

# Children's sustained attention to emotional facial expressions and their autonomic nervous system reactivity during parent-child interactions

WOODY ET AL., 2019

# Background

- ▶ The Research Domain Criteria (RDoC) five domains of functioning: negative valence systems, positive valence systems, cognitive systems, systems for social processes, and arousal/regulatory systems
- ▶ Processes implicated in processing and reacting to socio-affective information is largely highlighted within RDoC's negative valence systems
  - ▶ Disruption in fronto-limbic circuitry responsible for processing of salient socio-affective stimuli
  - ▶ Disruptions in how individuals attend to socio-affective information and how they react to socio-affective stress in children and adolescents
  - ▶ Disruptions in these brain networks have downstream effects on behavioral and peripheral responding

# Background

## ▶ CNS

- ▶ Method of measuring influence of fronto-limbic networks on sustained attention comes from the late positive potential (LPP) event-related potential (ERP) component
- ▶ LPP is posterior slow wave ERP with amplitudes that are modulated by sustained attention to and processing of an emotional stimulus
- ▶ LPP ERP component used as an index of sustained attention to facial expressions of emotions that ranged in emotional intensity

# Background

- ▶ ANS
  - ▶ Respiratory sinus arrhythmia (RSA) may be particularly sensitive to the influence of fronto-limbic circuitry
  - ▶ RSA is a peripheral measure of parasympathetic regulation of autonomic arousal in social contexts
  - ▶ RSA thought to serve as a marker of the ease with which individuals are able to effectively engage and regulate their physiological responses

# Background

- ▶ Individual differences in whether youth exhibit increases or decreases in RSA in response to challenge or stress
  - ▶ Suggesting that there may be identifiable factors that moderate ANS reactivity, consistent with RDoC framework
- ▶ Sustained attention to socio-affective stimuli and increased RSA reactivity to stress both reflect a hyperreactive response style to salient socio-affective information
- ▶ Socio-affective stimuli and stress responses may be synergistic forces underlying emotion reactivity in both youth and adults

# Aims

- ▶ To examine if children's attention to socio-effective stimuli was associated with their ANS reactivity during parent-child interactions
  - ▶ Hypothesis 1: Children who exhibited increased sustained attention (larger LPP amplitudes) to emotional facial expressions would also be more likely to display greater ANS reactivity (decreased in RSA from baseline) during both positive and negative parent-child discussion
  - ▶ Hypothesis 2: Emotional valence of facial expressions would moderate the link between RSA and LPP indices
- ▶ To examine the intensity of facial expressions as an exploratory moderator of the hypothesized relations

# Methods

- ▶ Participants

- ▶ 37 children (54% Female, 75% Caucasian) ages 7-11 and their parents (89% Female, 97% Caucasian)
- ▶ Recruited from community

- ▶ Measures

- ▶ Morphed faces task
- ▶ EEG
- ▶ Parent-child interaction task
- ▶ ECG

# Methods

- ▶ Morphed faces task (264 trials)
  - ▶ Viewed gray scale faces presenting as afraid, happy, sad, and neutral
  - ▶ Emotional and neutral photos morphed to form a continuum of 10% increments
  - ▶ Participant indicated which emotion was presented
- ▶ EEG
  - ▶ Continuously recorded during morphed faces task
  - ▶ Data recorded from 4 facial electrodes
  - ▶ LPP scored as mean activity from 400-1000ms after stimulus onset at occipital and parietal electrode sites



# Methods

- ▶ Parent-Child Interaction Task
  - ▶ Issues checklist → vacation planning task → issues discussion
- ▶ ECG
  - ▶ ECG and RSP data obtained during each phase of parent-child interaction task
  - ▶ RSA measured at resting and each phase of task

# Findings

- ▶ Higher LPP amplitudes to all emotional facial expressions were related to greater RSA reactivity during positive and negative parent-child discussions but not at rest
  - ▶ Not moderated by the valence of the discussion or the emotional intensity of socio-affective stimuli
  - ▶ Suggests children who exhibit greater sustained attention to emotional faces are also more likely to exhibit heightened ANS reactivity during parent-child interactions
  - ▶ OR reflects a link between ANS reactivity and a biases in interpreting the valence of facial expressions

