Emotion regulation

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PSYC 888– Affective (Cognitive) Neuroscience
Spring 2023

Don’t forget to record!

Overview

- What is emotion regulation? Gross perspective
- Perception change: Attentional control, distraction
- Interpretation change: Reappraisal, distancing
- Response change: Suppression, extinction

Review of General Psychology
1998, Vol. 2, No. 3, 271–299

1089-2680/98/$3.00

The Emerging Field of Emotion Regulation: An Integrative Review

James J. Gross
Stanford University

The emerging field of emotion regulation studies how individuals influence which emotions they have, when they have them, and how they experience and express them. This review takes an evolutionary perspective and characterizes emotion in terms of response tendencies. Emotion regulation is defined and distinguished from coping, mood regulation, defense, and affect regulation. In the increasingly specialized discipline of psychology, the field of emotion regulation cuts across traditional boundaries and provides common ground. According to a process model of emotion regulation, emotion may be regulated at five points in the emotion generative process: (a) selection of the situation, (b) modification of the situation, (c) deployment of attention, (d) change of cognitions, and (e) modulation of responses. The field of emotion regulation promises new insights into age-old questions about how people manage their emotions.

2020

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And >60 others since 2020 …

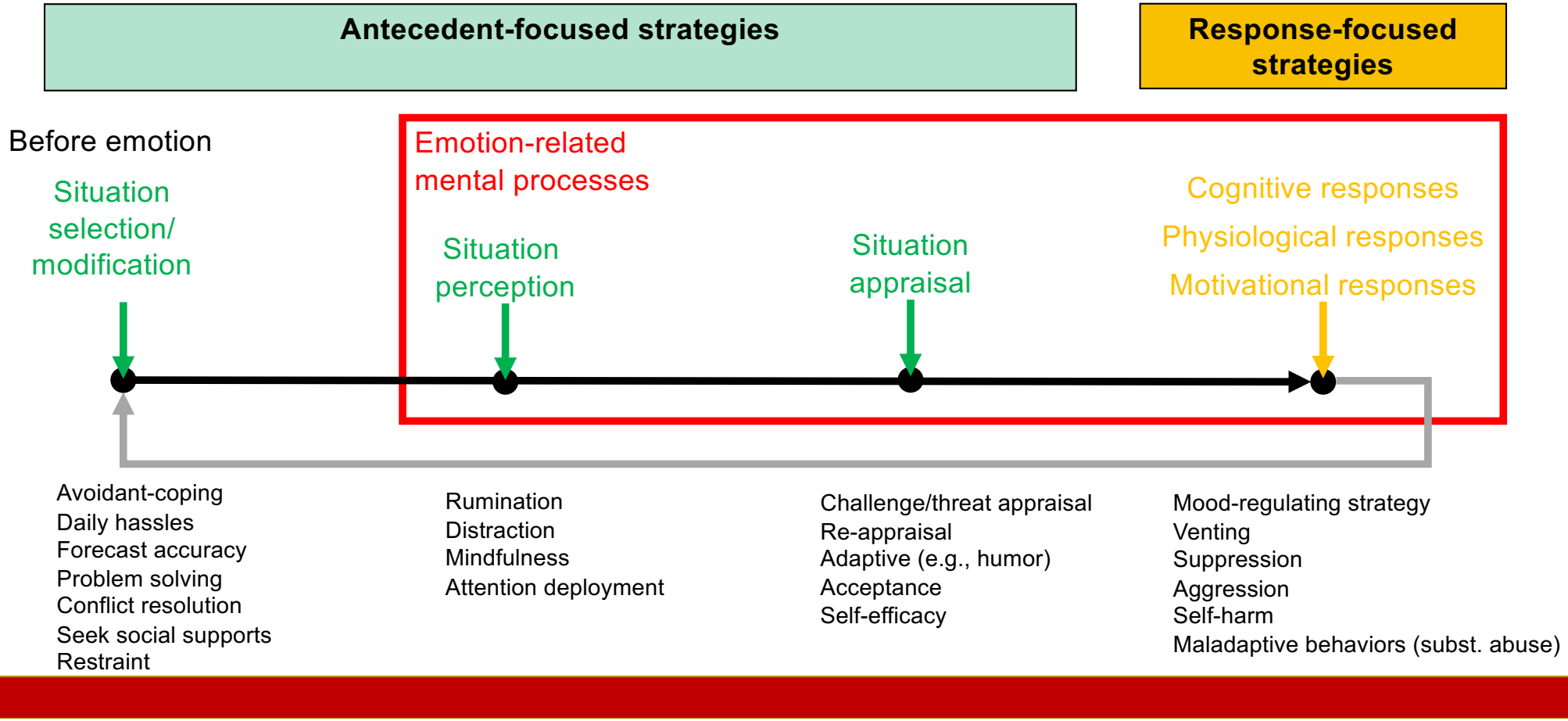
https://sites.tufts.edu/emotiononthebrain/tag/emotion-regulation/

Emotion regulation – 2-minute brainstorm

Context?

Strategies?

Emotion regulation - Gross perspective

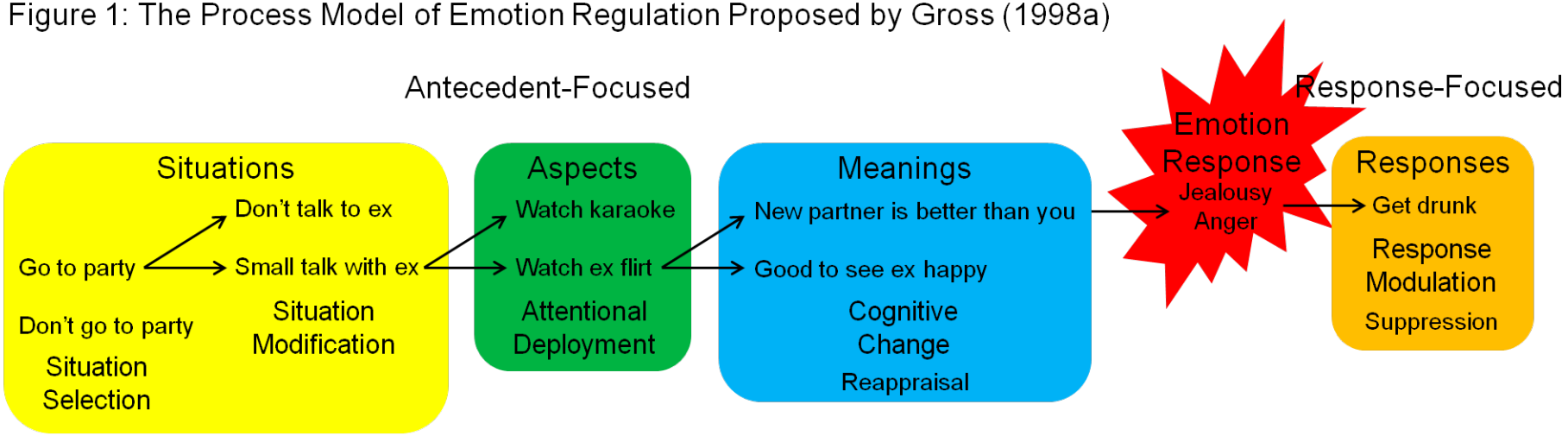


Emotion regulation - Gross perspective

Antecedent-focused strategies

Response-focused strategies

Figure 1: The Process Model of Emotion Regulation Proposed by Gross (1998a)



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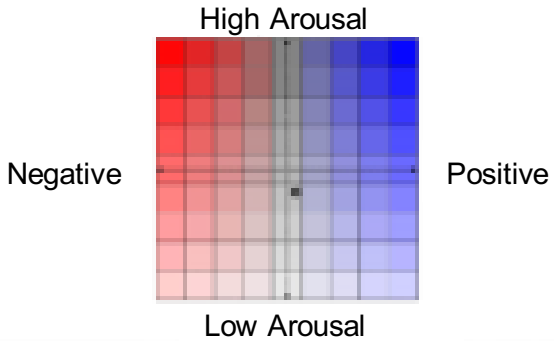
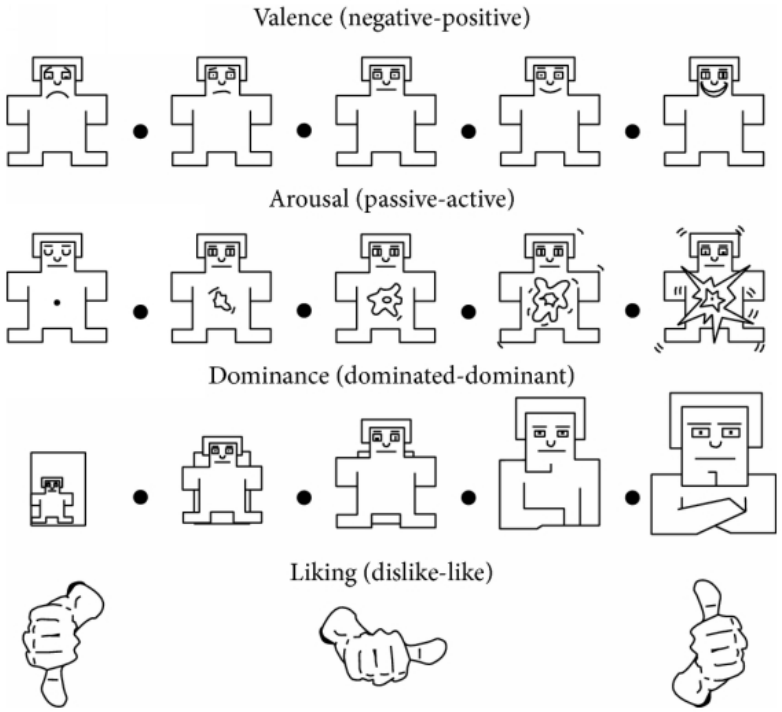
Important notes

