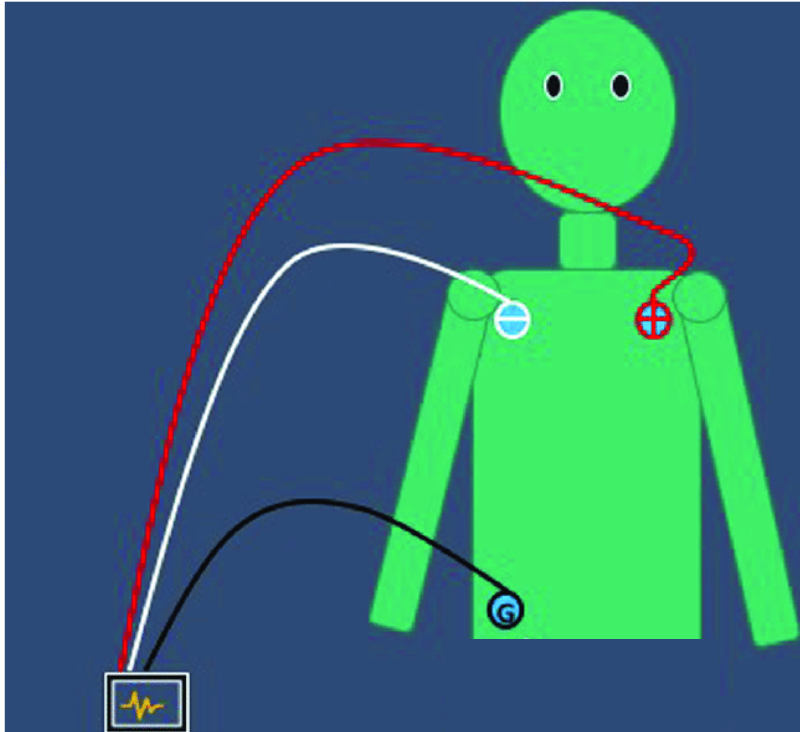




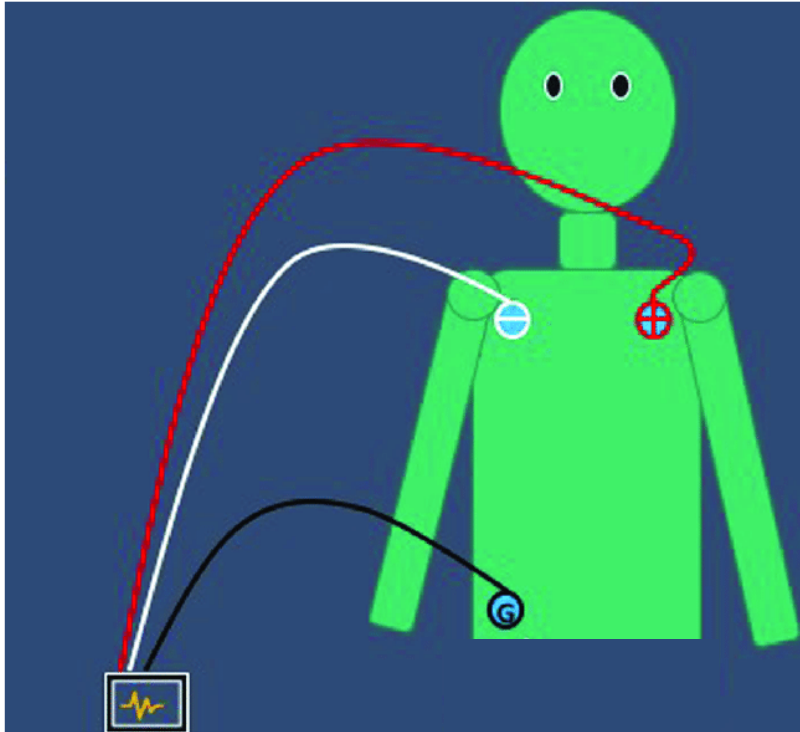
# Attention to Heart-rate



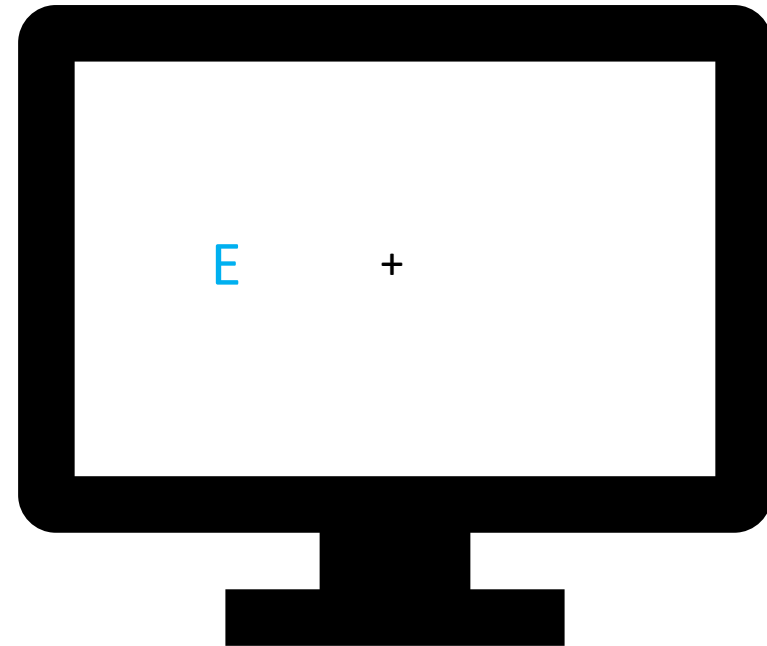
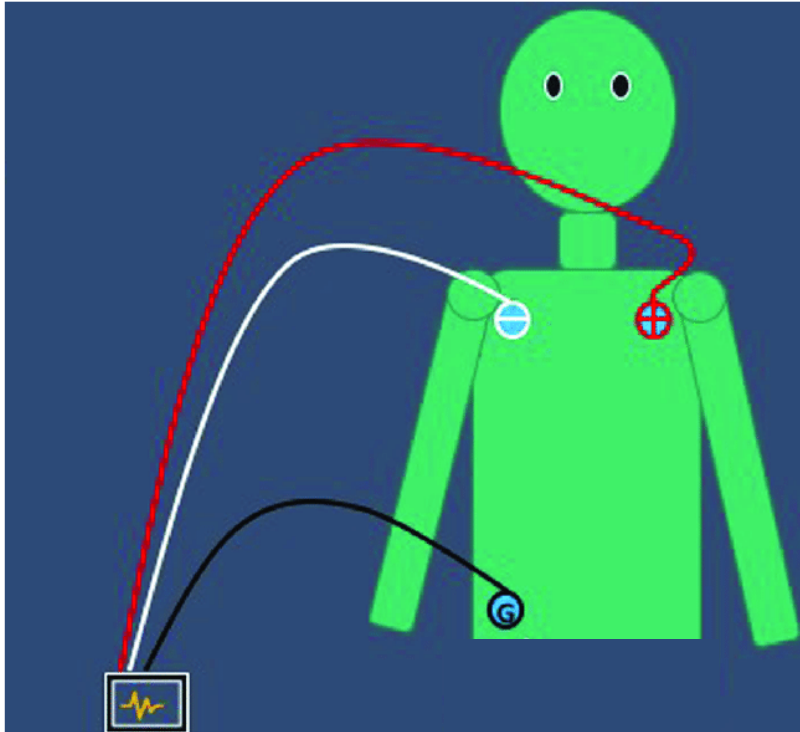
# Attention to Heart-rate



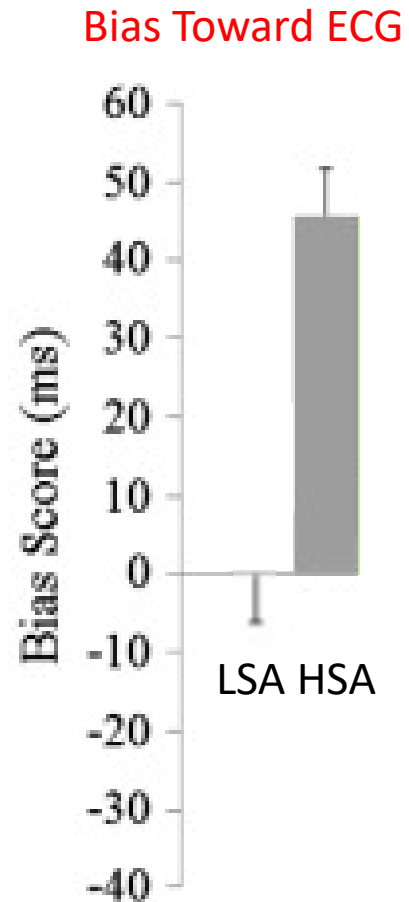
# Attention to Heart-rate



# Attention to Heart-rate

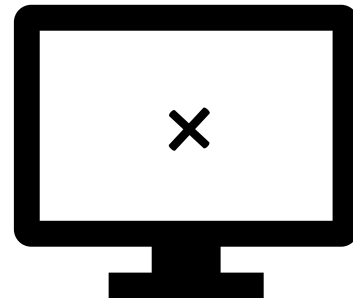
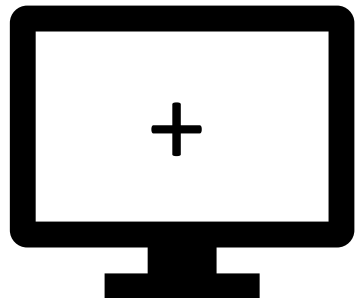


# Attention to Heart-rate: RT

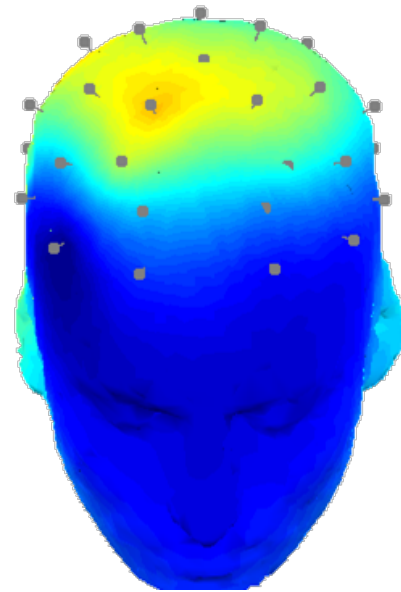
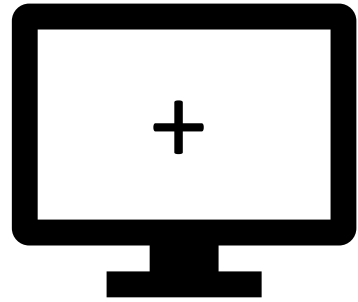




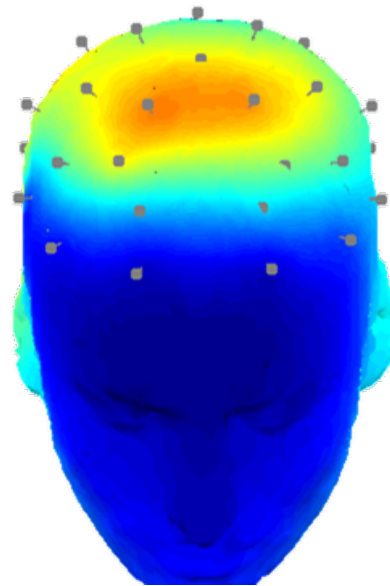
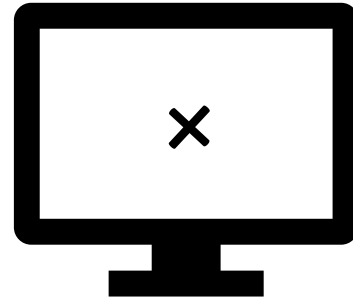
# Attention to Heart-rate