# Findings

- ▶ Provide preliminary evidence of construct validity for two processes implicated in the RDoC negative valence systems among community youth
- ▶ Support link between sustained attention to emotional stimuli and ANS reactivity heightened within RDoC matrix in a community sample of children
- ▶ Preliminary step in establishing a link between attention biases and ANS reactivity in community youth

# Discussion Questions

- ▶ Negative cognitive bias has been associated with development and maintenance of depression, and it's been associated with inaccurate negative interpretation of stimuli. I'm curious how that might relate to RSA activity during any social interactions, not just interactions between parents and children.
- ▶ Wouldn't we reasonably expect seeing faces of one's own- relative another- race and/or ethnicity influence attentional processing to emotional faces and possibly even RSA reactivity? Would the result of this study replicate in the same way with more diverse samples if the task does not account for race and/or ethnicity?

# Discussion Questions


- ▶ I'm curious as to how the parent-child relationship could come into play here. I did not notice any measures or indications that they took information about the relationship into account and I wonder if that could impact ANS reactivity (measured through respiratory sinus arrhythmia). How could emotional expression within the home play a role here as well?
- ▶ By not mentioning whether psychological disorders served as an exclusion criteria, readers really have no way of knowing if this was addressed or if children with diagnoses were included. How would results differ between groups if children were separated based on relevant disorders?

# Discussion Questions

- ▶ How can the results be generalized to the greater population since the sample was 97% Caucasian? Were any of the children diagnosed with any clinical disorder? Would there be changes if there were more fathers?
- ▶ How they are certain their sample does not include individuals diagnosed with any clinical disorder?

# Discussion Questions

- ▶ How would this study look if extended a little bit further in age to the young adolescent years of 11-17 years of age? How would sleep changes impact adolescents within this study? Would the results have a significant change in comparison to the younger children sample in the Woody et al. (2019) study?
- ▶ How would the emotions of disgust or disappoint impact the results considering those are two common emotions that children are probably used to in seeing in their parents faces more often than other ages?



# Tuning down the emotional brain: An fMRI study of the effects of cognitive load on the processing of affective images

VAN DILLEN ET AL., 2009



# Background

- ▶ Enduring negative emotional states impair both psychological and physical health and it is vital for people to develop ways of effectively dealing with negative emotion
- ▶ Performing an attention-demanding task has been found to attenuate the emotional impact of negative stimuli
- ▶ Activity in emotion processing brain regions in response to negative emotional stimuli, such as amygdalae, depend on the availability attentional resources for processing of these stimuli

# Background

- ▶ Cognitive load may prevent the processing of the emotional impact of negative stimuli altogether
- ▶ Task load may be capable of down-regulating emotional circuits even after these circuits have been mobilized
  - ▶ Performing a demanding task may similarly down-regulate the unfolding of the emotional brain response to a previously displayed emotional stimulus

# Aims

- ▶ Investigate the neural dynamics by which cognitive load modulates the emotional brain response, even after this response has already been initiated
  - ▶ Hypothesis 1: Relative to exposure to neutral pictures, exposure to negative pictures would activate both negative feelings and emotional brain circuits such as the amygdalae and the insulae
  - ▶ Hypothesis 2: Task load would increase activation in brain regions implicated in cognitive processing, such as the dorsolateral frontal cortex, superior parietal cortex, and the dorsal occipital cortex
  - ▶ Hypothesis 3: Cognitive load would modulate subjectively reported emotional states and the activation of emotional brain circuits
    - ▶ Neural activity in regions implicated in emotional processing to decrease with increases in task load

# Methods

## ▶ Participants

- ▶ 17 volunteers at the VU University Amsterdam (13 women, average age 20)
  - ▶ Right-handed, native Dutch speakers
  - ▶ No history of neurological or psychiatric problems
- ▶ Completed experiment in scanner

# Methods

## ▶ Procedure

- ▶ Picture viewing task (128 trials)
- ▶ Each trial consisted of a picture (4s) followed by an arithmetic task (4s) and a mood scale
- ▶ Negative and neutral sets of pictures selected from International Affective Picture System
- ▶ fMRI data analyzed at each voxel (whole brain) and then specifically for ROI's

# Findings

- ▶ Even when emotional circuits have already been engaged, performing a demanding task may still attenuate processing in the emotional brain
- ▶ Both regions involved in the arithmetic task (right dorsolateral frontal cortex, right superior parietal cortex, left dorsal occipital cortex) and emotion regions (bilateral amygdalae, right insula) initially showed greater activity in response to negative pictures than neutral pictures
  - ▶ Emotional and cognitive circuits in the brain operate in a coordinated manner to deal with changing task demands