1. **”Emotions” are distinct from “emotion regulation”**
   - “Cognitive regulation of emotion” rather than “*emotion regulation of thoughts/actions/cognition*”
2. **Do we need to separate emotion/mood/affect when identifying mechanisms of regulation?**
   - Difficult challenge, currently unclear
   - Focusing on emotion may be broad enough
3. **Considerations for temporal dynamics, interactions between strategies, and iterative/additive processes**
4. **Limitations on experimentally testing antecedent strategies**

Empirical AffNeuro limitations

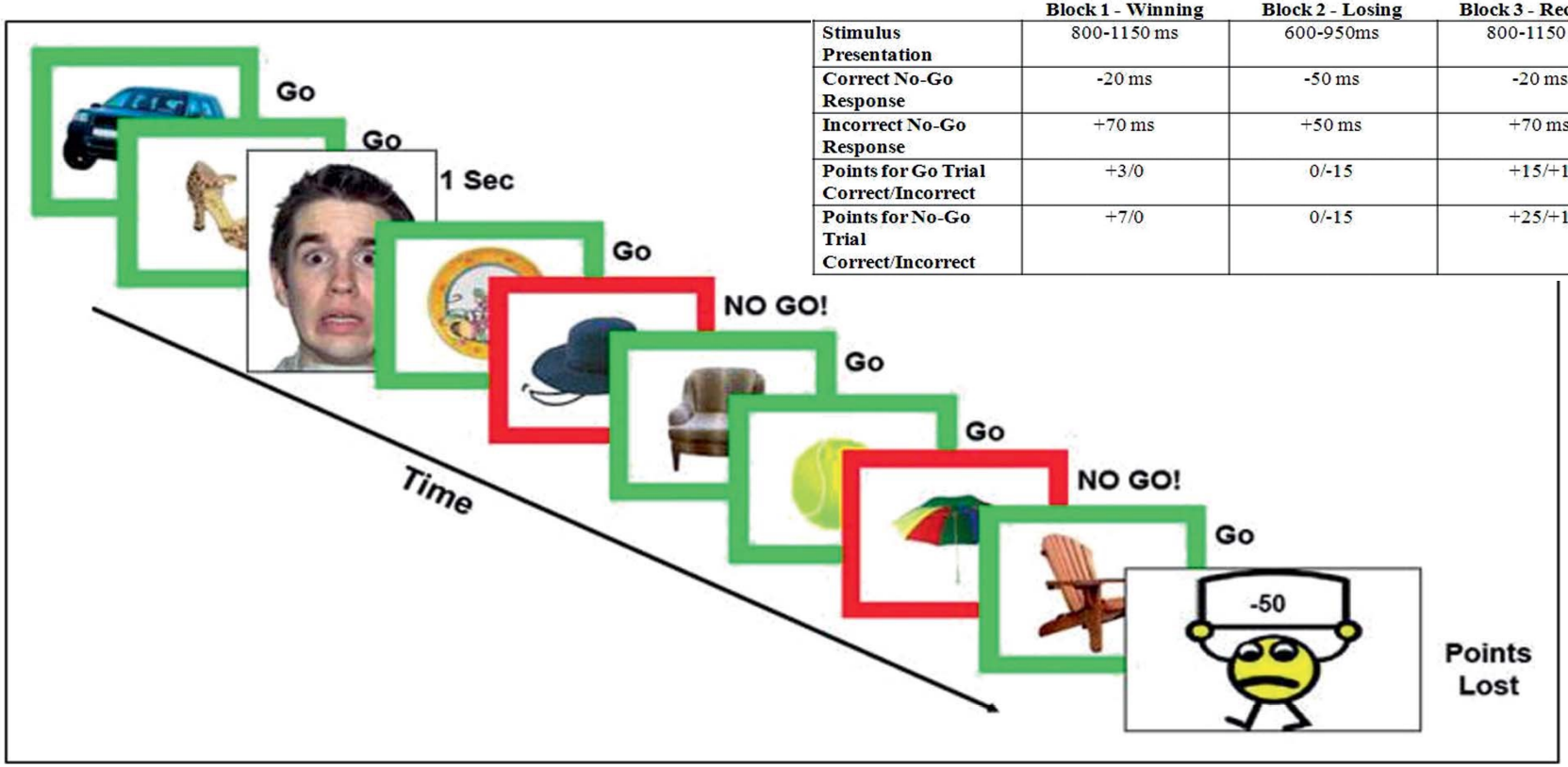
- Limitations on experimentally testing antecedent strategies
- How do we *know* there was "successful" regulation?
  - Subjective awareness
  - Physiological responses can map onto brain responses





Self-Assessment Manikin (SAM)
Margaret Bradley & Peter Lang 1994

Empirical AffNeuro limitations



	Block 1 - Winning	Block 2 - Losing	Block 3 - Recovery
Stimulus Presentation	800-1150 ms	600-950ms	800-1150 ms
Correct No-Go Response	-20 ms	-50 ms	-20 ms
Incorrect No-Go Response	+70 ms	+50 ms	+70 ms
Points for Go Trial Correct/Incorrect	+3/0	0/-15	+15/+1
Points for No-Go Trial Correct/Incorrect	+7/0	0/-15	+25/+1

Perlman & Pelphrey, 2010; Hudac, Friedman, et al., in prep

Emotion regulation study

- **Problem**: Racial disparities related to pediatric concussion:
  - Diagnosis of concussion and mTBI
  - Parent knowledge of symptoms/signs
  - Disparities in baseline performance (neurocognitive, oculomotor)
- **Goal**: Evaluate change in brain correlates from (T1) pre-season & pre-contact to (2) post-season
- **Study:** Invited ~50 football athletes -- majority of participants w/ coarse/curly hair
  - Pre-season *N*=23
  - Post-season *N*=17