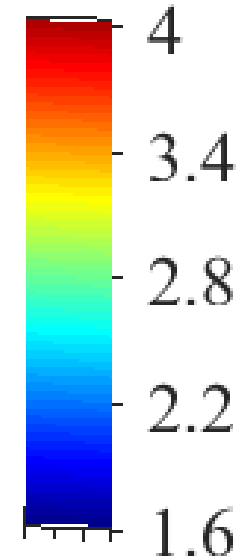
# Attention to Heart-rate



Normal Cue

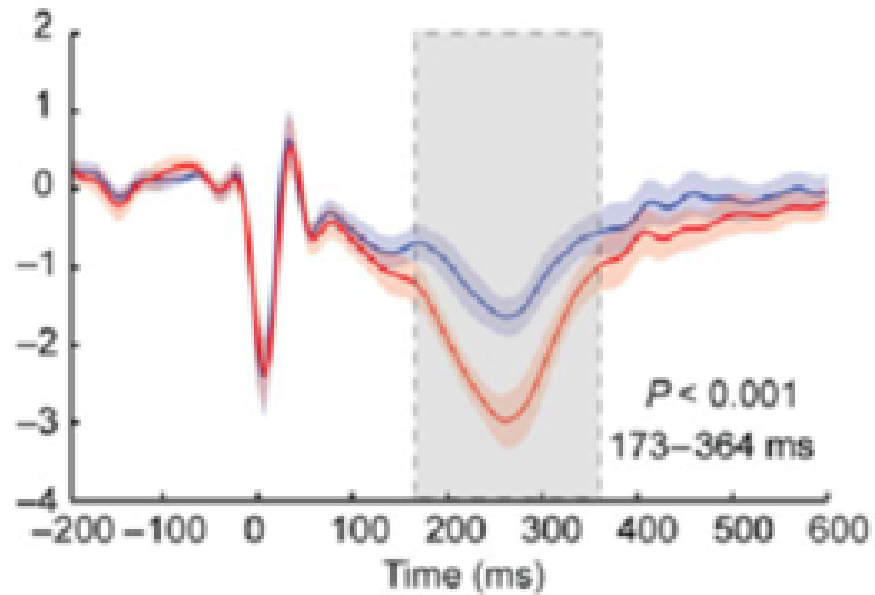


Acceleration Cue

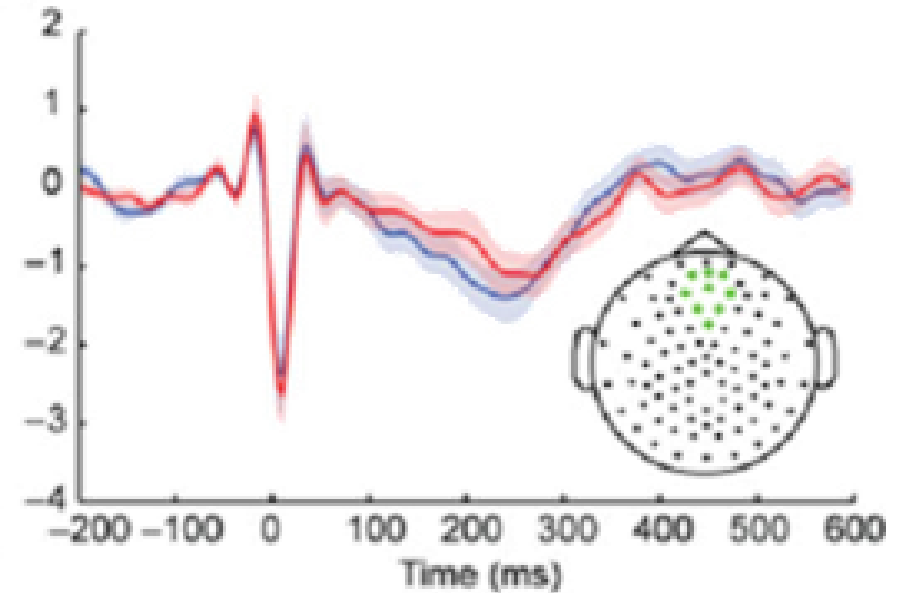


# Attention to Heart-rate: ERPs

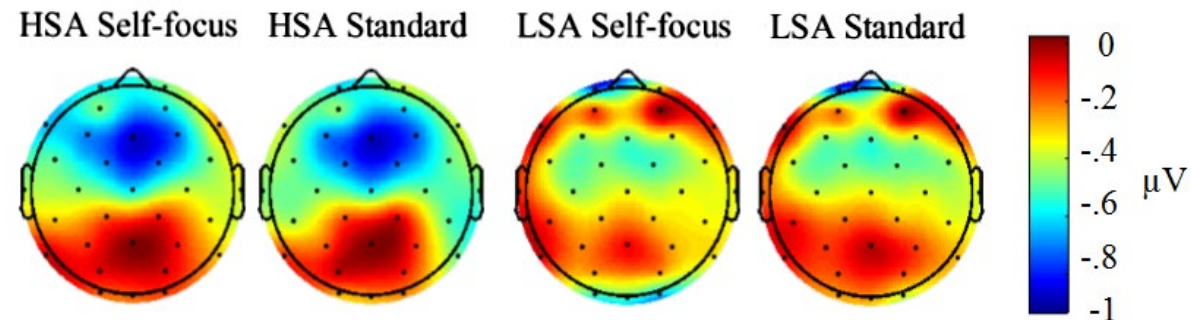
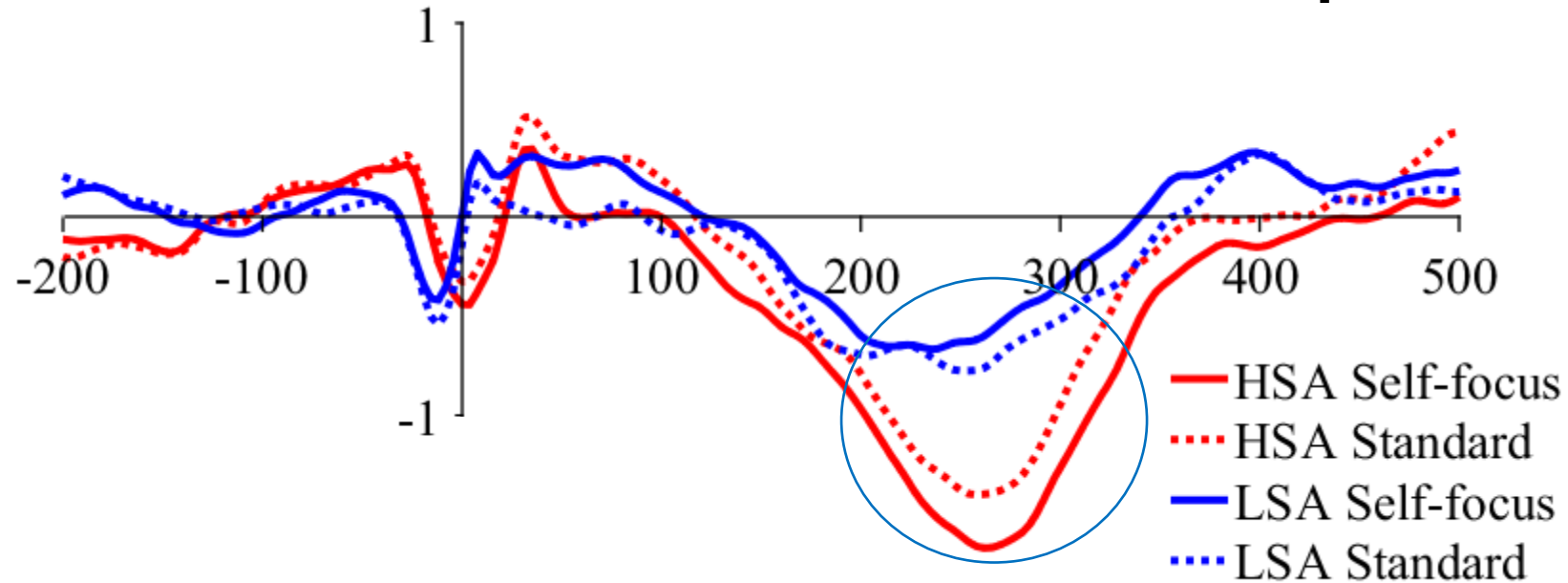
**B** Learners: centro-frontal



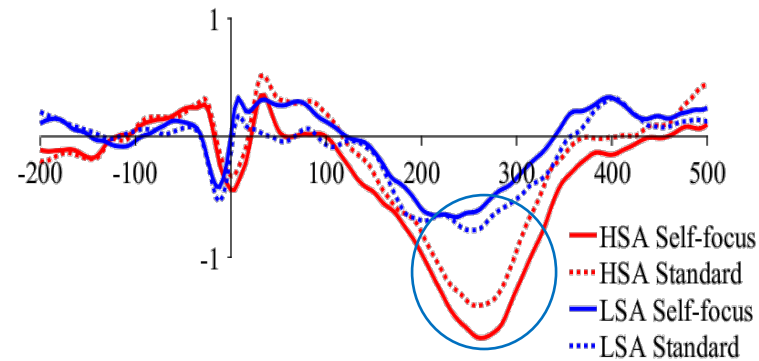
**E** Non-learners: centro-frontal



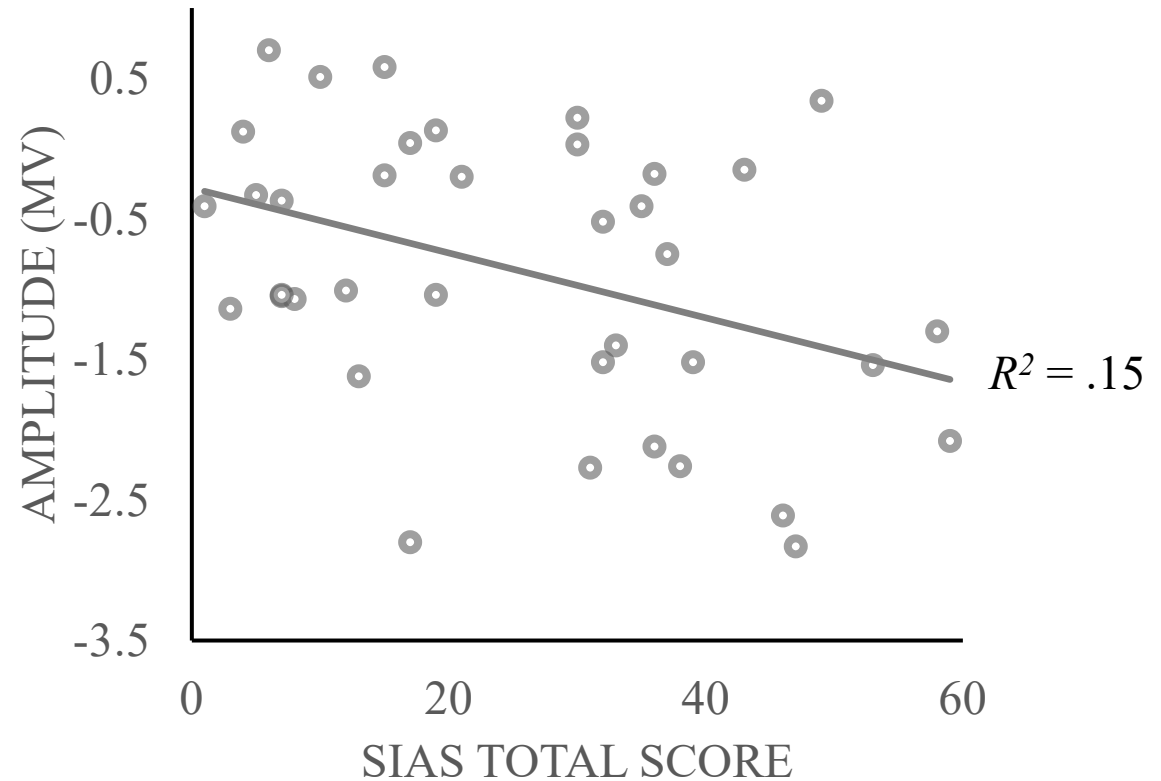
# Self-focus: Heart beat evoked potential



# Self-focus: Heart beat evoked potential

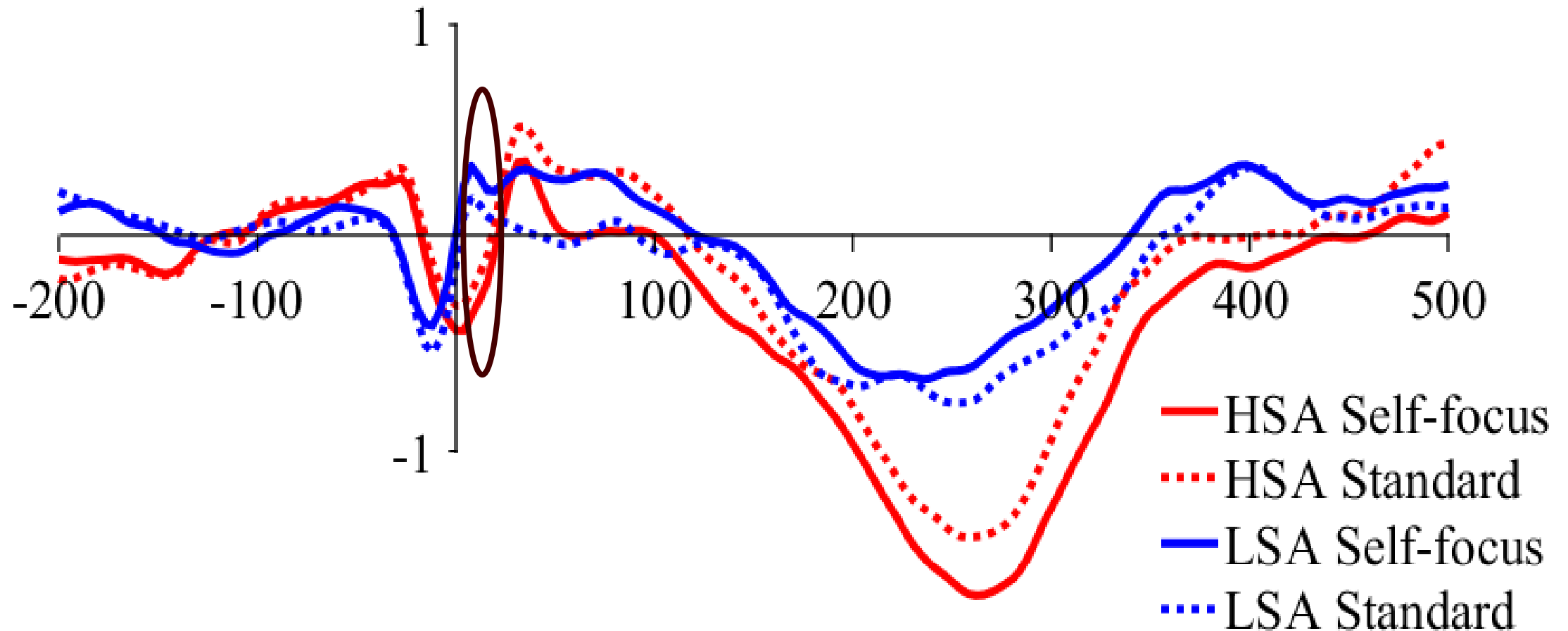


Correlation of Social Anxiety and HEP

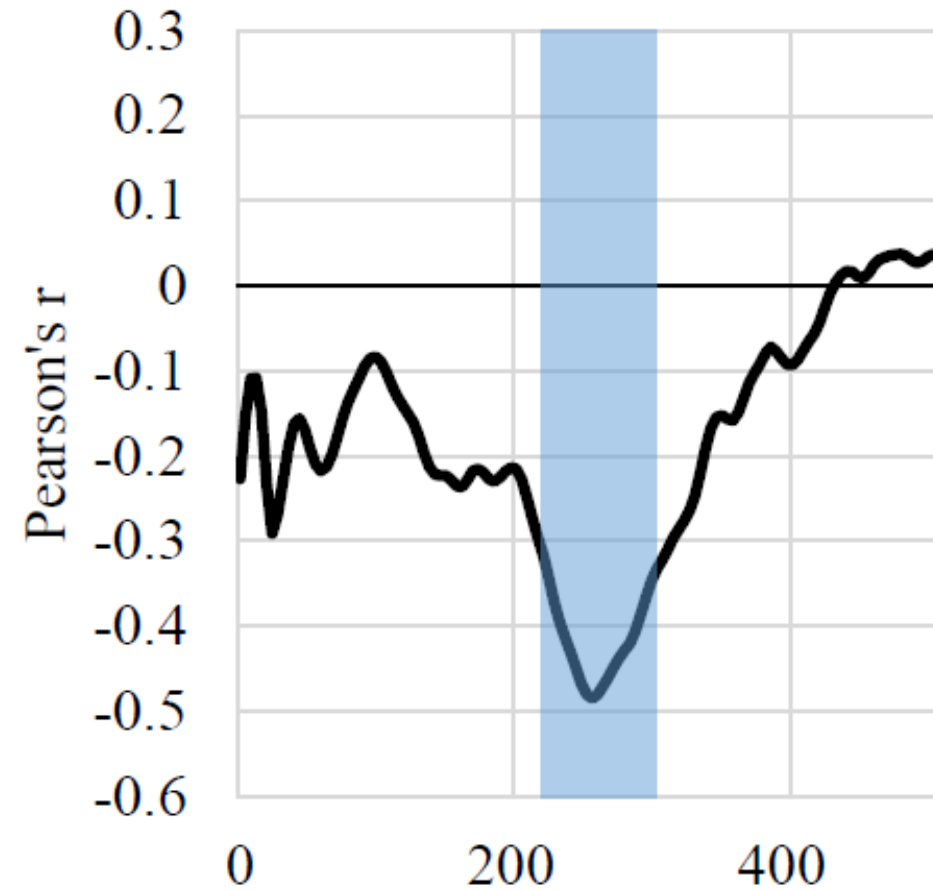




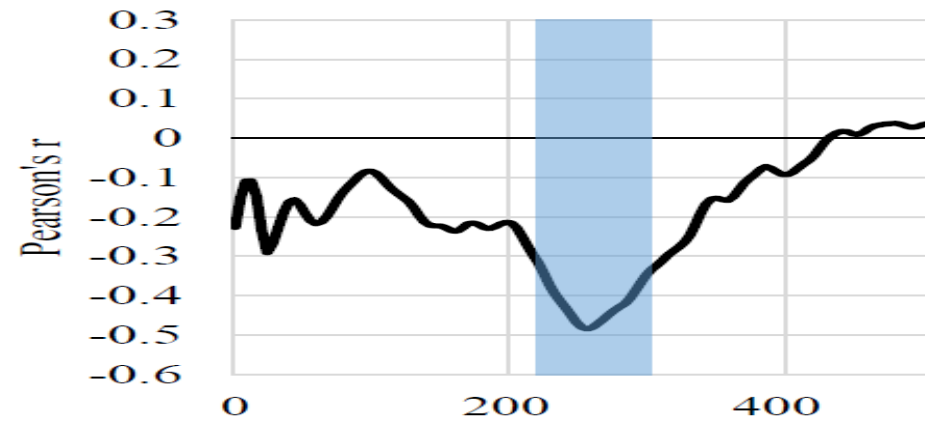
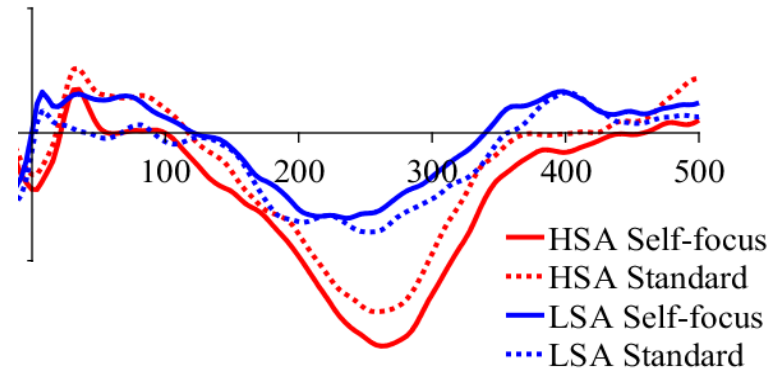
# Self-focus: Heart beat evoked potential



# Self-focus: Heart beat evoked potential



# Self-focus: Heart beat evoked potential



# Where Do Cognitive Biases Come From?

- Biases are related and influence each other  
(Hirsch, Clark, & Mathews, 2006)
- Behaviors that affect sensation/perception
  - Gaze affects visual input, so cognitive biases may depend on where one looks



# Eye Contact and Social Functioning



You gonna share that?