# Findings

- ▶ During picture display, activity in the right dorsolateral frontal cortex, right superior parietal cortex, and left dorsal occipital cortex, as well as limbic regions, was greater in response to negative pictures than neutral pictures
  - ▶ Neural responses in these regions only began to differentiate when participants performed the arithmetic equations
  - ▶ Activity in cognitive regions increased whereas activity in limbic regions decreased when performing arithmetic equations
    - ▶ Suggests the more the cognitive regions were engaged by the arithmetic task, the more the emotional responses were attenuated

# Findings

- ▶ Integration effect for processing negative emotion and task load in right dorsolateral frontal cortex
  - ▶ Engaged more with increasing task load to sustain priority of processing of central task?
- ▶ Role of lateral frontal cortex in controlling information processing may extend beyond the cognitive domain, and control processing of emotional information
- ▶ Cognitively demanding tasks may eventually be used as a therapeutic tool



# Discussion Questions

- ▶ The Van Dillen et al. (2009) paper proposed that cognitive load modulates the unfolding of the emotional brain response. They say in the implications that cognitively demanding tasks may eventually be used as a therapeutic tool and that letting people cool down didn't result in a neutral state. **These findings made me question if mindful practice would have the same or a better effect. I kept thinking about the cognitive load and if attention was focused on something else, maybe that would have shown a difference?**
- ▶ After reading the Van Dillen et al. (2009) demonstrating the down-regulating effects of task load on the emotional processing of negative stimuli, I'm curious whether the same effects would extend to positive stimuli. That is to say, **would increasing cognitive demands be as effective in "tuning down the emotional brain" or would positive emotions (per their positive content) require a higher cognitive load to offset interference?**

# Discussion Questions

- ▶ The Van Dillen (2009) article really has me curious about reading and emotion processing. Their study examined the effects of cognitive load (via an arithmetic task) on the processing of affective images. **What does emotion processing look like when you're reading a novel?** For many people (myself included) the scenes of a good novel seem to play out in our "mind's eye" even though we're just reading words on a page. **Does processing emotionally charged content that's been delivered through text differ from processing visual or in-person emotionally charged content? Is our emotional processing hampered in some way?** Just thinking retrospectively, there are definitely some scenes in popular books that I think hit different when I saw them on the big screen, even though I had read them in the books. (thinking Harry Potter here... y'all know that "Always" scene hit different)

# Discussion Questions

- ▶ I was really amused by the Van Dillen et al. (2009) paper, because the measured intervention (having people do arithmetic problems while exposed to negative emotional photos) is similar to a strategy I used as a child to regulate my own emotions. Whenever I felt upset and wanted to avoid crying, I would do long division in my head (but only with non-evenly divisible numbers, to make sure the task was difficult enough). Although the research (and my own childhood experience!) shows this is an effective strategy, I cannot think of any concrete therapeutic techniques that teach this behavior. **Are there existing examples that I'm not thinking of where therapists teach the use of working memory to distract from negative emotions?**
- ▶ Conversely to the aims of this study, I am also curious the extent to which the negatively valenced stimuli hinders the ability to complete working memory tasks. Is this “vice versa” really just the well documented phenomenon of depressed people exhibiting cognitive deficits?

# Discussion Questions

- ▶ In the Van Dillen (2009) paper, the authors suggest that doing a complex task may alleviate the intensity of emotional responses and could improve people's receptiveness to therapeutic interventions. **When I think of using complex tasks to alleviate the intensity of emotions, I wonder if more intense emotional responses can still be alleviated by complex tasks or if this may vary across individuals? Would this be helpful or even work for people who struggle with emotion regulation difficulties or experience heightened emotions? Would some people in a heightened state of emotional distress struggle to concentrate on a complex task?**
- ▶ In the Van Dillen (2009) paper, **I also wondered if the effects found would have differed if they used personally relevant stimuli, such as autobiographical recall? I also wondered if participants may return to experiencing the strong emotion after completing the complex task if the stimuli is relevant for the participant.** In the study, the authors displayed the stimuli in a continuous sequence so they were not able to examine how these effects could change if time was varied.