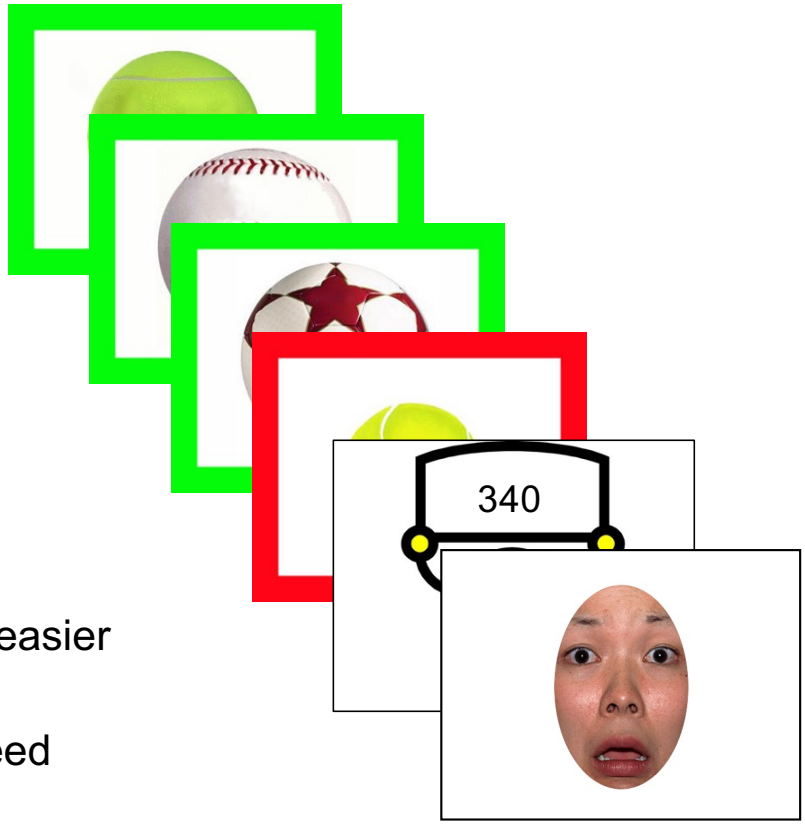
Dr. Jessica Wallace

Wallace et al., 2021; Wallace et al. 2020a; 2020b

EEG testing at local high school

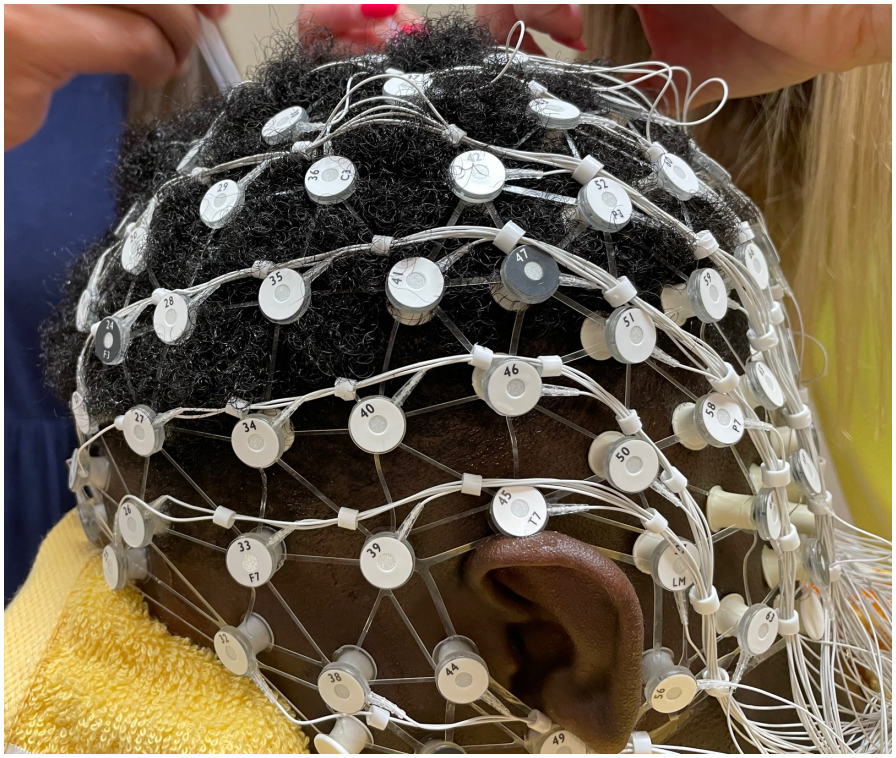
Completed two EEG tasks:

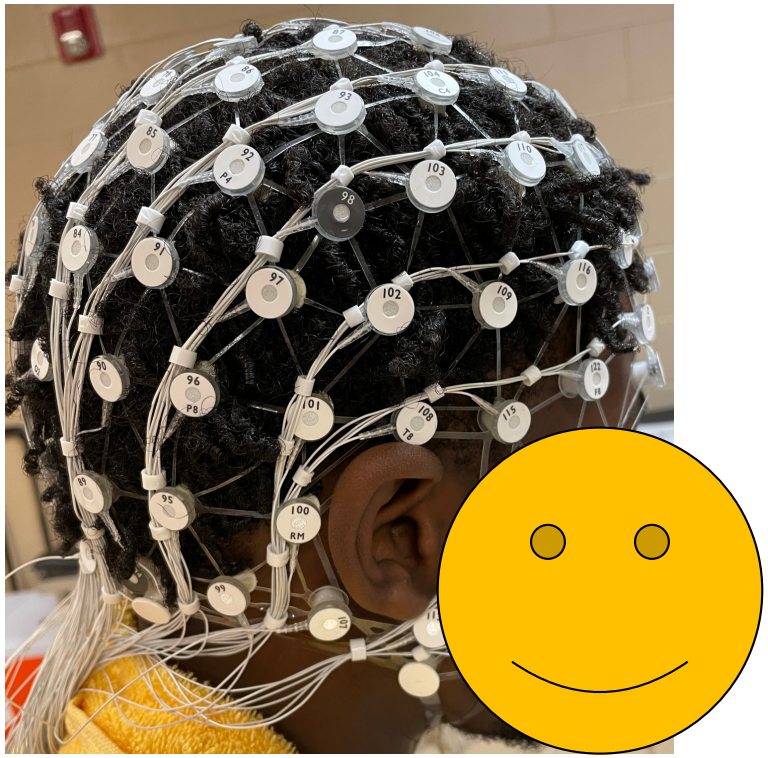
1. 2-back working memory task
2. **Affective emotion regulation task**
   - Inhibition
   - Fear perception
   - Frustration induction:
     - **Baseline** – gain points, moderate speed
     - **Frustration** – cannot gain points, fast speed, easier to lose points
     - **Recovery** -- cannot lose points, moderate speed



WM: Hudac et al., 2019; ER: Perlman & Pelphrey, 2011

EEG Net application





EEG Net application

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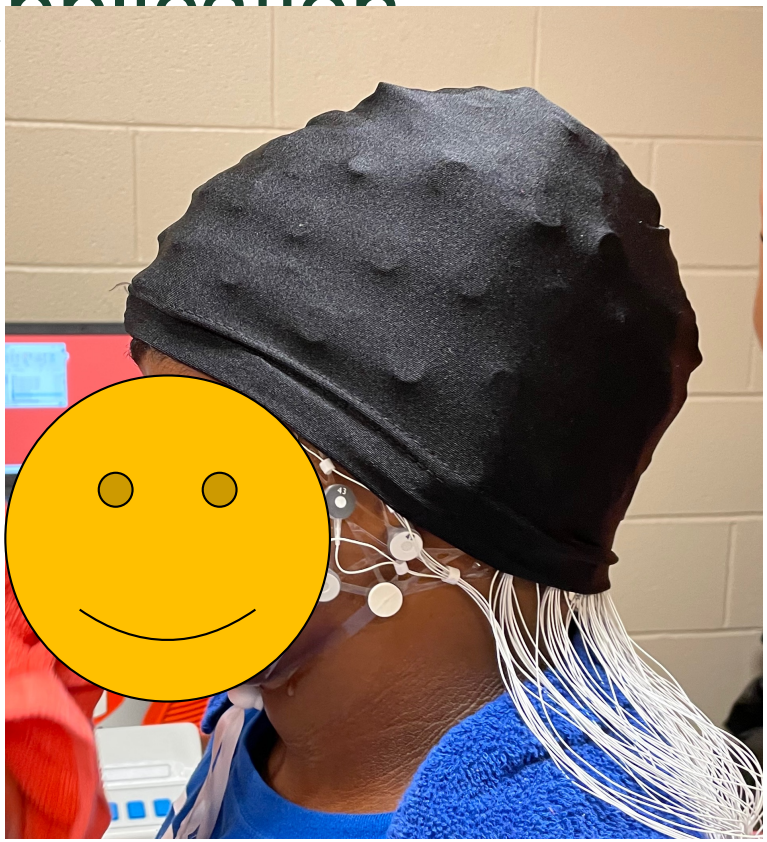

EEG Net application

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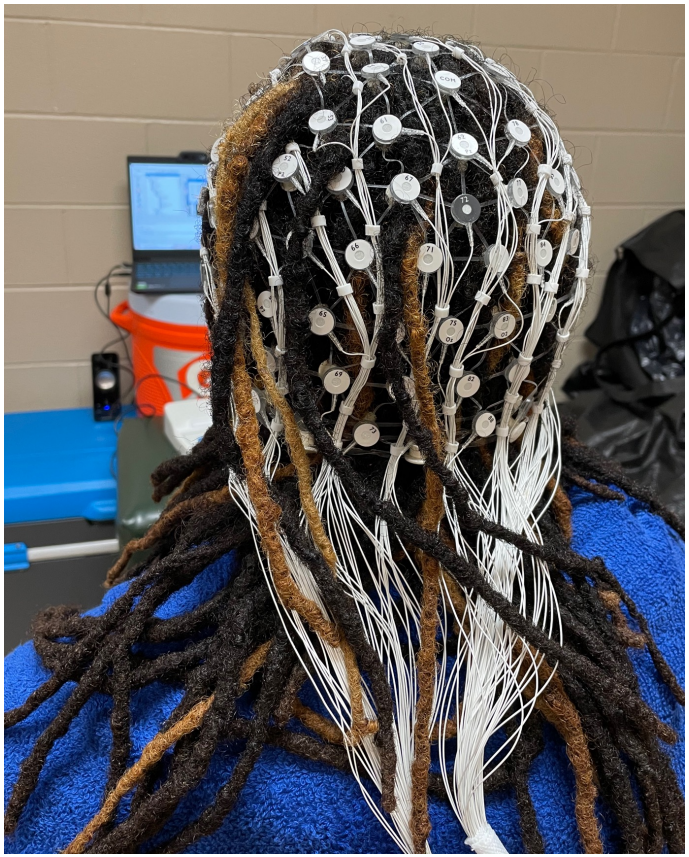