Ignore... ignore...  
ignore....



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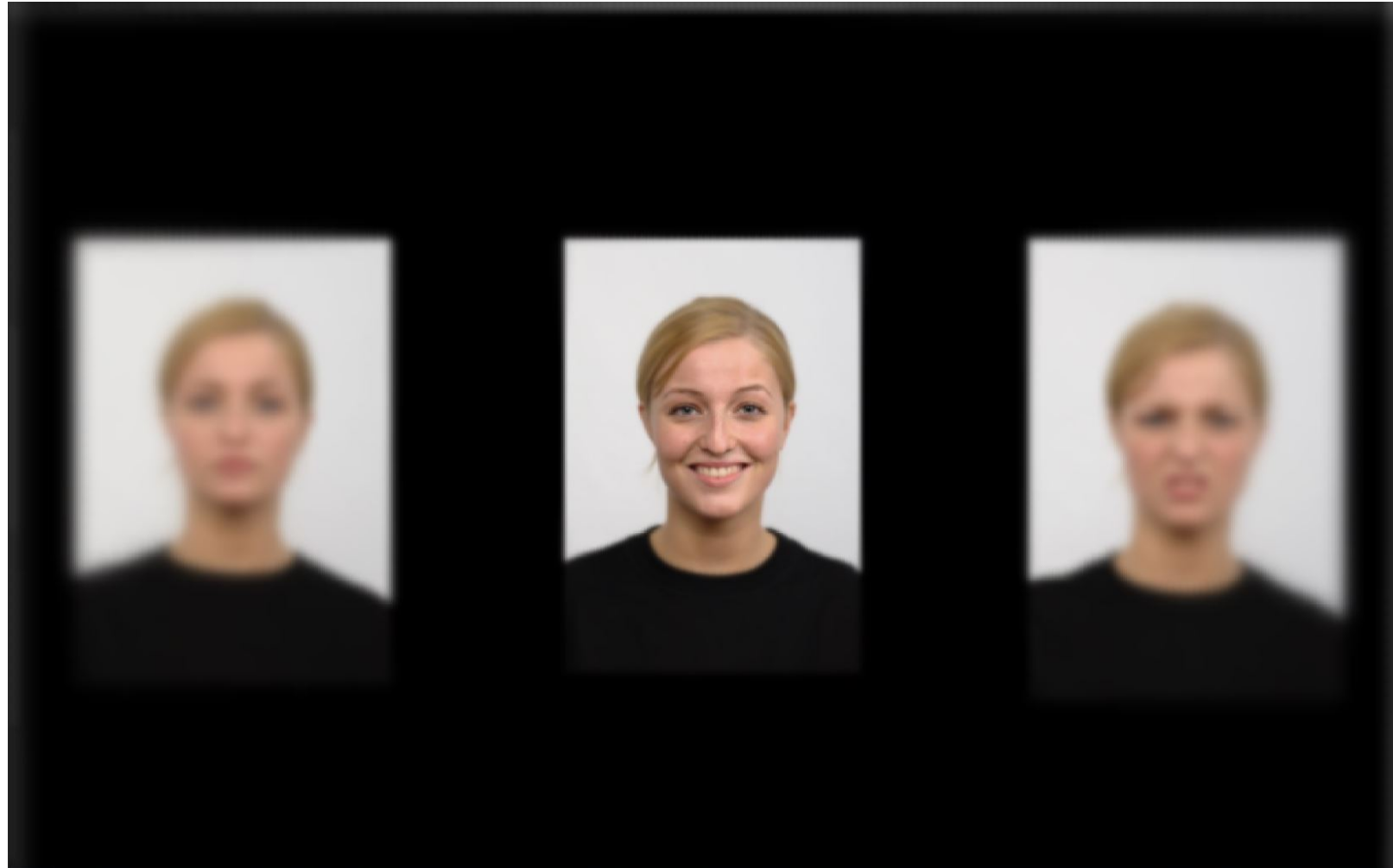


# Fear and Avoidance of Eye Contact



Judah et al., 2019; Moukheiber et al., 2012; Weeks et al., 2013; Wieser et al., 2010

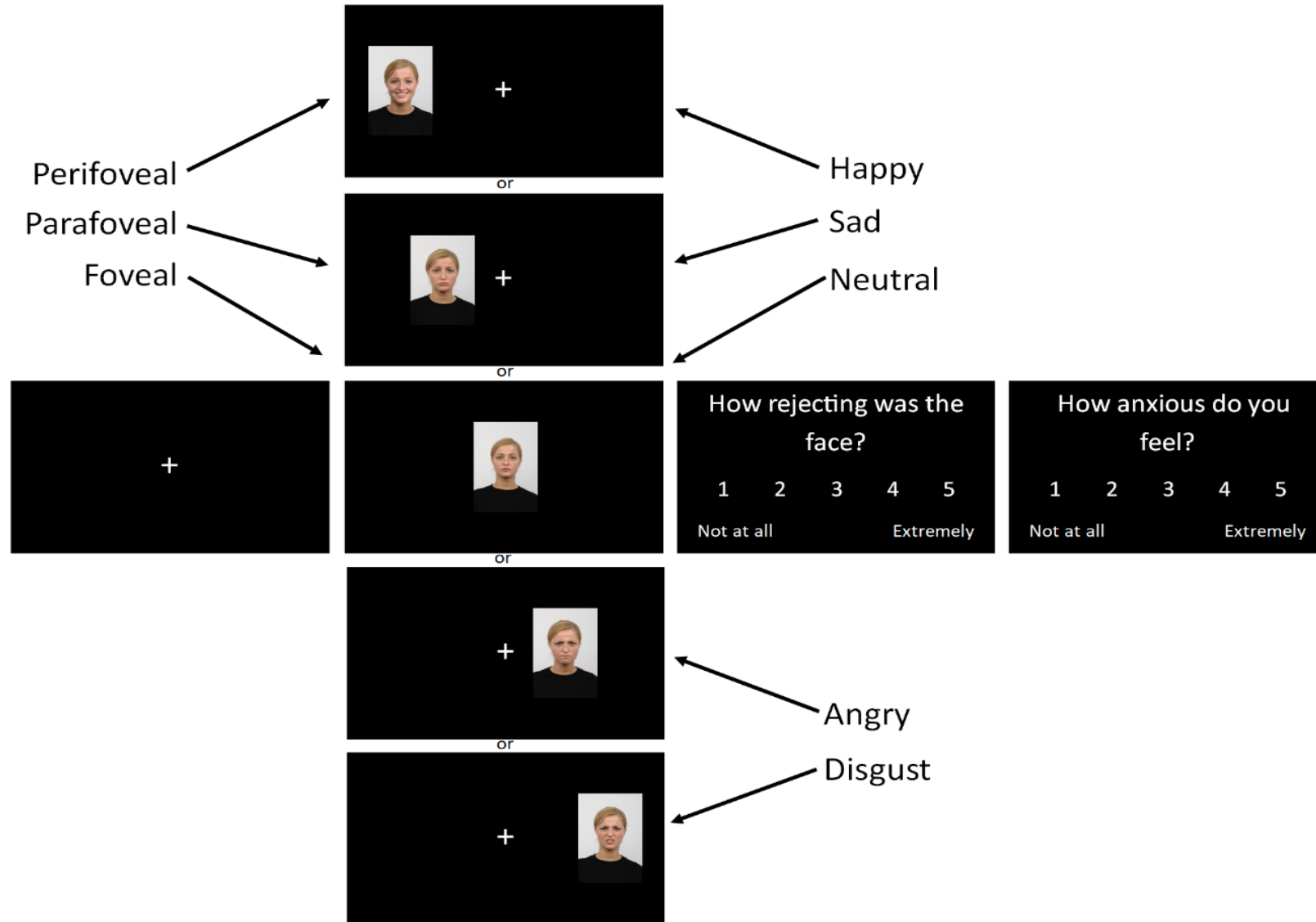
# Eye Contact and Visual Acuity



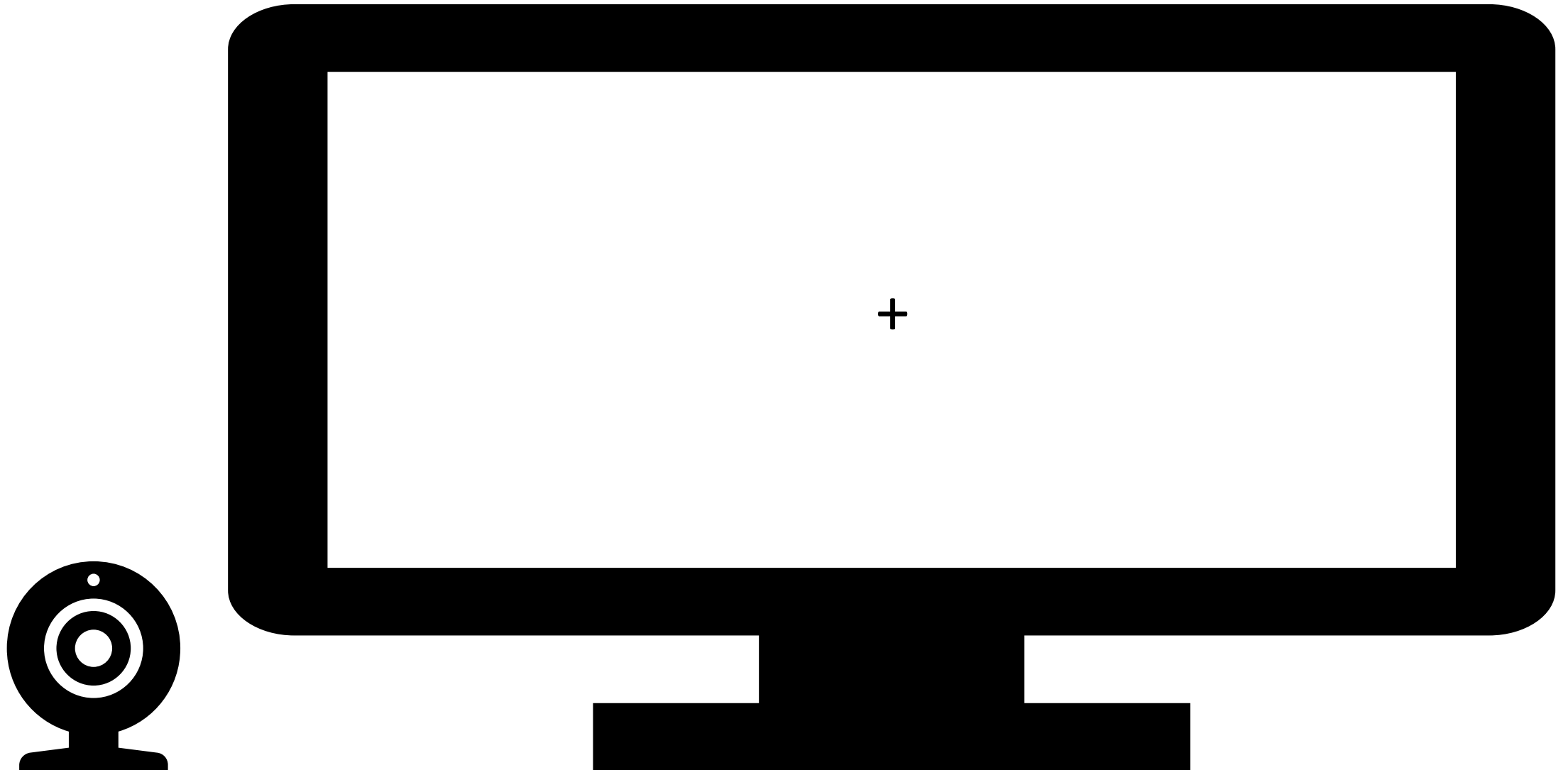




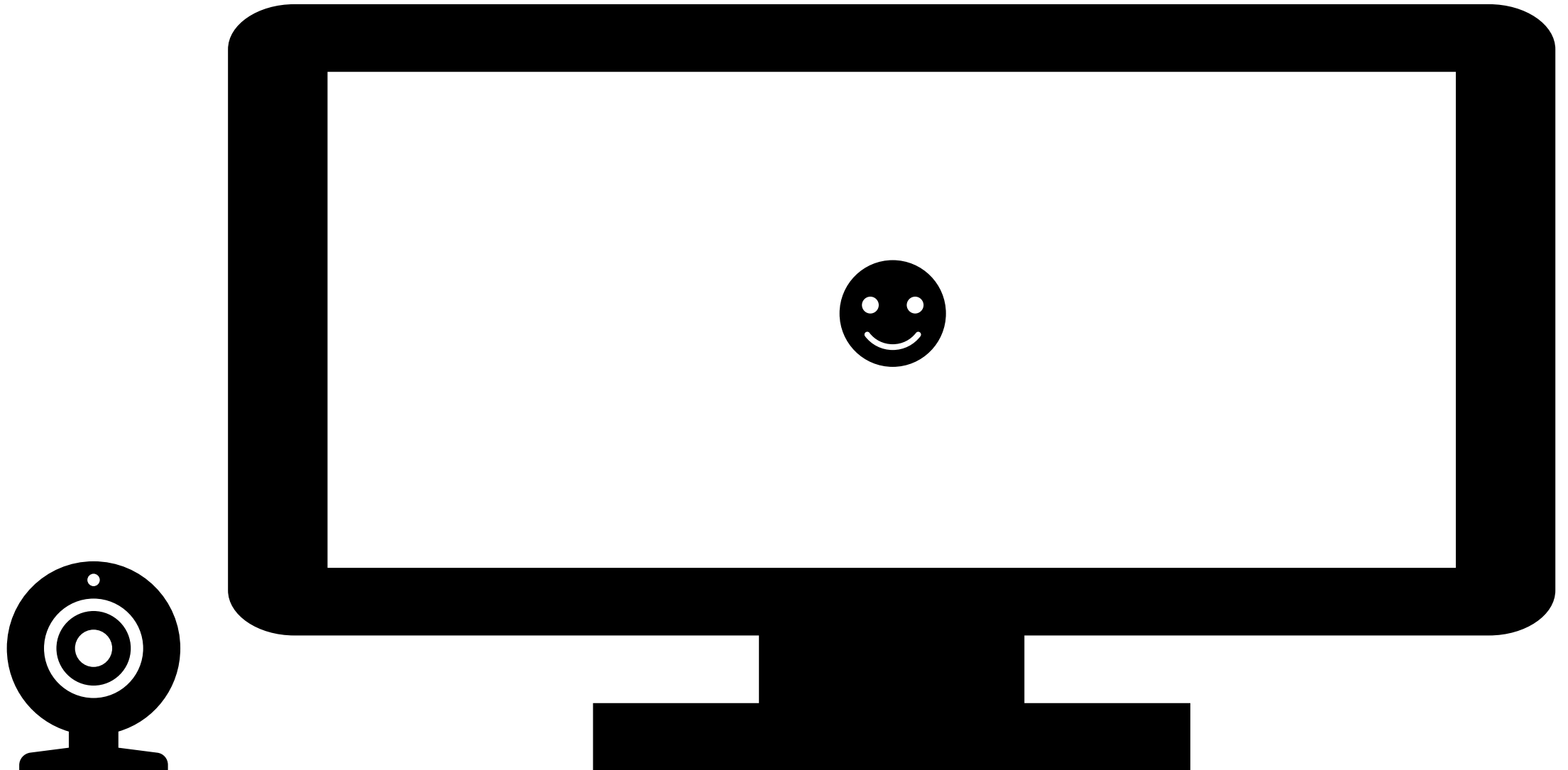
# Gaze Contingent Face Perception Task



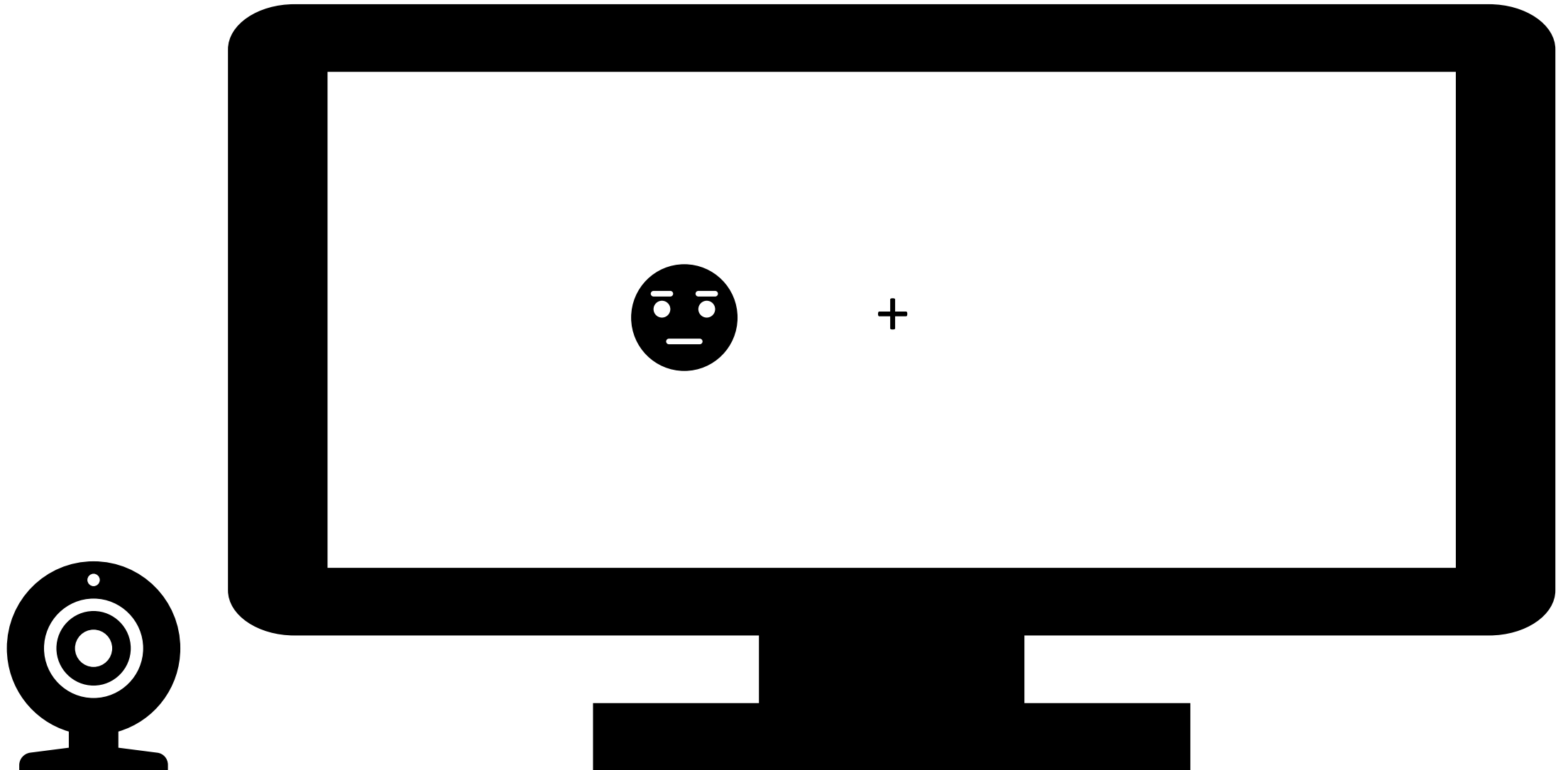
# Gaze Contingent Face Perception Task



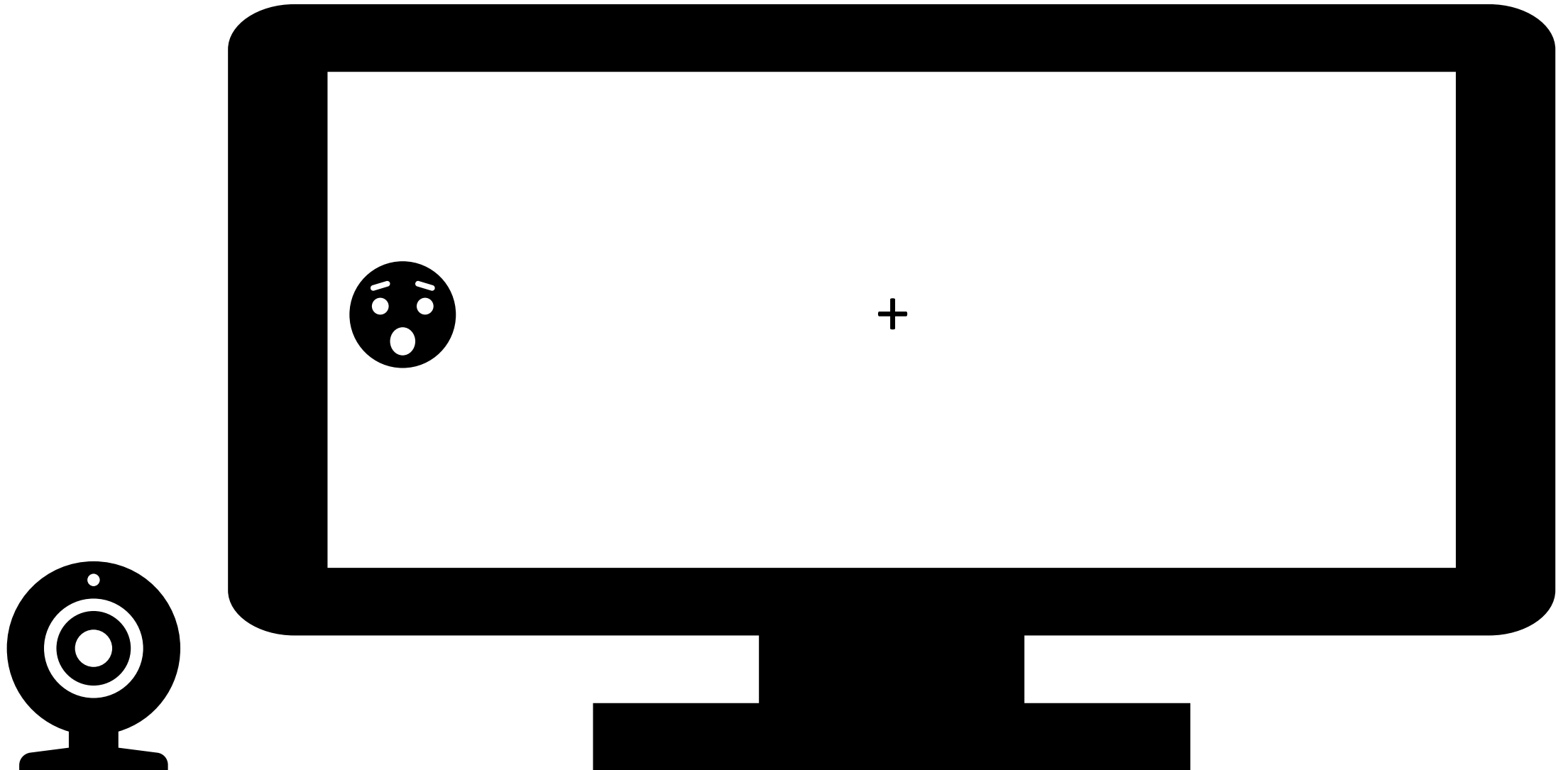
# Gaze Contingent Face Perception Task



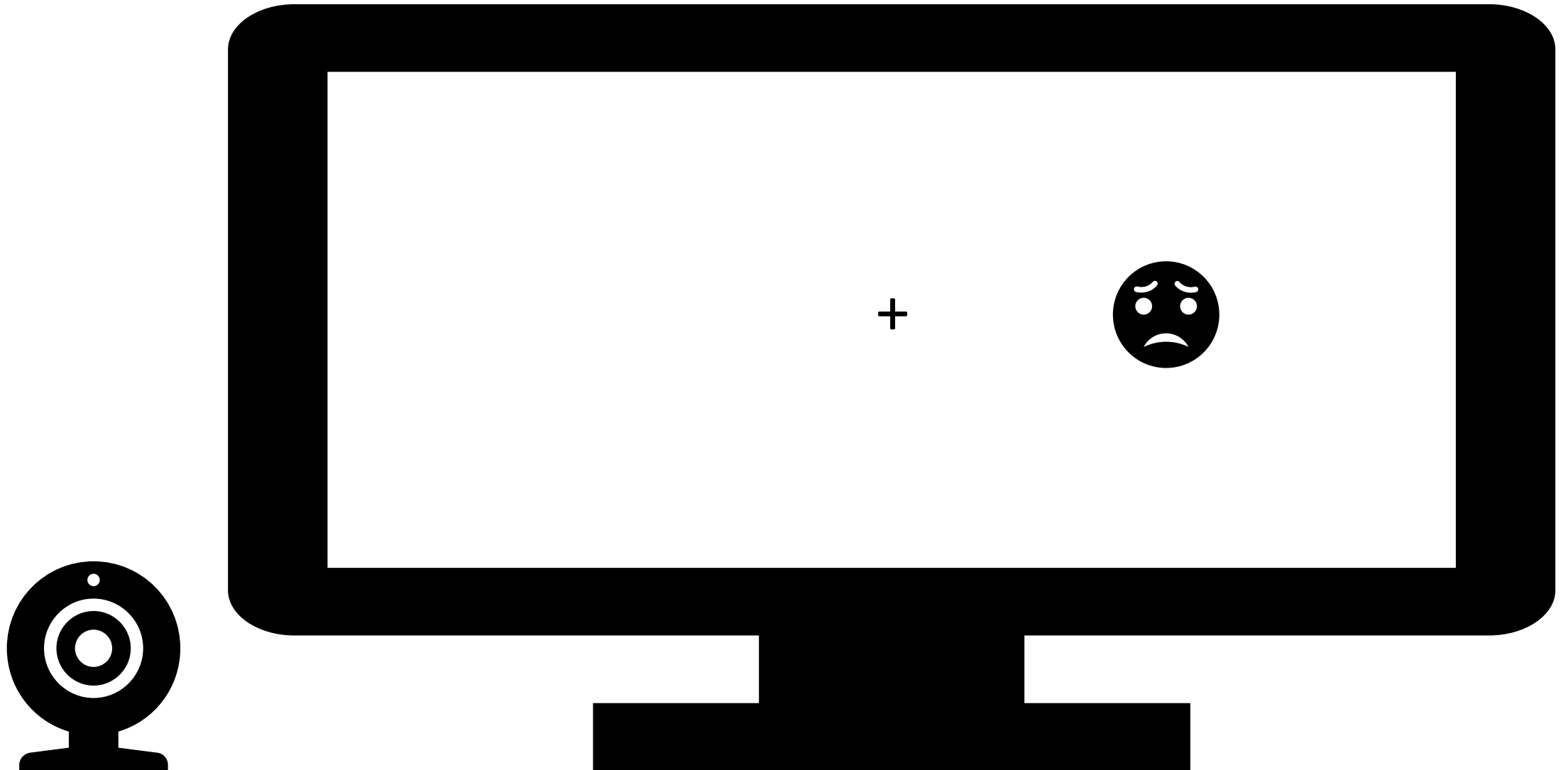
# Gaze Contingent Face Perception Task



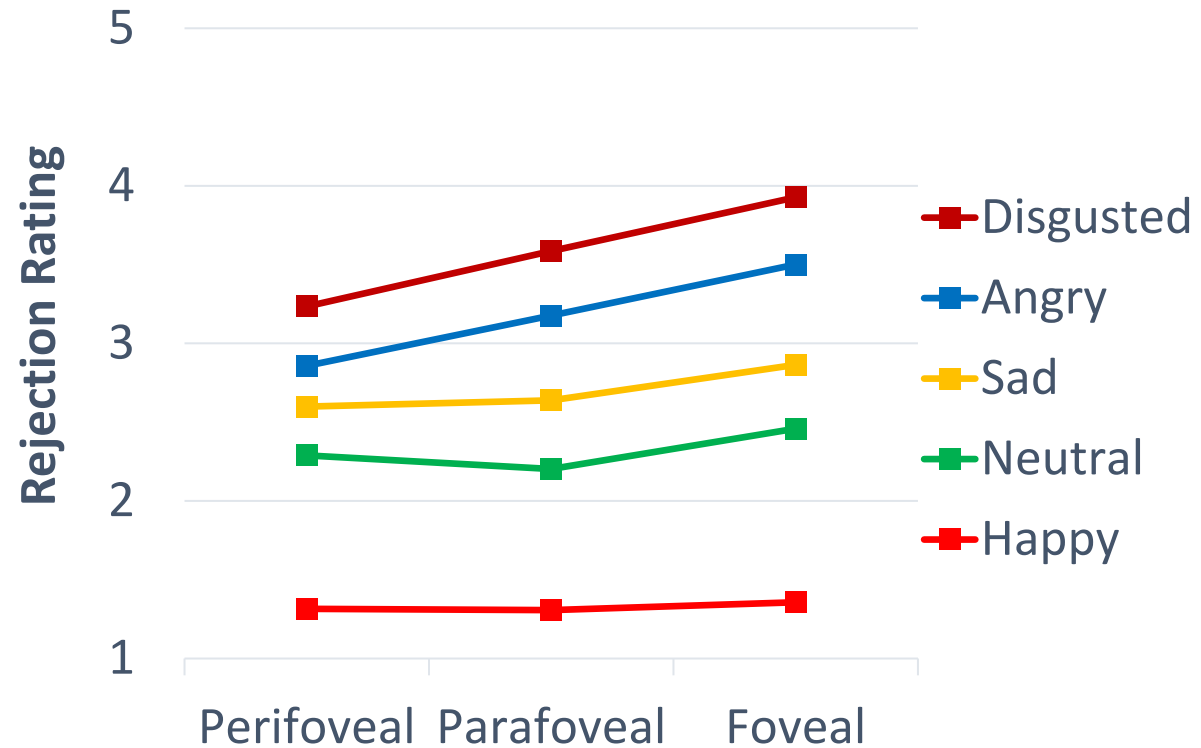
# Gaze Contingent Face Perception Task



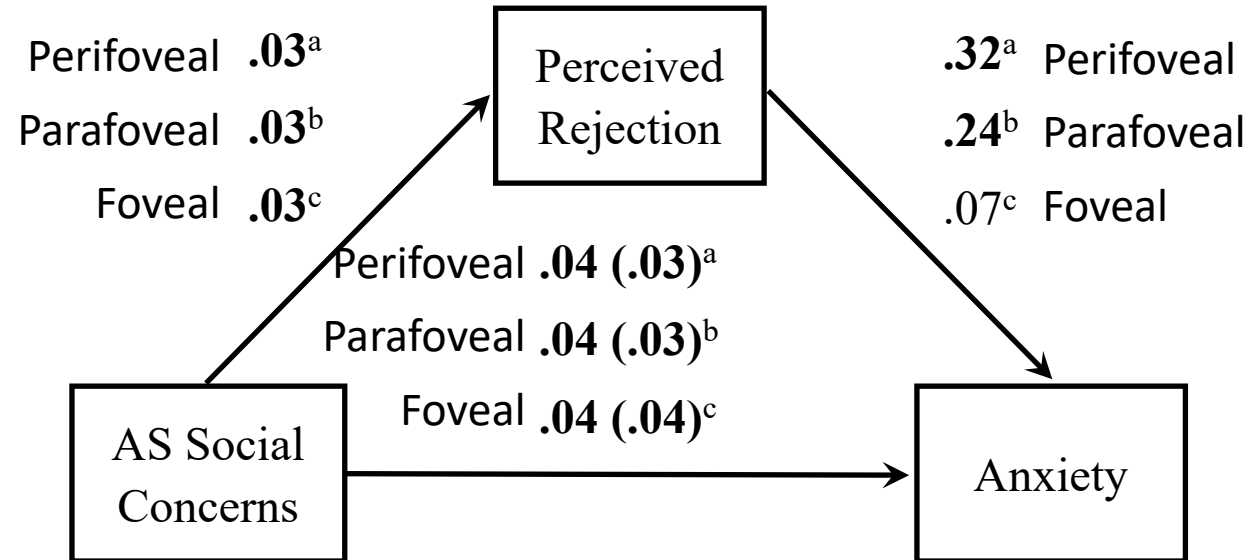
# Gaze Contingent Face Perception Task



# Perceived Rejection

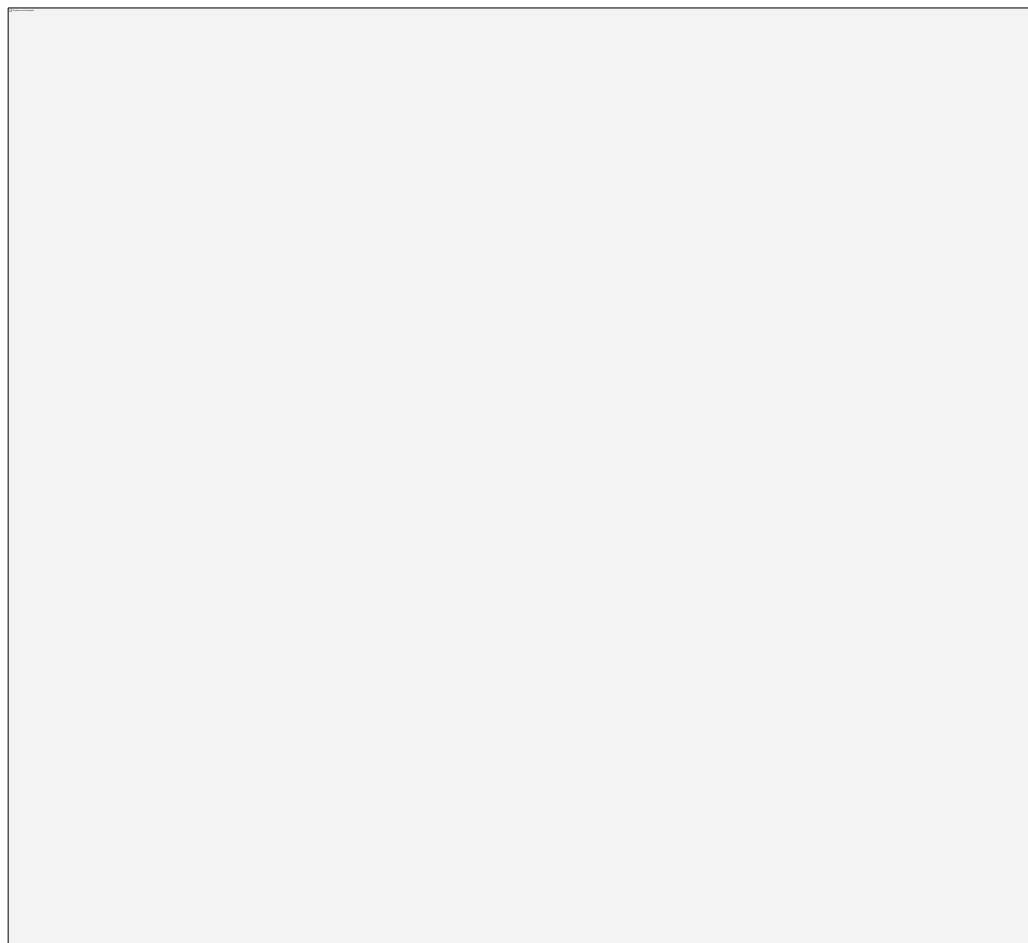