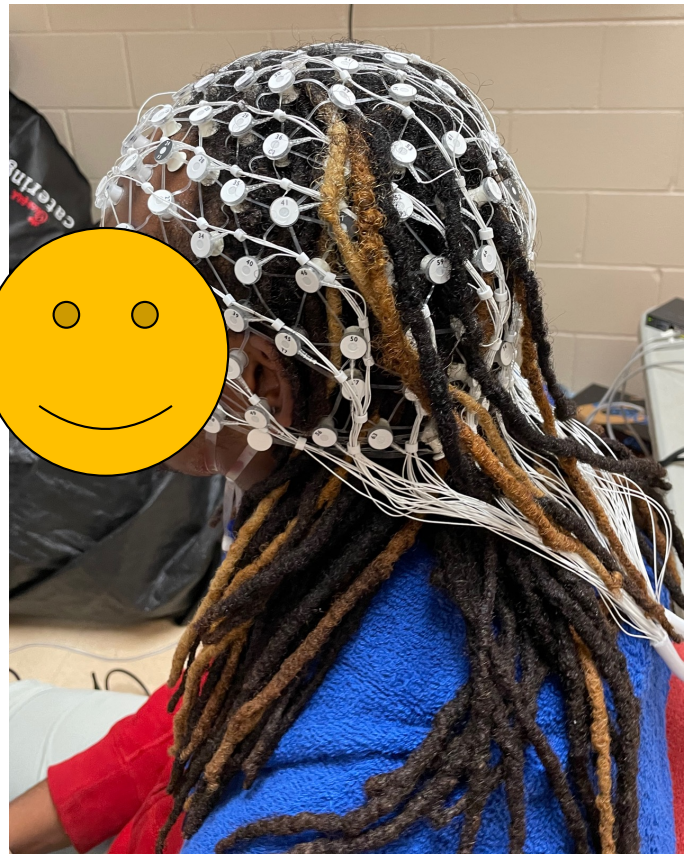

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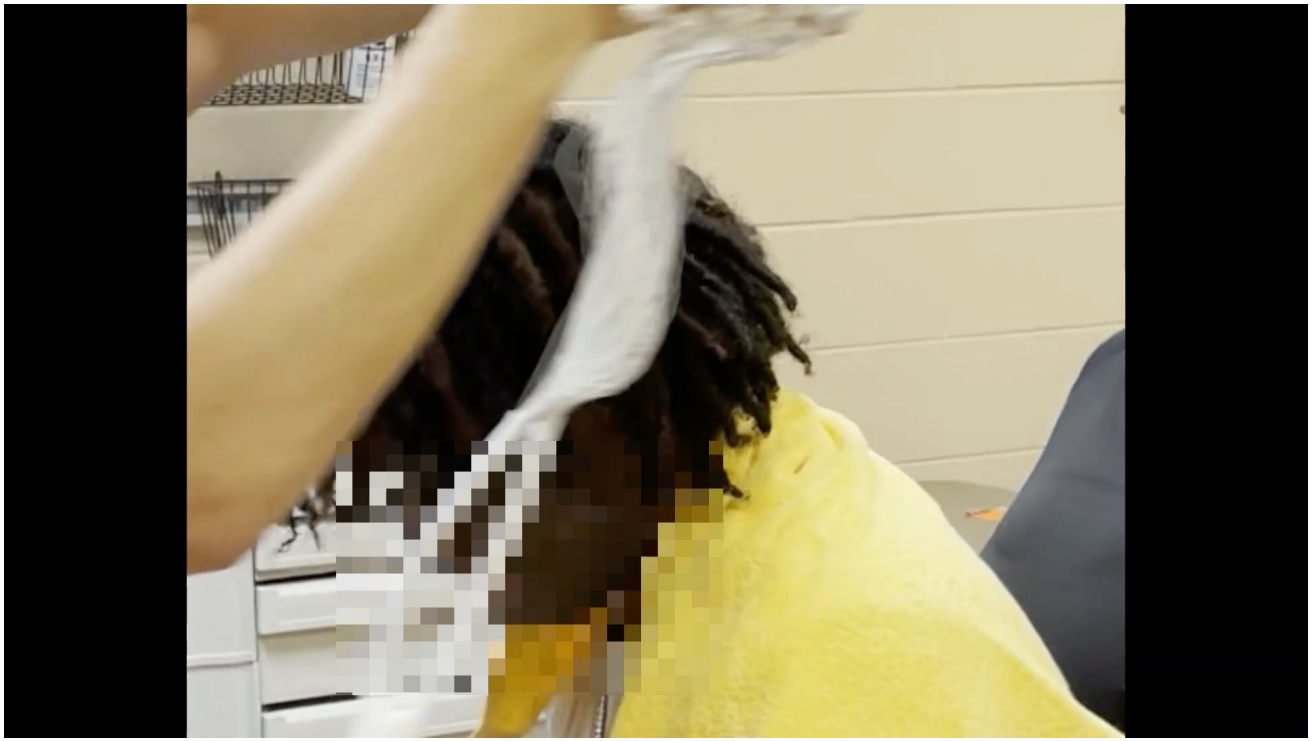


Results: Great signal!
Effective frustration manipulation

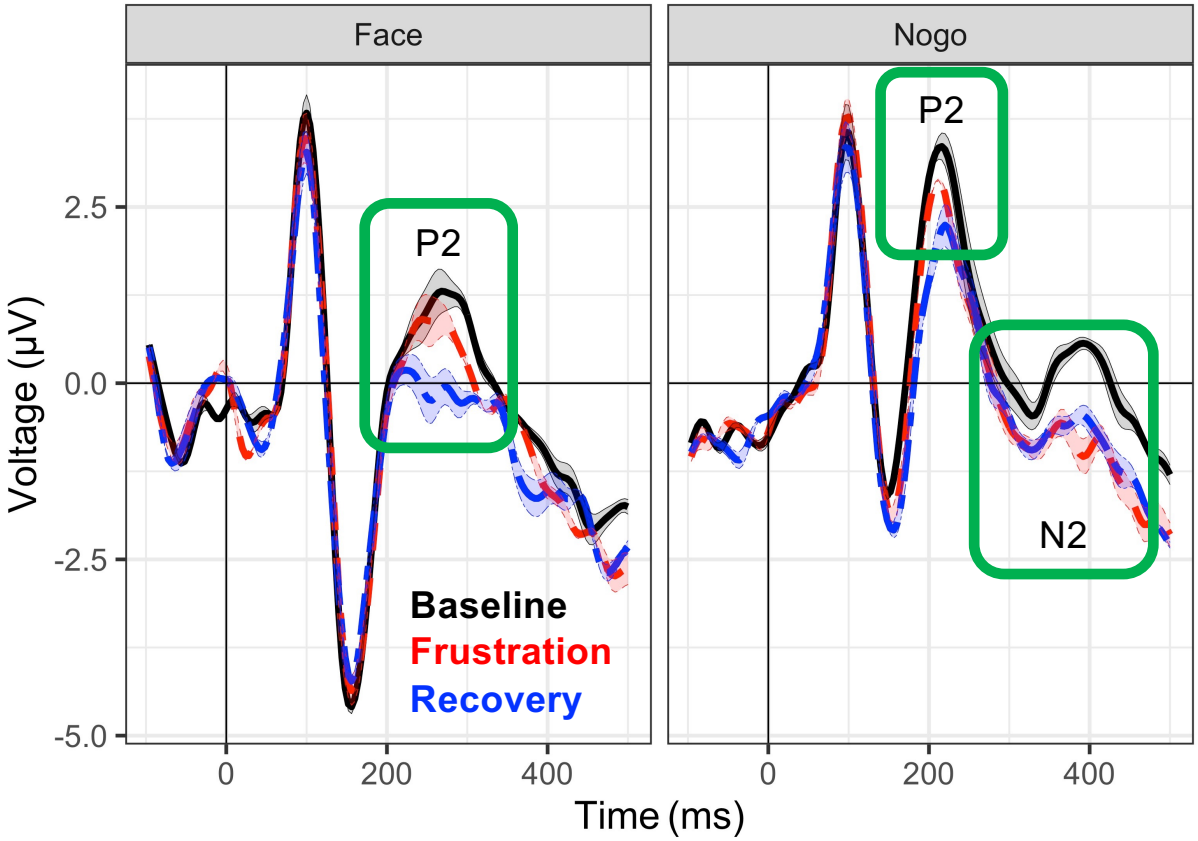
P2 during fear perception

- **After frustration induction**
  - Amplitude decreases
  - Latency increases
- **Habituation of amplitude**
  - B1 Baseline = decreasing
  - B2 Frustration = increasing
  - B3 Recovery = stabilized