# Perceived Rejection





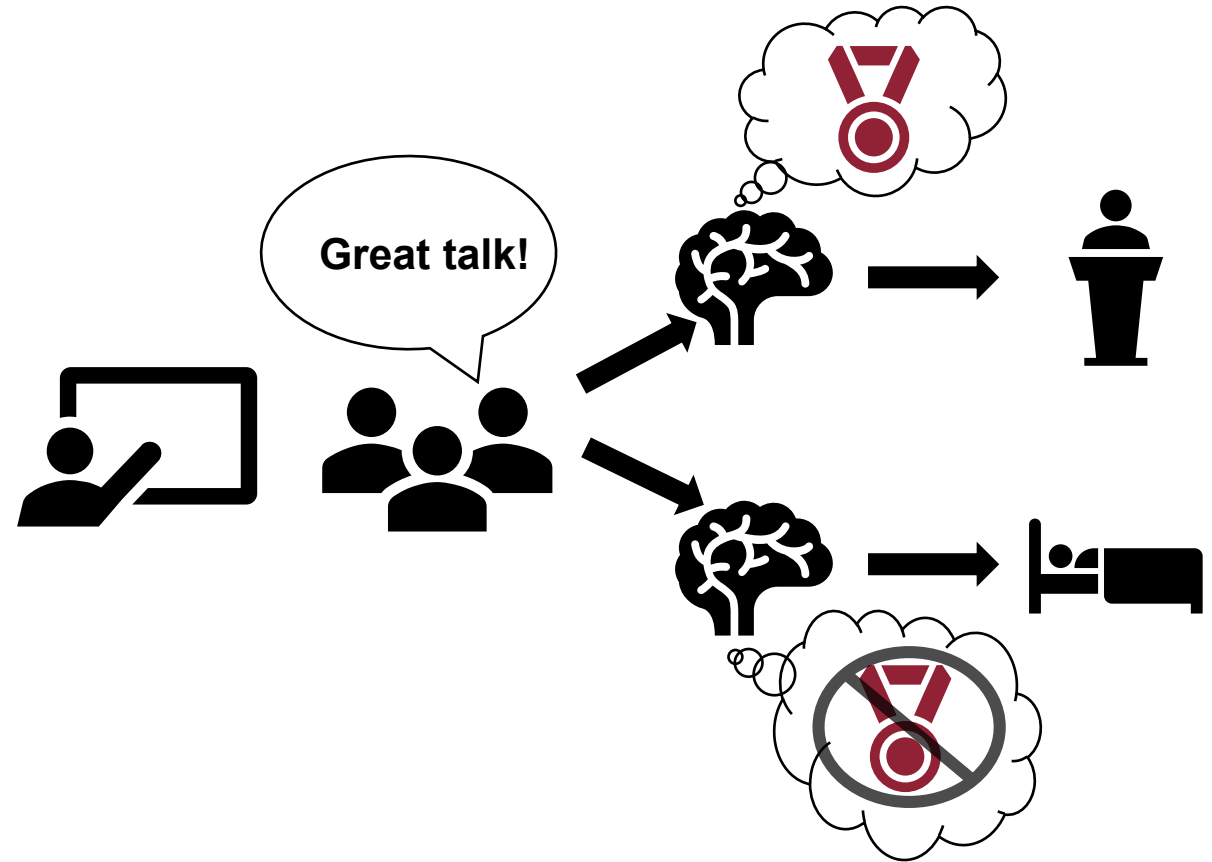
# Gaze During Social Interaction



# Reward Processing and Depression

People with depression have reduced **reward sensitivity**

This leads to reduced reinforcement of adaptive behavior



# The Reward Positivity (RewP)

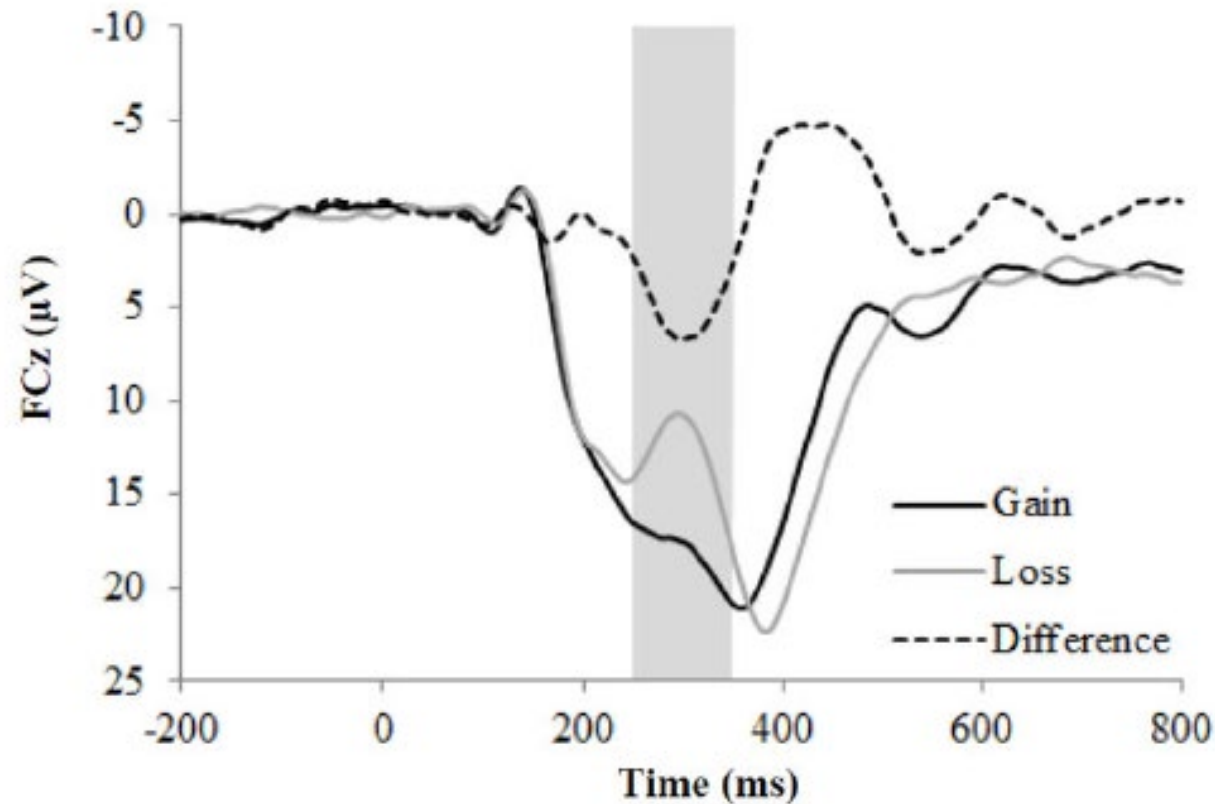
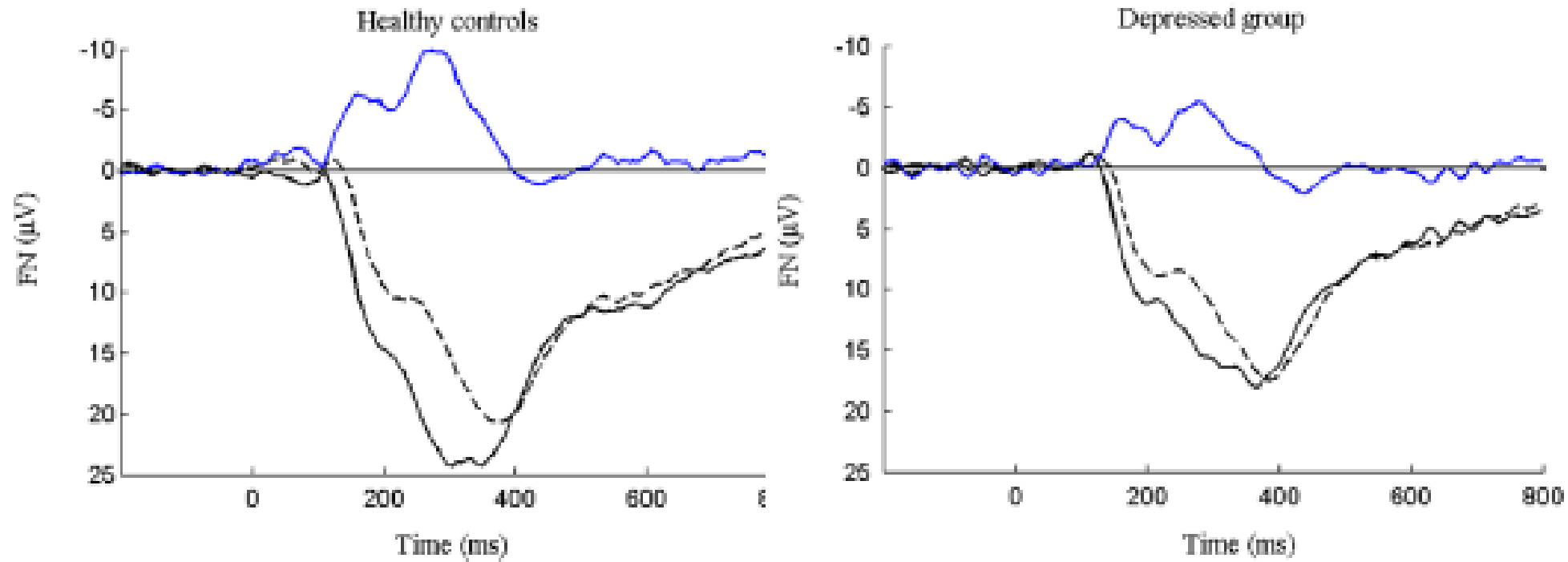


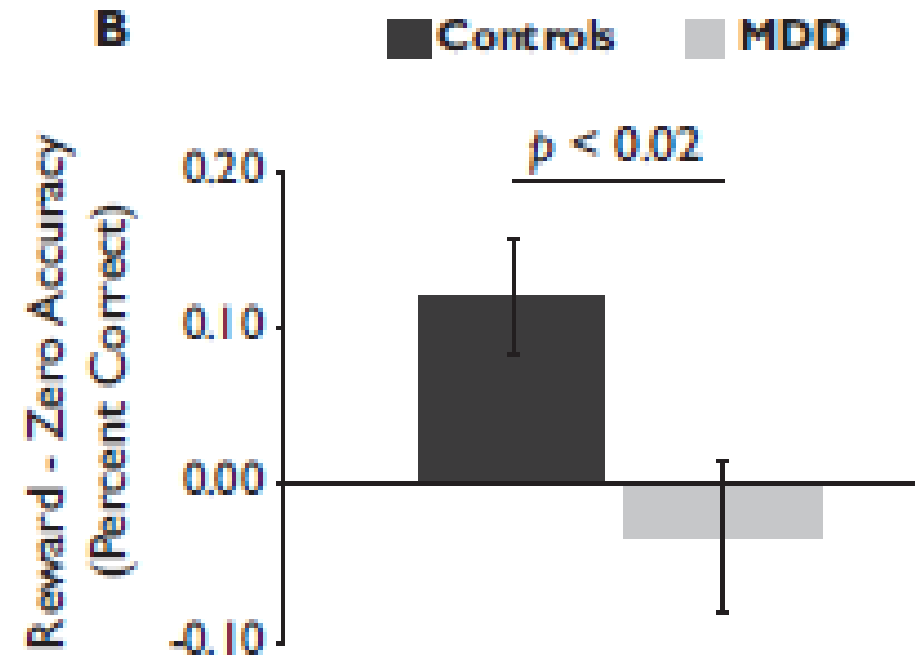
Figure 5. ERP response to gain, loss, and their difference (gain minus loss); positive plotted downward (Hausman et al., 2018, Figure 1)

# Reduced RewP in Depression



# Reduced Reward Memory in Depression

Better **memory for reward** in healthy controls compared to depressed individuals