P2 and N2 during inhibition

- **After frustration induction**
  - Amplitudes decrease
  - Latency decreases
- **Habituation of amplitude**
  - B1 Baseline = decreasing
  - B2 Frustration = increasing
  - B3 Recovery = stabilized

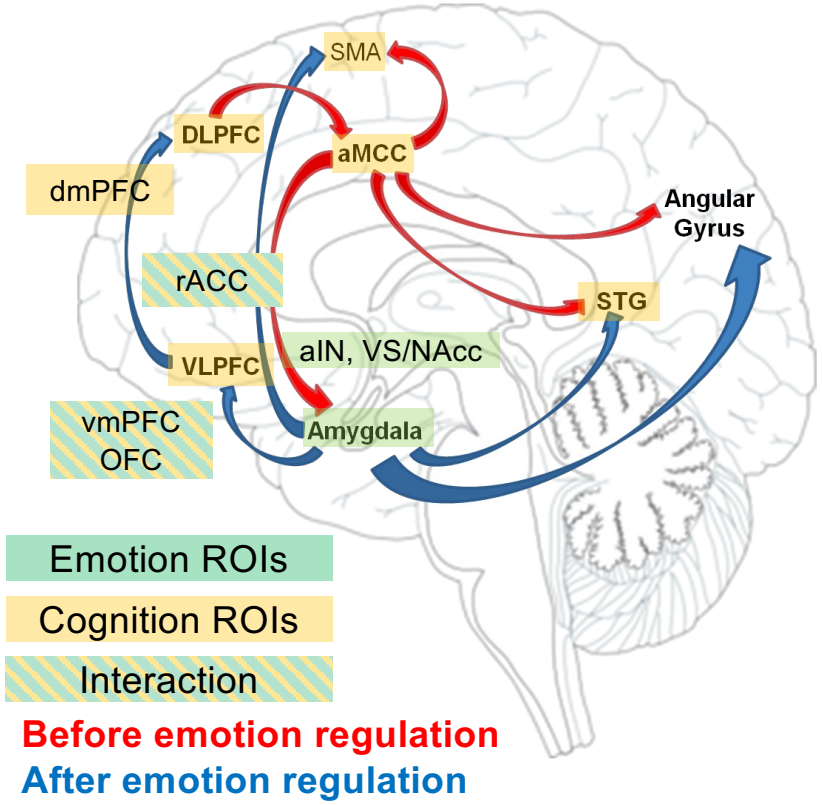
Hudac, Friedman, & Wallace, *in prep*



Central brain regions

- Sensing emotion and *maintaining* negative affect
  - AMY, anterior insula, ventral striatum, nucleus accumbens
- Reappraisal and cognitive strategies
  - Dorsomedial PFC, dorsolateral PFC, ventrolateral PFC, anterior ACC, superior temporal gyrus, supplementary motor area
- Bi-directional emotion-cognition interactions
  - Rostral ACC, ventromedial PFC, OFC

Figure 2: Neural Network of Emotion Regulation Proposed by Kohn et al., 2014



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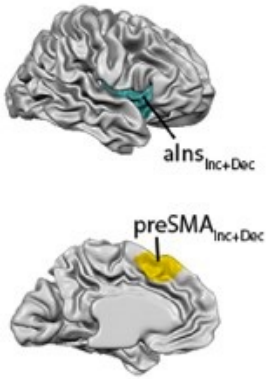
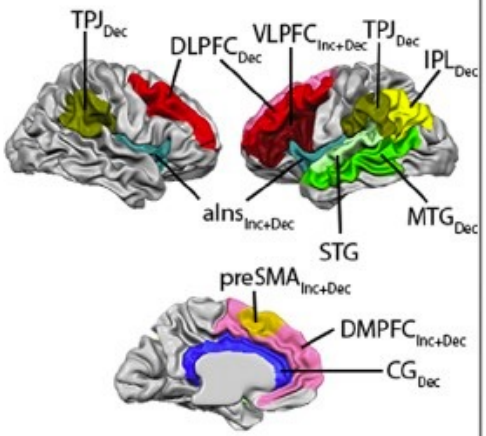
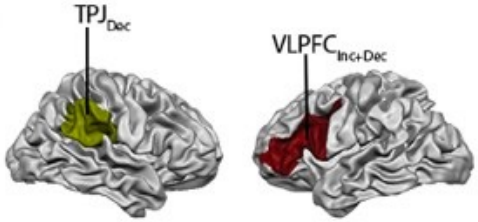
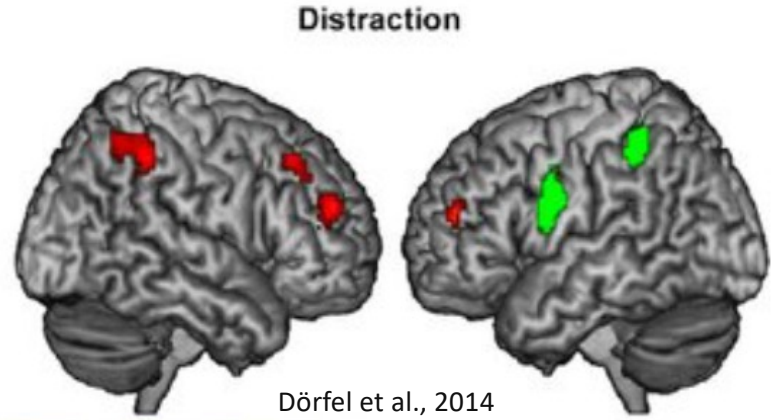
Process	**Attention**	**Knowledge/ Appraisal**	**Body/ Response**
Strategy	Distraction (active/ passive) Distraction (positive/ neutral) Concentration (feelings/ causes and implications)	Reinterpretation/ reappraisal (emotional stimulus/ emotional response) Distancing / perspective taking	Suppress the expression of emotion Suppress the experience of emotion Suppress thoughts of emotion-eliciting event Suppress the expression and experience of emotion
Cognitive Functions	Selective attention Interoception Working memory	Selective attention Memory (working memory, episodic memory) Social cognition (theory of mind, empathy) Language (semantic memory, inner speech) Response selection/inhibition	Selective attention Reorienting Embodiment Response inhibition
Neural Networks			

https://itsnlp.com/neuroscience-emotional-regulation/

(1) Perception change: Attentional control, distraction

- Alter *HOW* we see it, smell it, feel it
  - Down-regulate: Look away from unpleasant
  - Up-regulate: Look towards pleasant
  - Attend to different part of stimulus
- Role for top-down regulation (e.g., AMY)→ i.e., last week conversations



Dörfel et al., 2014

Increased activation:
Right SMA, dlPFC

ONLY FOR DISTRACTION:
Left IPC
Left postcentral/precentral

(1) Perception change: Attentional control, distraction

Possible Methods

- "Pay attention to non-emotional features"
  - ACC, dlPFC→ AMY
- Increase cognitive load otherwise (e.g., add additional tasks)
  - Engage dlPFC, vlPFC, ACC, IPC & down-regulate amPFC, AMY
- "Suppress thoughts/feelings"
  - May be less effective, but some evidence of DLPFC