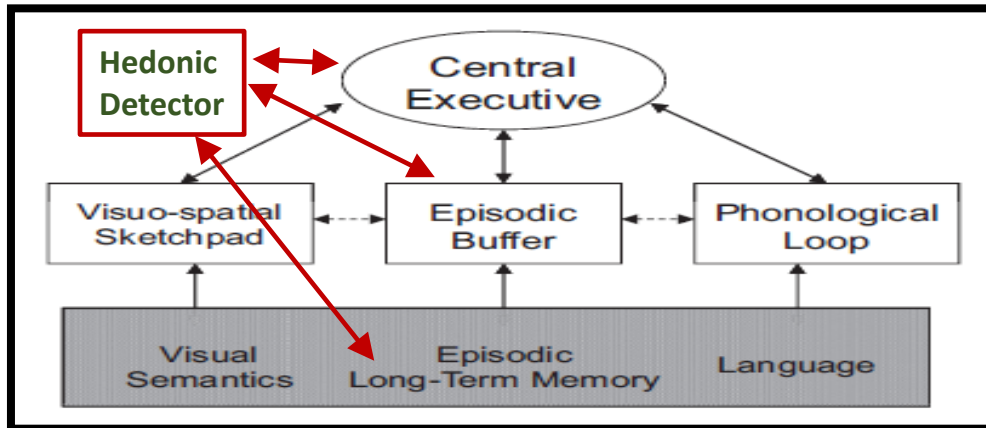


Dainer-Best et al., 2018; Dillon, Dobins, Pizzagalli, 2014; Steele, & Seriès, 2018

# Reward Processing and Depression

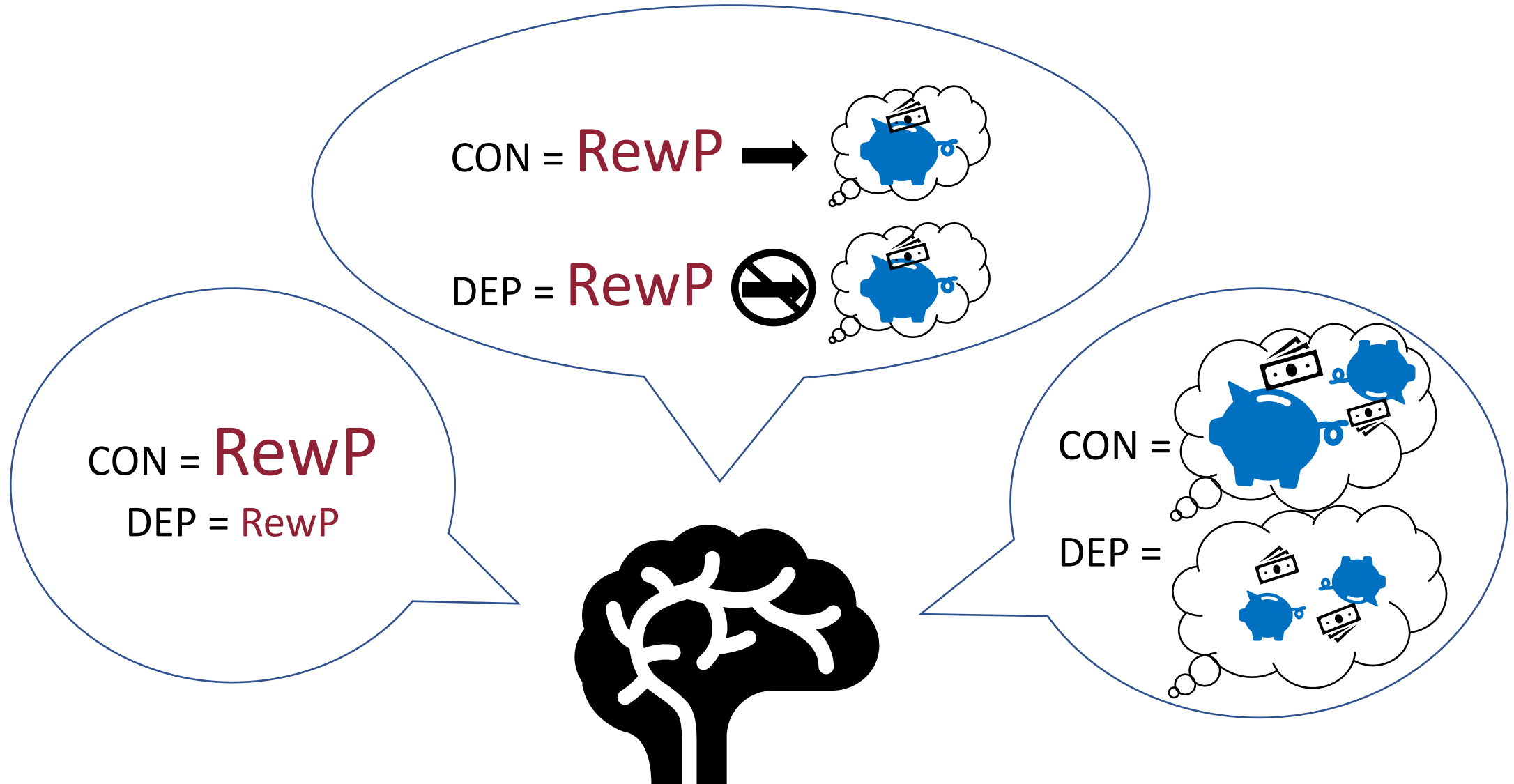
Reduced **reward sensitivity** may reduce **positive memory bias** in depression

Dysfunction in reward mechanism during working memory (Baddeley, 2007, 2013)

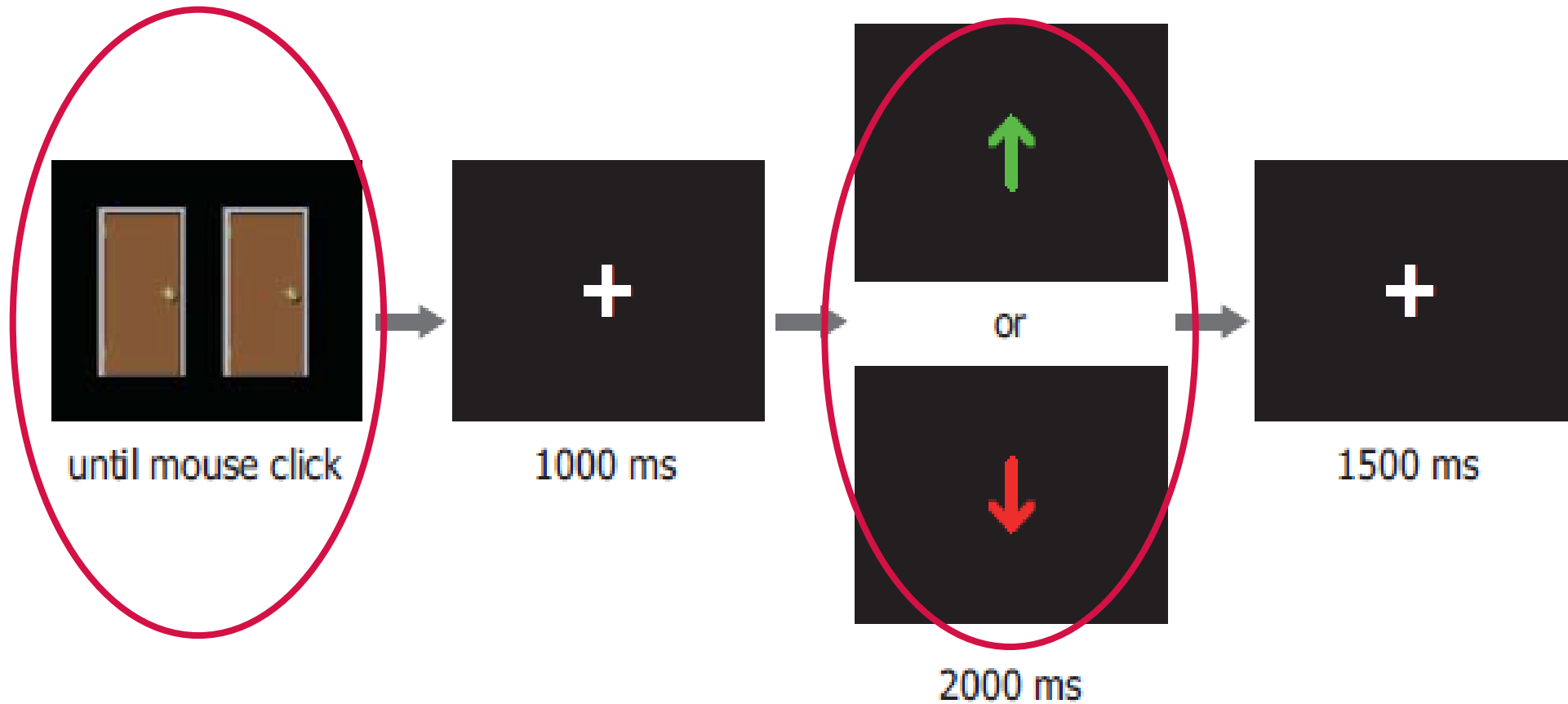


The multicomponent model of working memory with a reward sensitivity component added; adapted from Baddeley (2013; Figure 1)

# Hypotheses

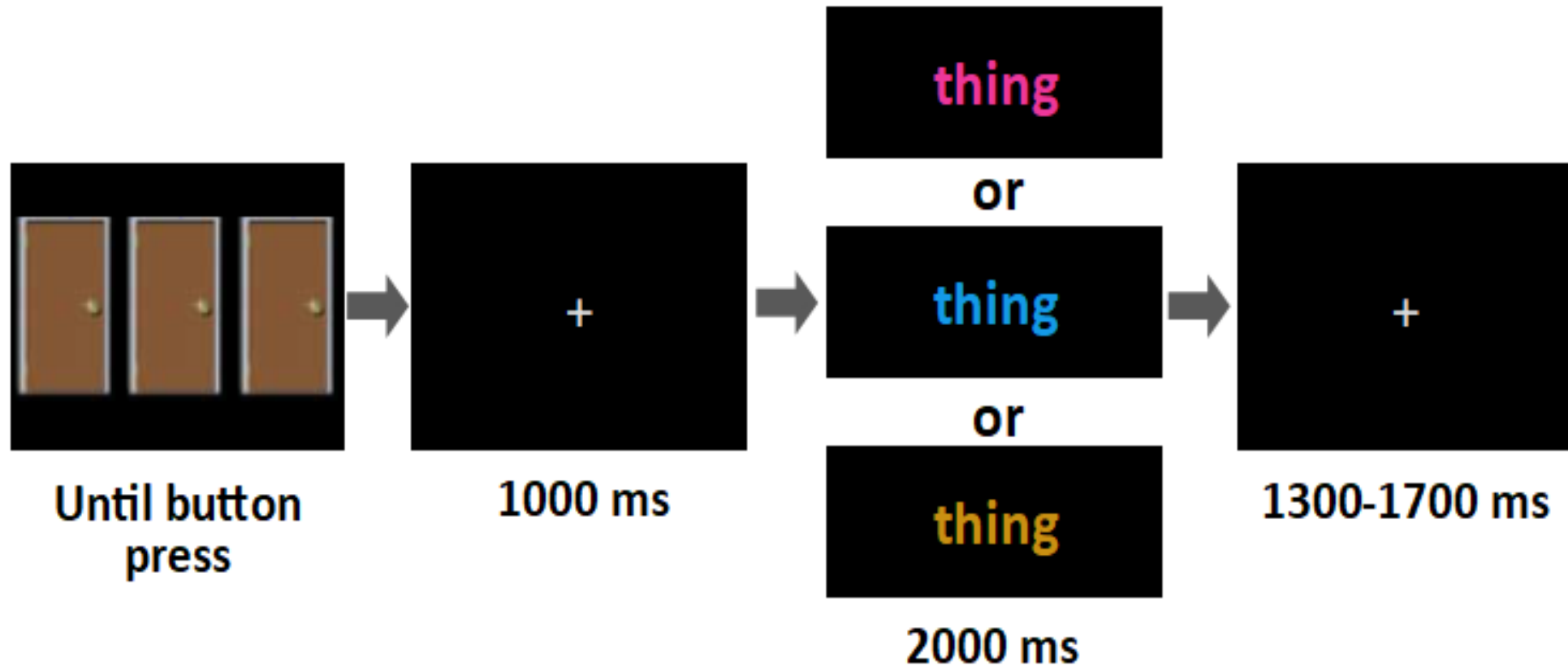


# The Doors

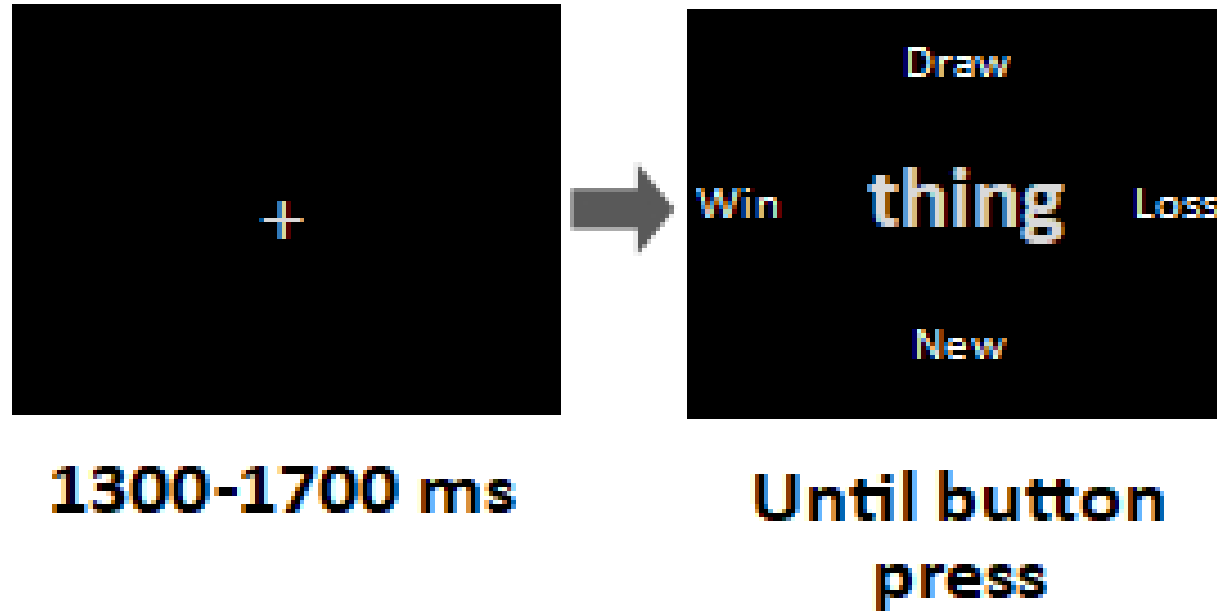




# The Reward Memory Task (RewM)



# The Reward Memory Task (RewM)



$$H_u(\text{reward}) = \frac{f_{\text{reward} | \text{reward}}}{(f_{\text{reward} | \text{reward}} + f_{\text{reward} | \text{loss}} + f_{\text{reward} | \text{draw}} + f_{\text{reward} | \text{new}})} \times$$

$$\frac{f_{\text{reward} | \text{reward}}}{(f_{\text{reward} | \text{reward}} + f_{\text{loss} | \text{reward}} + f_{\text{draw} | \text{reward}} + f_{\text{new} | \text{reward}})}$$