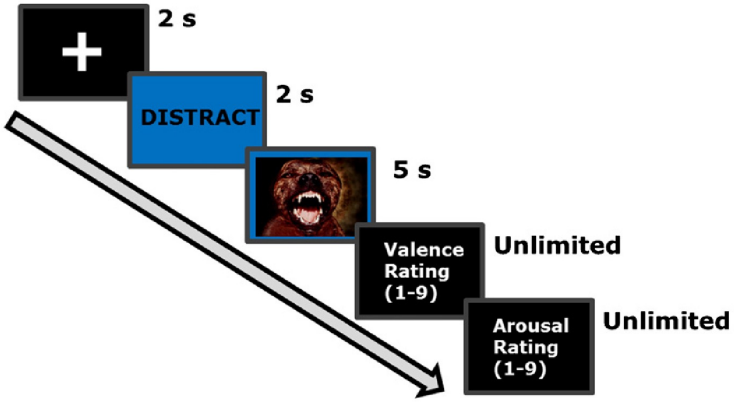
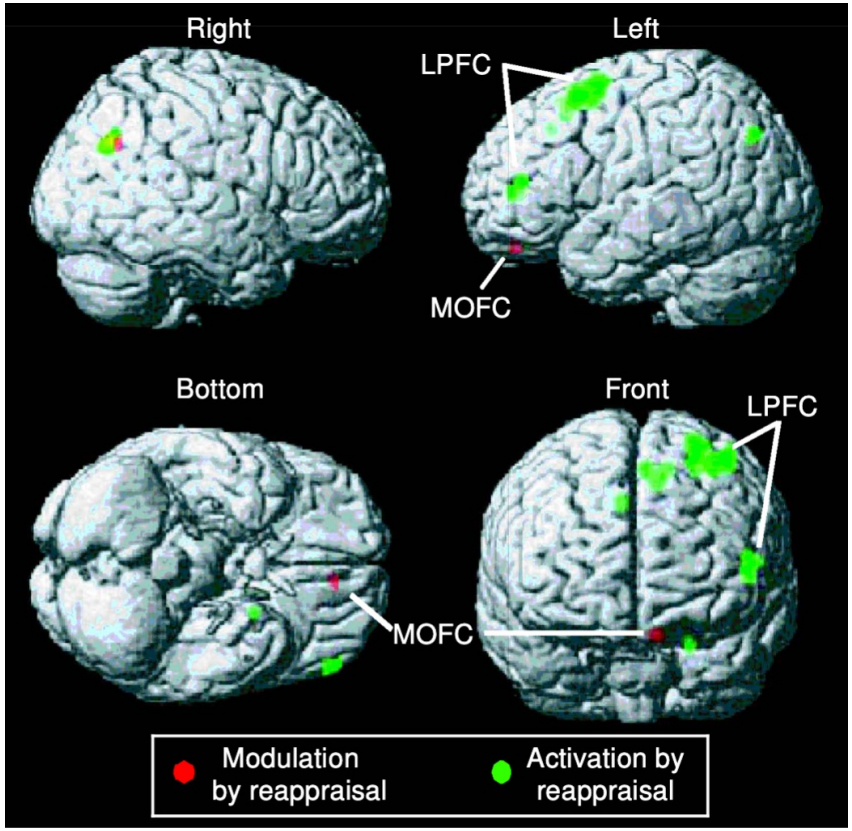


Fig. 1. Trial structure for the regulation task (an example of a DISTRACT trial).

Explicit processing of emotional features → Increased AMY
Implicit processing (i.e., less focus on emo features) → Decreased AMY

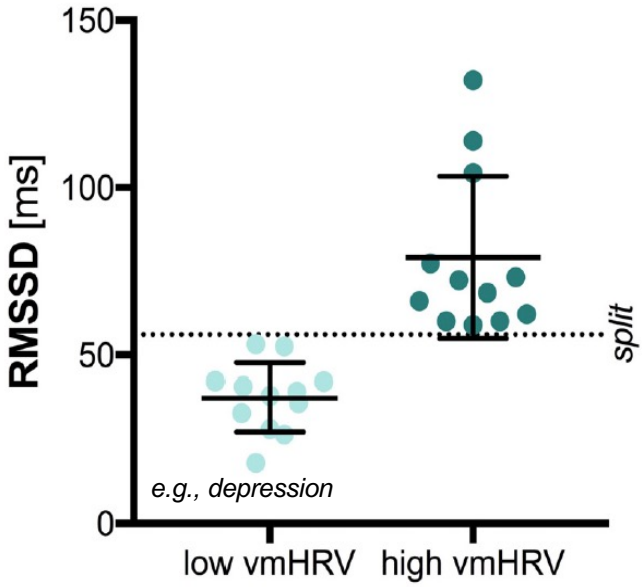
(2) Interpretation change: Reappraisal, distancing

- **Volitional, effortful, conscious process to reframe emotional content of an emotionally evocative situation**
- Often negative → positive
  - "Imagine those are tears of joy"
- Ochsner 2002: Increase/decrease trials vs. "maintain"
  - Increased activation in dlPFC, vlPFC, dmPFC (↑emotion reappraisal)
  - Decreased AMY, OFC (↓emotion appraisal/generation)



(2) Interpretation change: Reappraisal, distancing

Split-half comparisons based upon resting vagally-mediated HRV



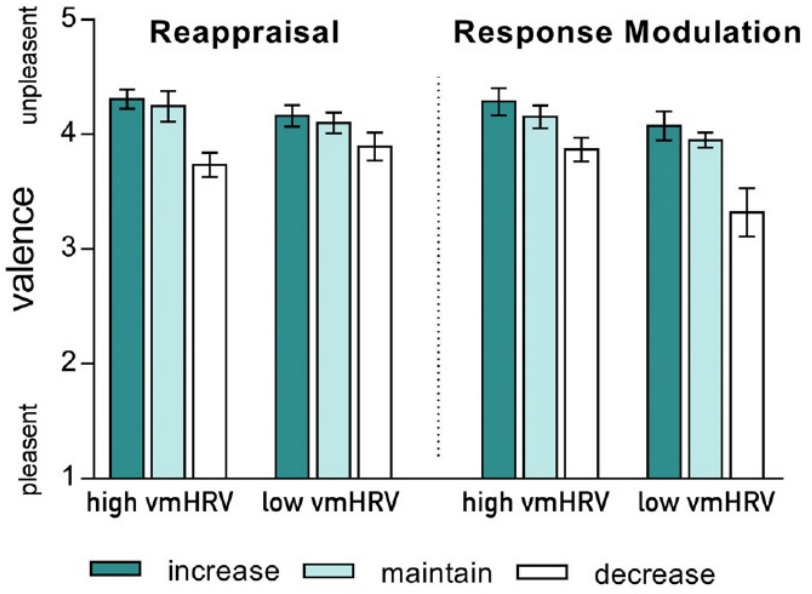


FIGURE 2 | Valence ratings of the current emotional state after regulating emotions evoked by unpleasant pictures using either reappraisal (left) or response modulation (right) in participants with high and low resting state vagally mediated heart rate variability (vmHRV). Bars represent group means with standard errors.

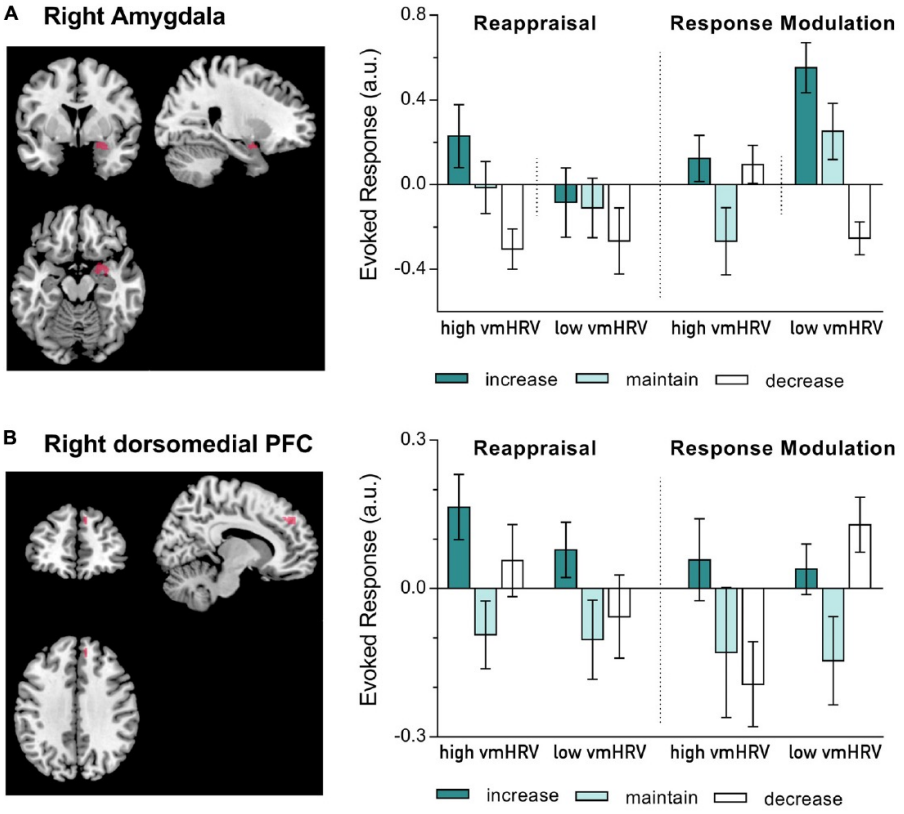
Steinfurth et al., 2018

(2) Interpretation change: Reappraisal, distancing

Reappraisal strategies (Increase, maintain, decrease) x **Valence** (pleasant, unpleasant)

AMY and dlPFC influenced by resting vmHFV levels as a function of the used strategy:

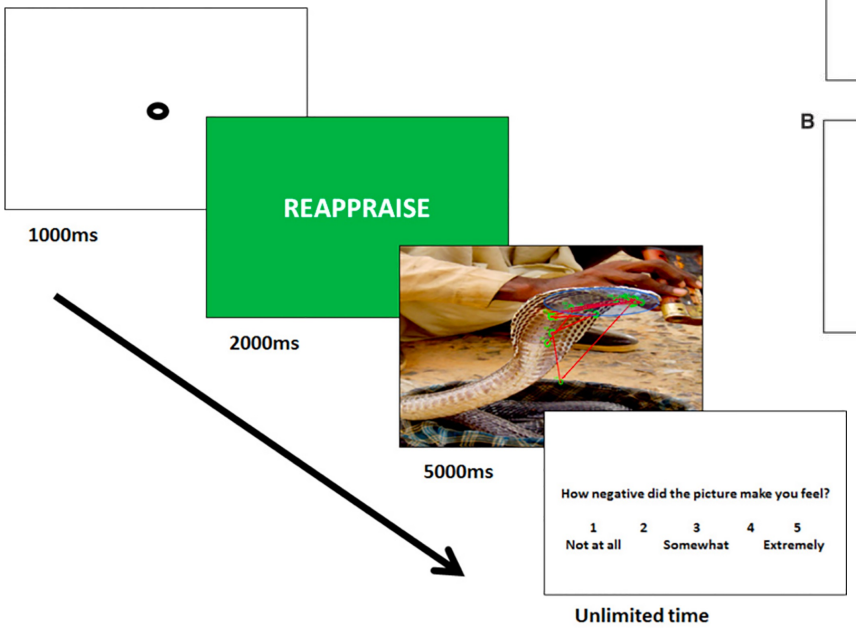
- Low vmHRV→ only unpleasant pictures
- Appraisal:

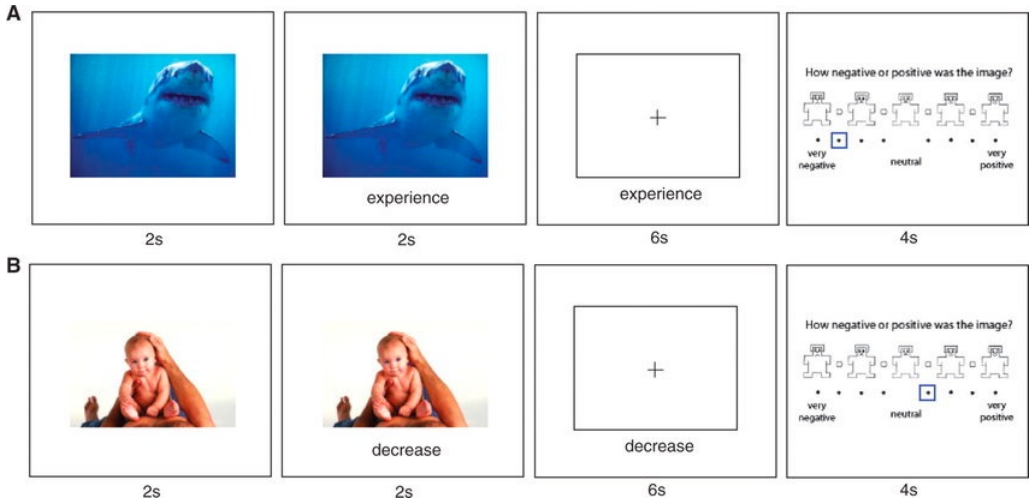


Steinfurth et al., 2018

(2) Interpretation change: Reappraisal, distancing

Possible methods



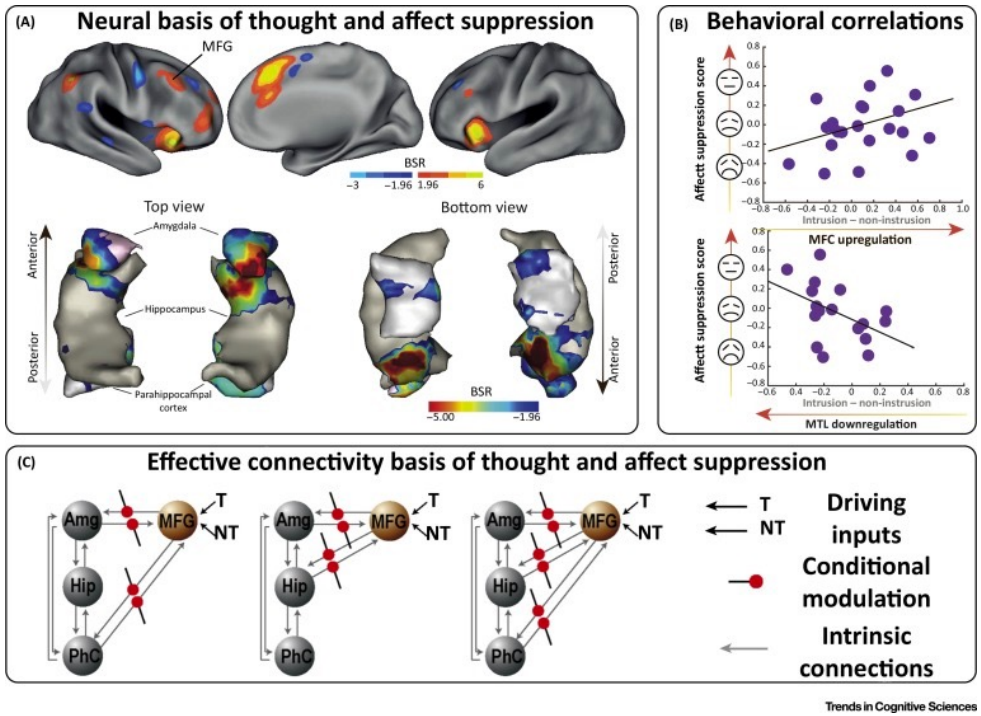


IAPS

DECREASE

(3) Response change: Suppression, extinction

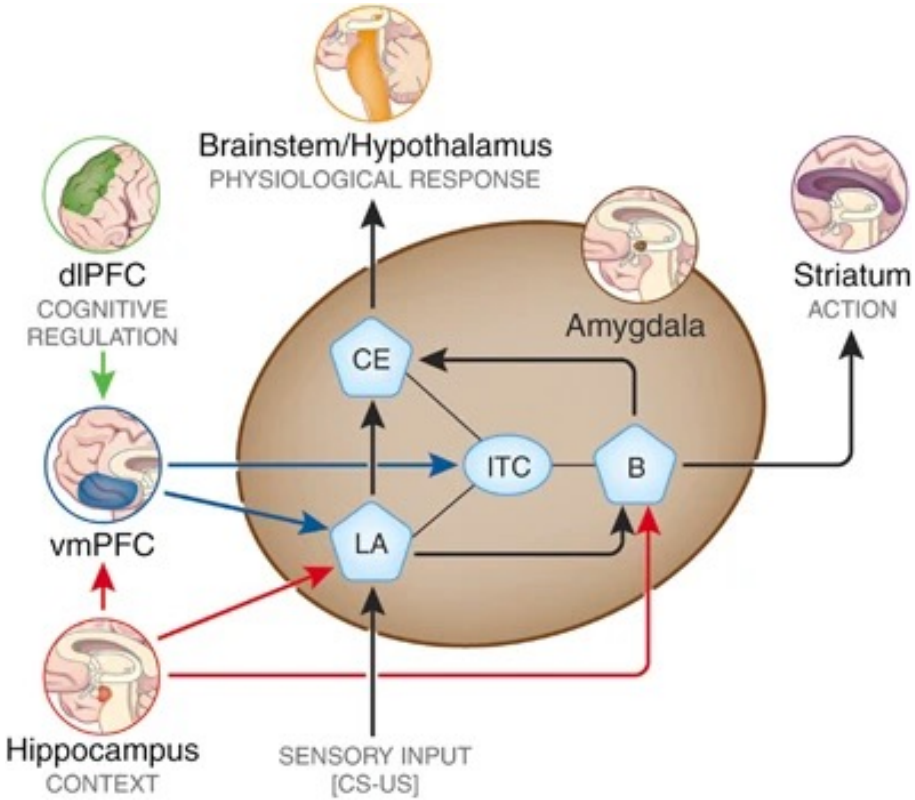
- **Suppression**: Direct attempts to influence cognitive, physiological, or behavioral manifestation of emotional responses
  - Increases bilateral OFC, r/vACC, SPG, dlPFC
  - Increases skin conductance



Egen & Anderson, 2018

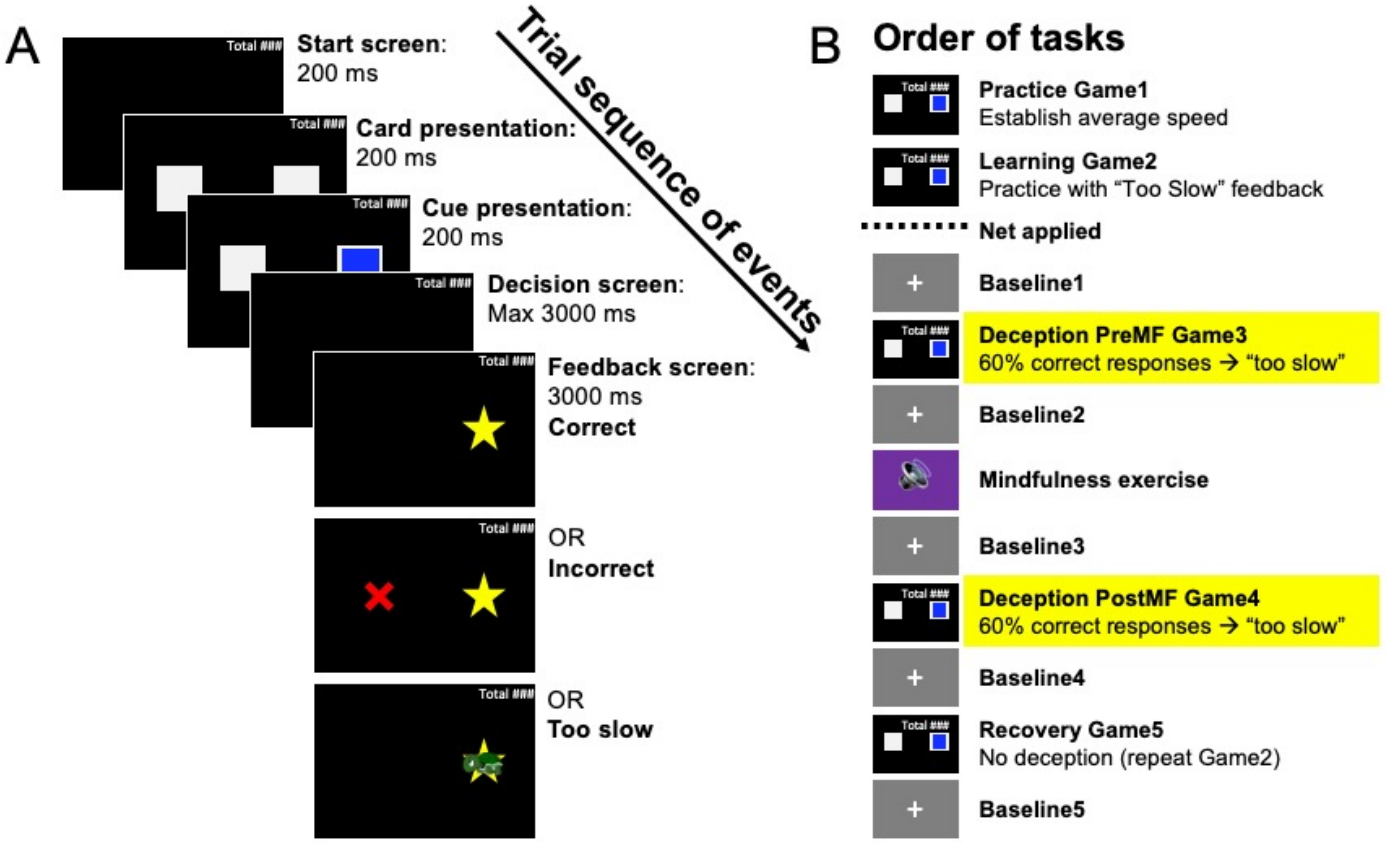
(3) Response change: Suppression, extinction

- **Extinction**: Suppression of responses that have been acquired through stimulus-reinforced/ conditions associations
  - Involves active learning, inhibition – fits less into the Gross model of ER
  - More automatic, less effortful
  - Examples from anxiety treatment (fear extinction)
  - Potentially degrades over time



Hartley & Phelps, 2010

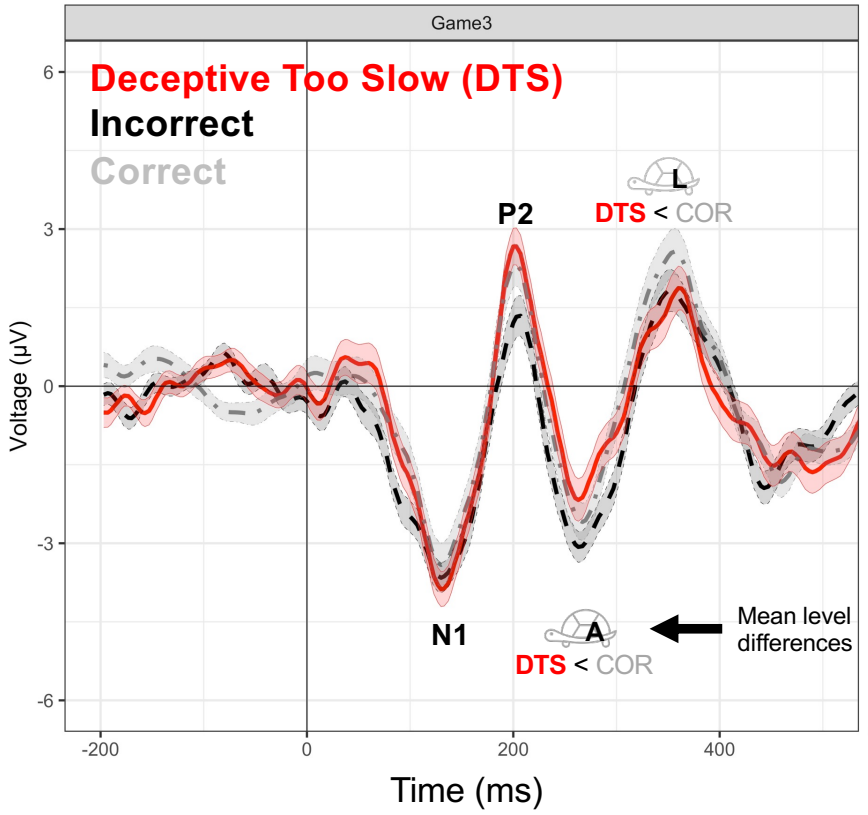
Affective Posner task



Riek et al., under review; Hudac et al in prep

Affective Posner task

Before Mindfulness DTS dynamics	Amplitude	Latency
N1 Detection	Heightening	Heightening
P2 Encoding	ns	Heightening Heightening
N2 Cognitive control	**Lessening**	ns
P3 Evaluation	ns	ns



Riek et al., under review; Hudac et al in prep

Affective Posner task

Mindfulness exercise:
2-minute guided (audio)
awareness of breathing

Before Mindfulness DTS dynamics	Amplitude	Latency
N1 Detection	Heightening	Heightening
P2 Encoding	ns	Heightening Heightening
N2 Cognitive control	**Lessening**	ns
P3 Evaluation	ns	ns

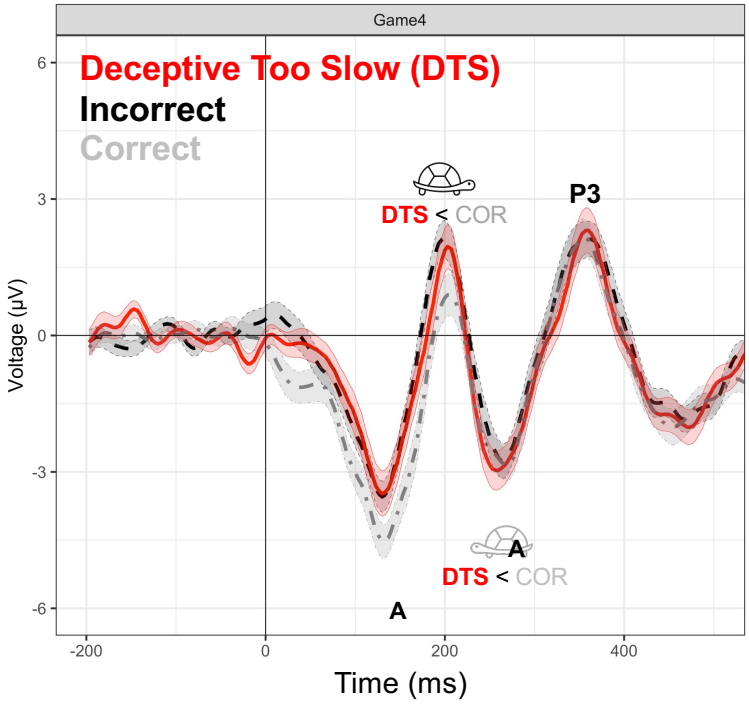
After Mindfulness DTS dynamics	Amplitude	Latency
N1 Detection	**Lessening**	ns
P2 Encoding	ns	ns
N2 Cognitive control	ns	**Lessening**
P3 Evaluation	ns	ns

Riek et al., under review; Hudac et al in prep

Outstanding questions

- Interactions at a chemical level – considerations for drug treatment
- Development of methods?
  - Improve ability to capture dynamic feelings rather than posthoc behavioral rating
  - Opportunity for more multi-methodological assessments?
- Utility of emotion regulation measurements as treatment (e.g., neurofeedback) or treatment markers

Affective Posner task



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