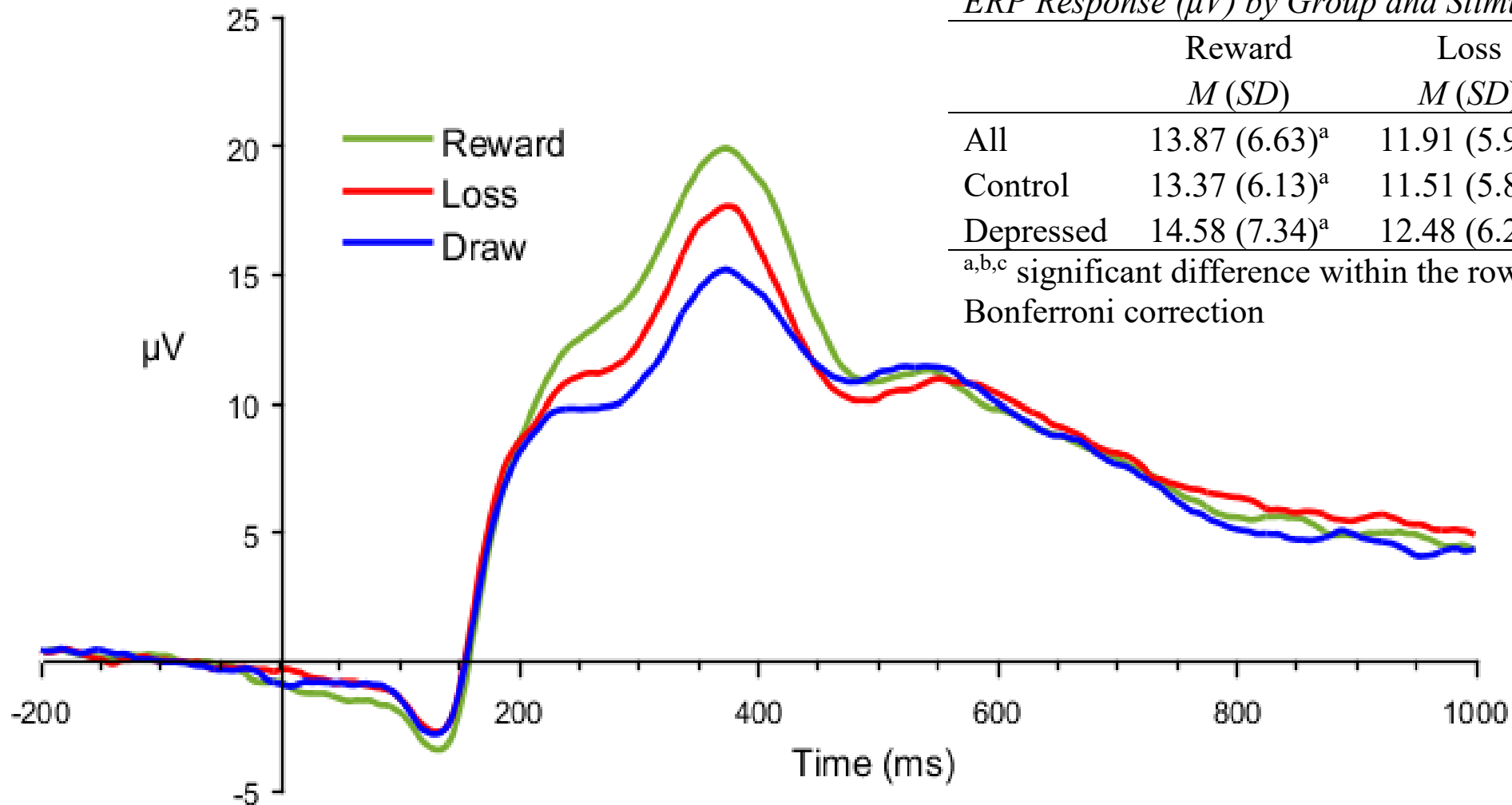
Wagner, 1993

# RewP Results

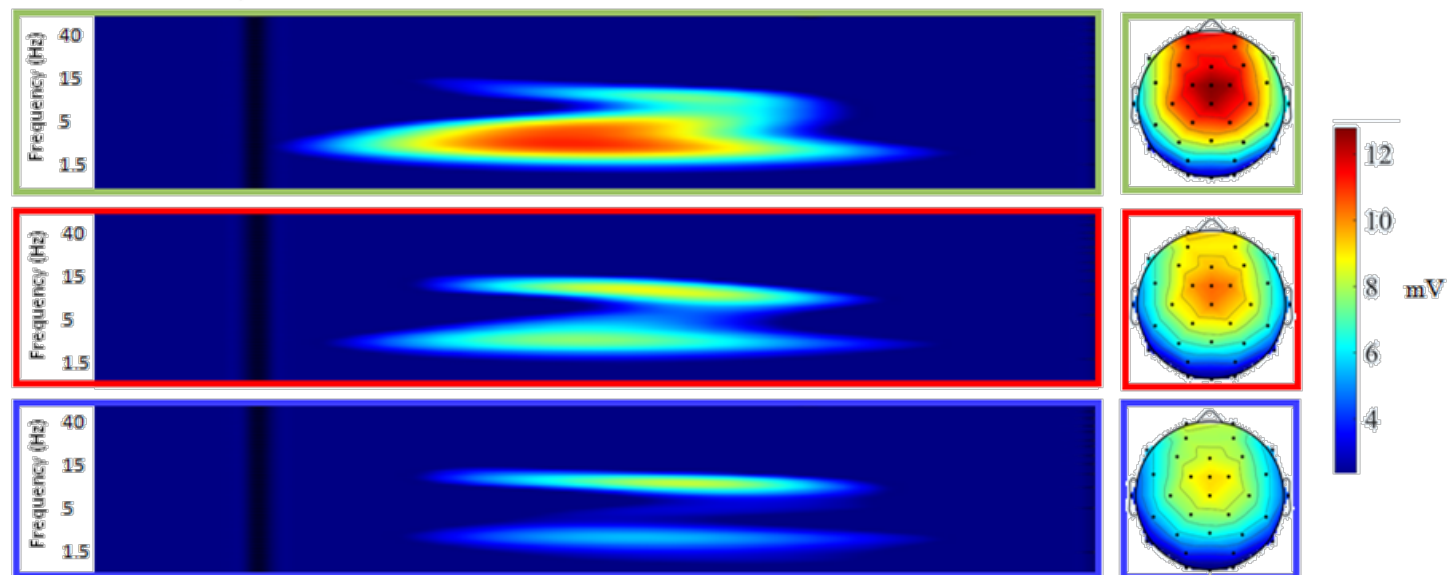
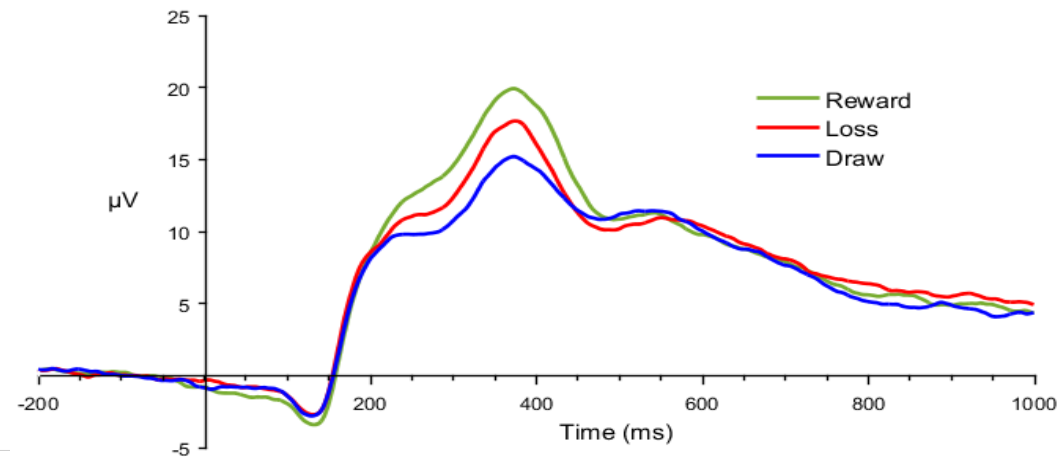
*ERP Response ( $\mu V$ ) by Group and Stimulus Value*

	Reward	Loss	Draw
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
All	13.87 (6.63) <sup>a</sup>	11.91 (5.99) <sup>b</sup>	10.26 (5.16) <sup>c</sup>
Control	13.37 (6.13) <sup>a</sup>	11.51 (5.80) <sup>b</sup>	9.85 (4.93) <sup>c</sup>
Depressed	14.58 (7.34) <sup>a</sup>	12.48 (6.29) <sup>b</sup>	10.82 (5.52) <sup>c</sup>

<sup>a,b,c</sup> significant difference within the row at  $p < .05$  with Bonferroni correction



# RewP Results



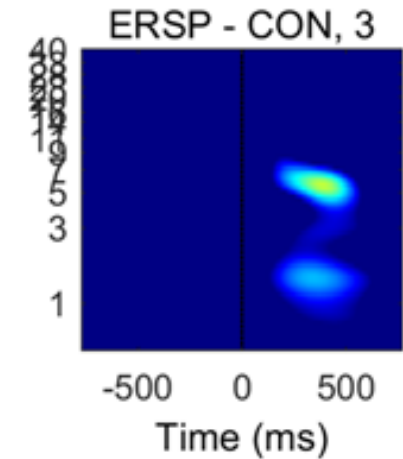
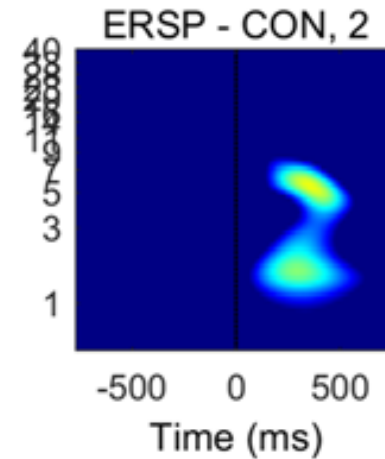
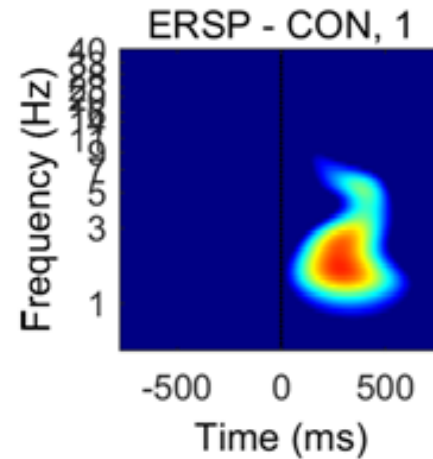
# RewP Results

Reward

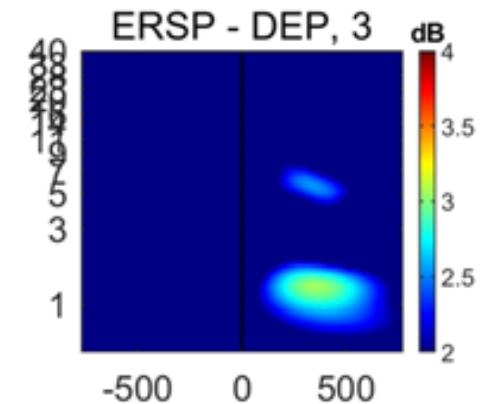
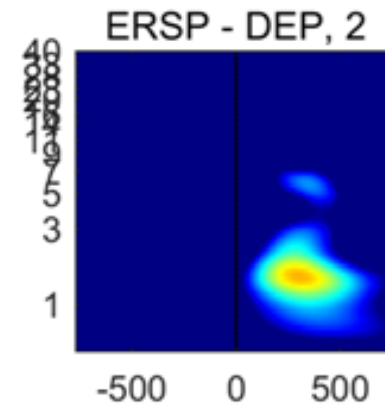
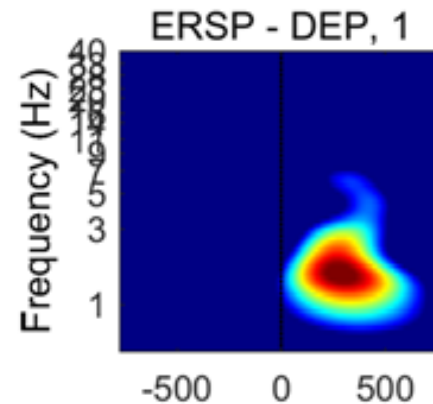
Loss

Draw

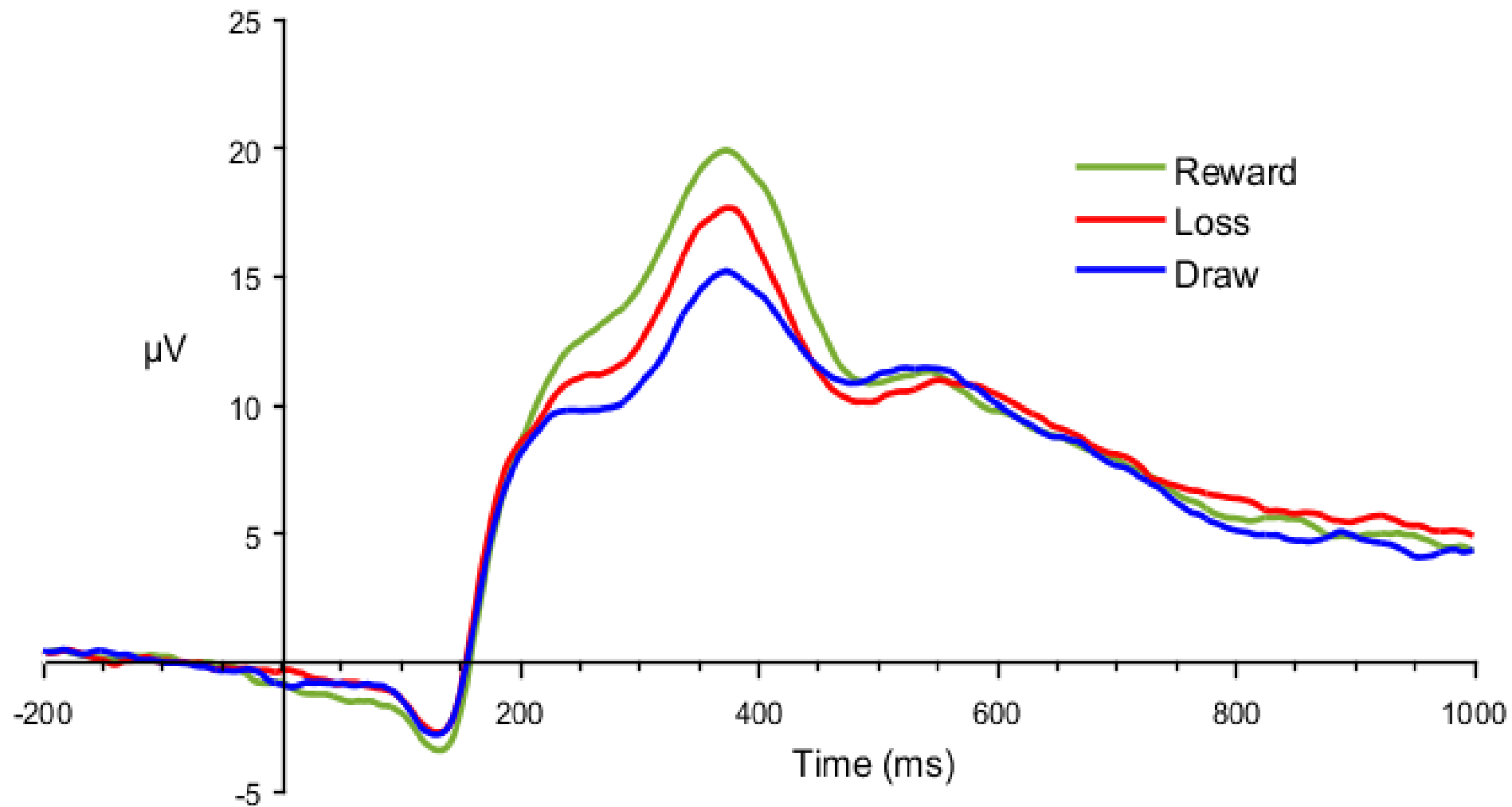
Control



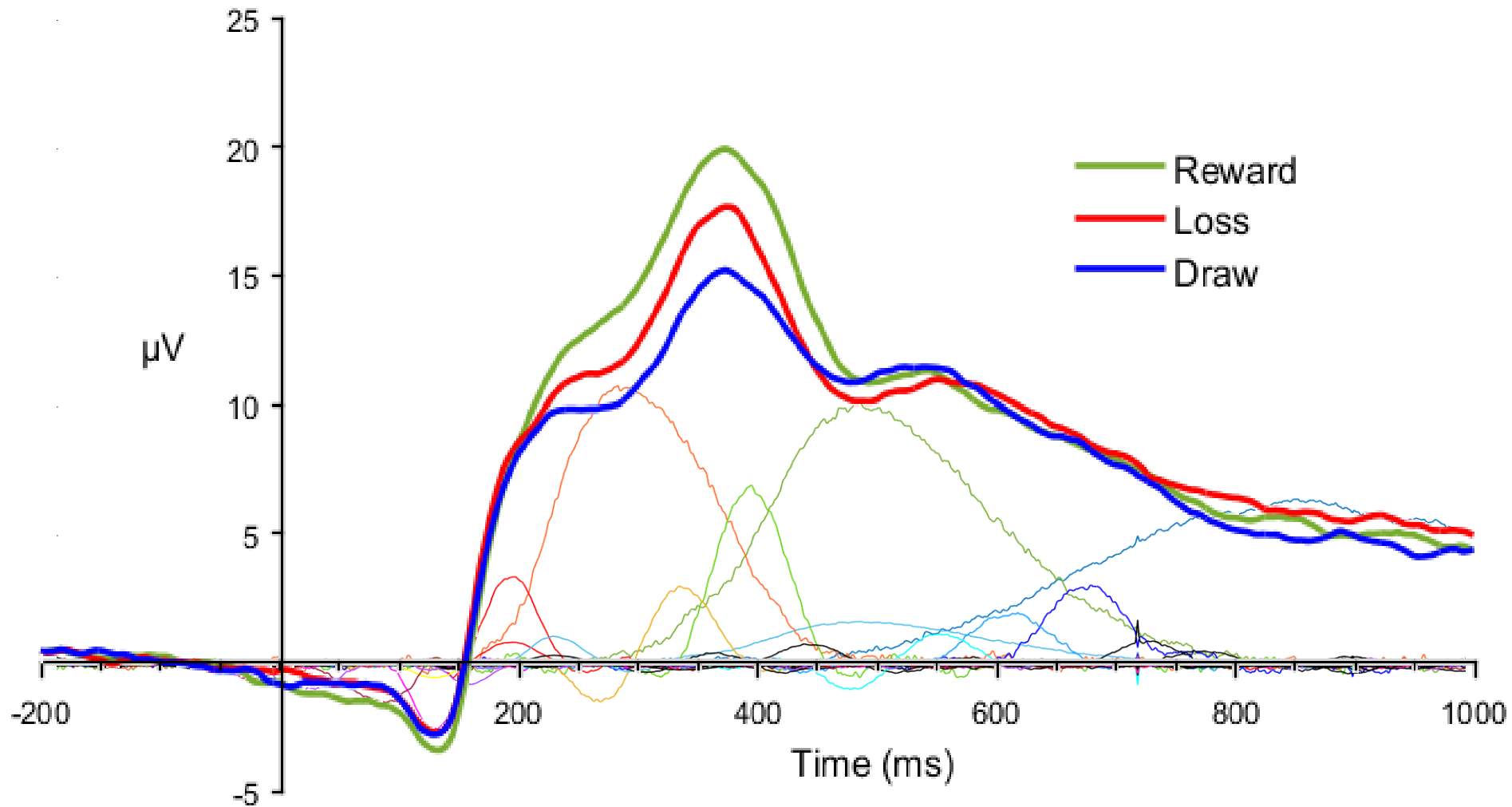
Depression



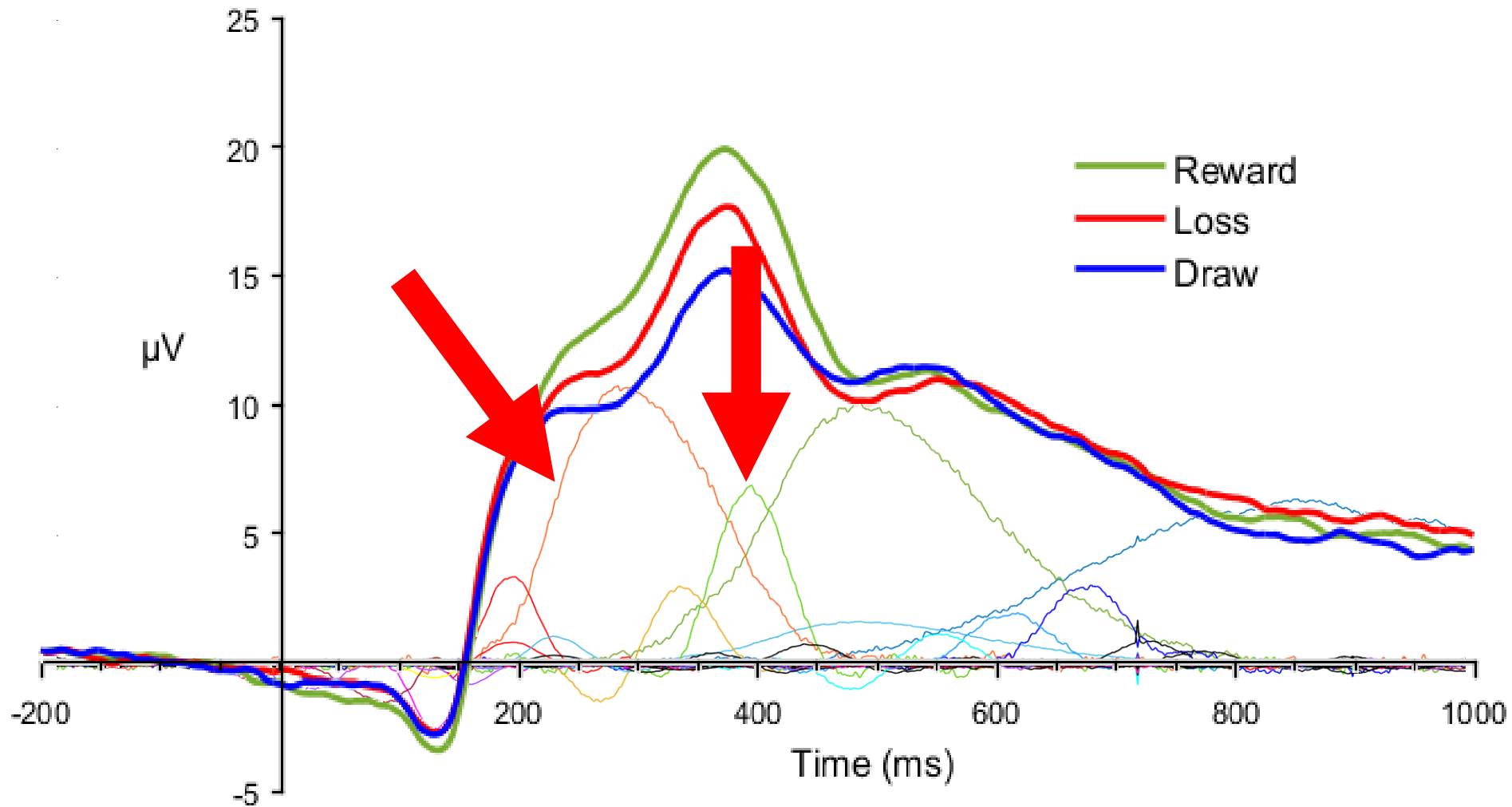
# RewP Results



# RewP Results

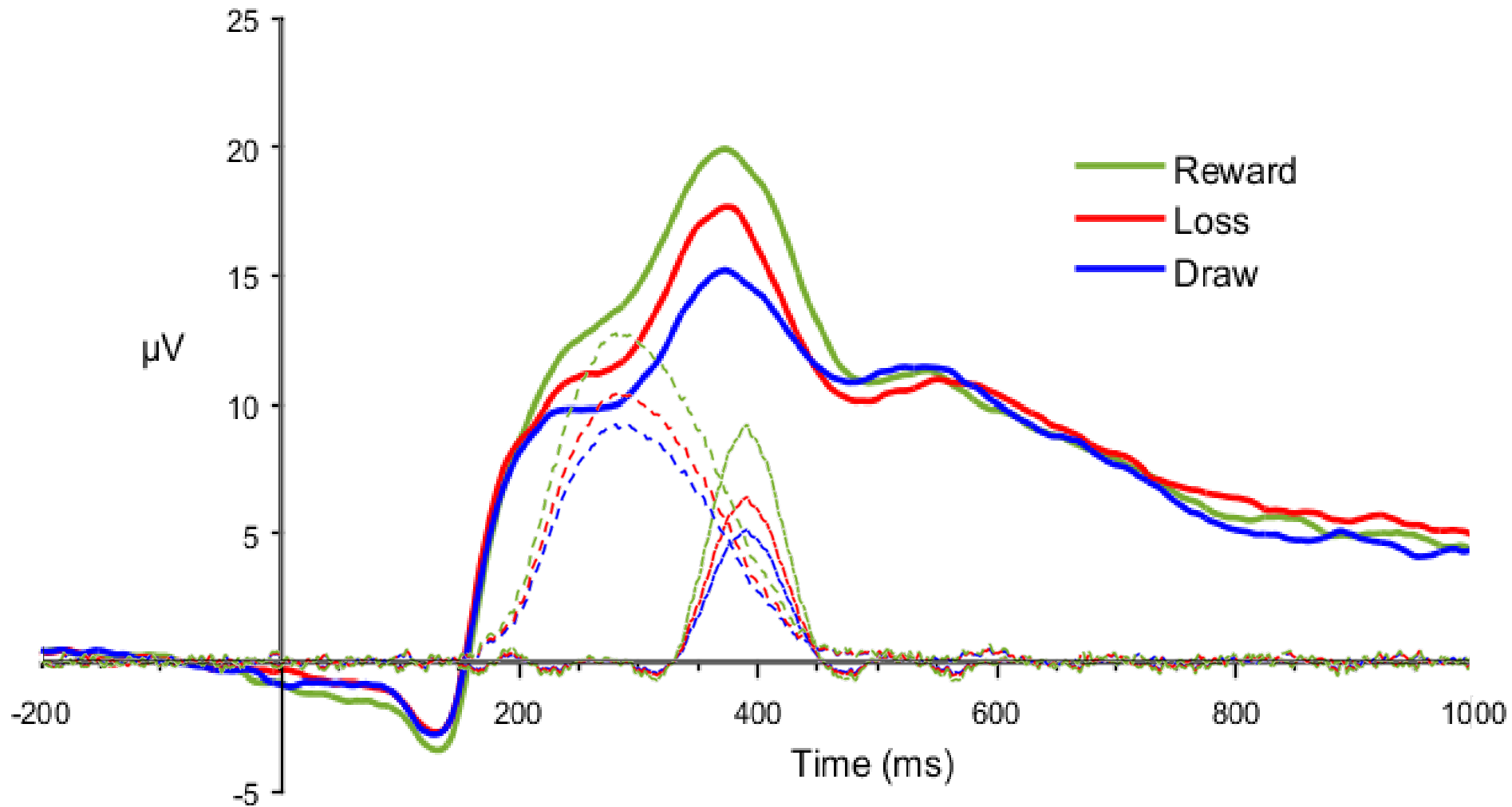


# RewP Results





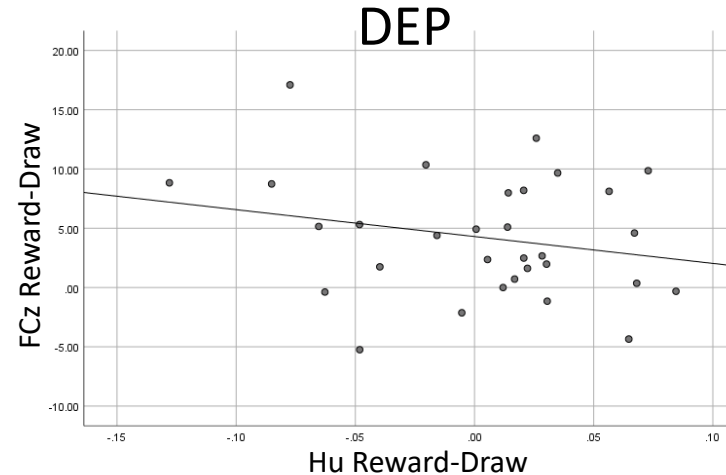
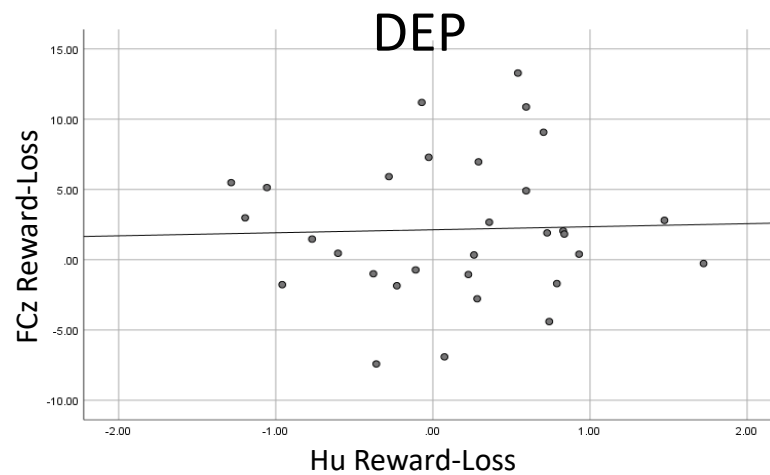
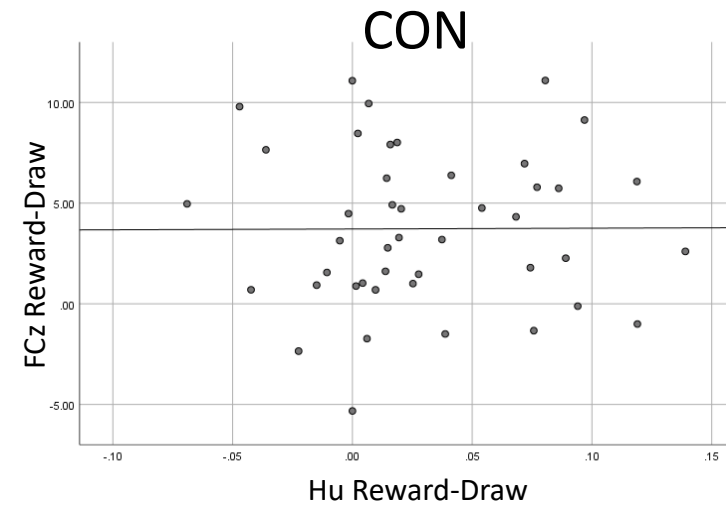
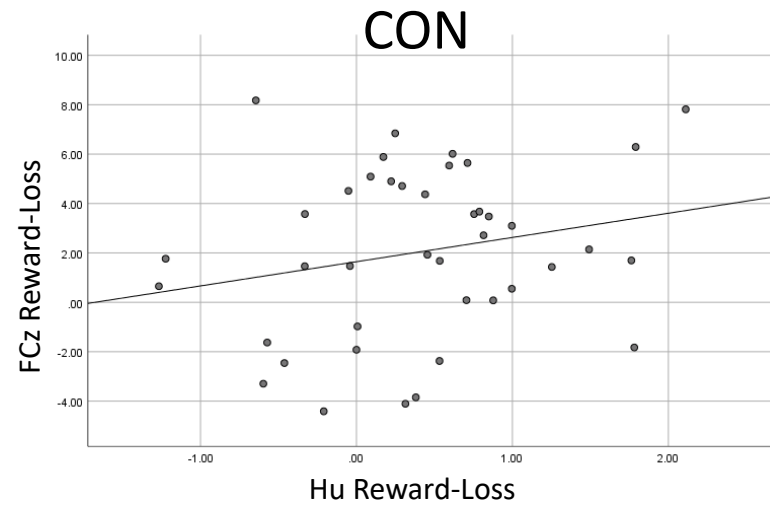
# RewP Results



# Reward Memory



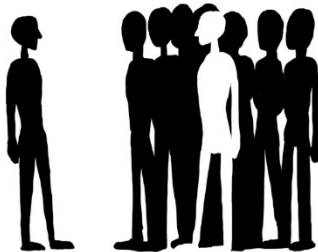
# RewP and Reward Memory



# What have we learned?



- SA → more “oops” signal – even when correct
- SA → more attention to heart beats
- SA → more early attention to disgust faces
- SA → echoes of disgust bias in working memory
- Not looking at faces increases link between perceiving rejection and anxiety
- Depression → memory bias for reward is lacking



# Thank you!!!

