Adolescent Frontal Neurodevelopment of Emotion Regulation

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Introduction

- Emotion regulation (ER) is often disrupted in psychiatric disorders
- Adolescence marks the peak onset of mental disorders[1], thus understanding normative development during this period can inform clinical endpoints
- ER can be broadly categorized as Implicit or Explicit, which are thought to engage different prefrontal circuits
  - ➢ Implicit: automatic, unconsciously implemented
  - ➢ Explicit: effortful, consciously implemented
- Goal: Identify regions of the frontal cortex that change across adolescence during Implicit and Explicit ER

Methods

Participants: Community sample enriched for youth with psychopathology

	Session 1 (N = 137)	Session 2 (N = 102)
Sex	Male = 42% Female = 58%	Male = 45% Female = 55%
Age	$\bar{x}$ = 13 (10.2 – 17.2)	$\bar{x}$ = 14.8 (11.4 – 20.3)

Tasks

- Implicit ER: Emotional N-Back
  - Stimuli: Positive, Negative, and Neutral faces
  - Regulation: Minimal (0-back), Implicit (2-back)
- Explicit ER: Perspective/Reappraisal Task
  - Stimuli: Negative, Neutral pictures of scenes
  - Regulation: None (“Close”), Instructed (“Far”)

Youth Self-Report Questionnaires

The following were collected to control for confounds:

- Adversity: Stressful Life Events Screening (SLES)
- Psychopathology symptoms: Child Behavioral Checklist – Youth Self Report (CBCL-YSR)

Regions of Interest (ROIs):

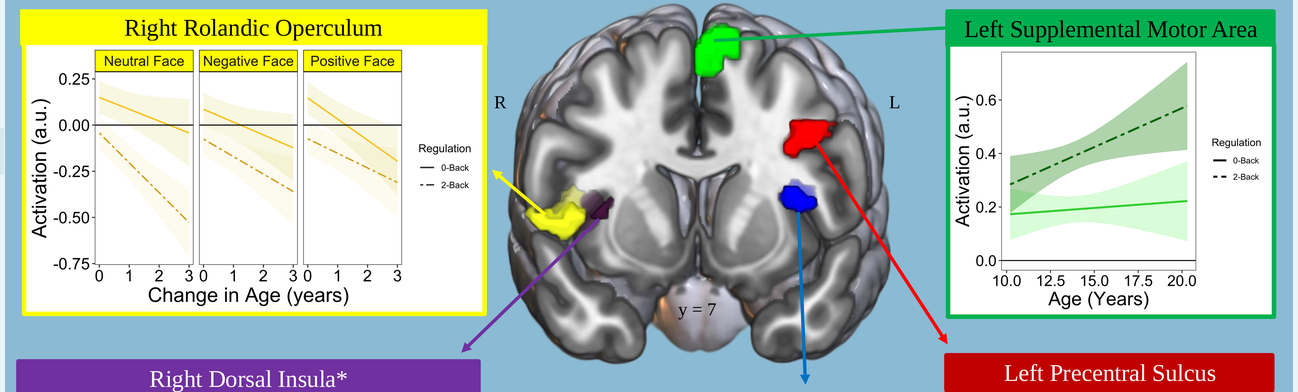
- All frontal lobe regions, defined by the Schaefer Atlas[2,3]
- Amygdala, posterior and anterior hippocampus, as defined by the Tian Atlas[4]

Statistical Linear Mixed-Effects Model

ROI Activity ~ Stimulus*Regulation*Baseline Age* Change in Age + Sex + CBCL YSR + SLES + (1 | Subject)

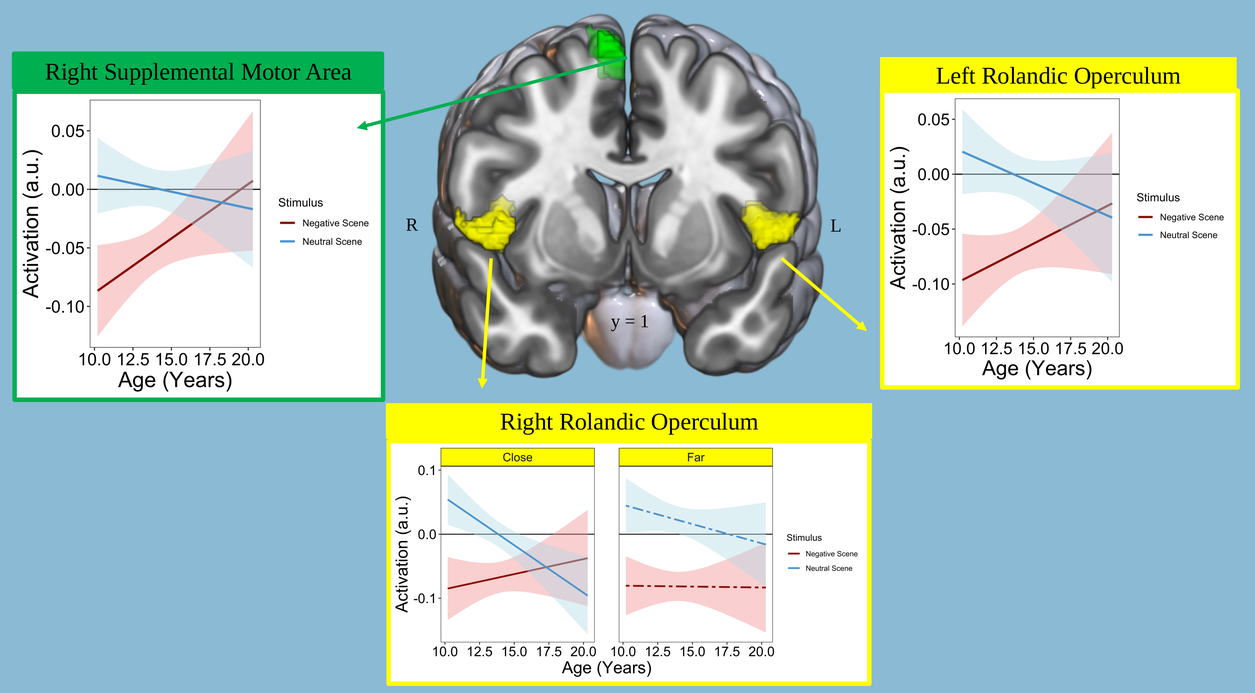
- Baseline Age = Age at session 1
- Change in age = Age at session 2 – Age at session 1

As youth age, salience-related regions disengage during Implicit Regulation



*For positive faces, the negative slope during 2-Back is only significant for youth aged 14.5 - 17

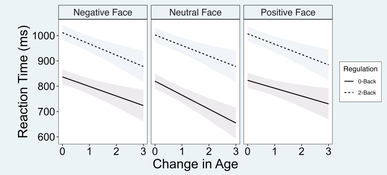
and converge across negative and neutral stimuli during Explicit Regulation



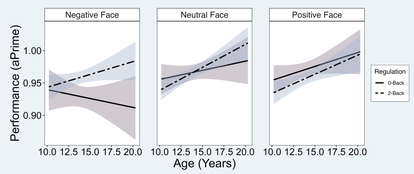
Behavior

Implicit ER

- Reaction Time: sped up for all conditions, but particularly for neutral faces in the 0-Back condition



- Performance: Increased with age



Explicit ER

- Stimulus Rating (Likert scale, -5 to 5)
  - ➢ More positive when explicitly regulating for negative stimuli but not for neutral stimuli
  - ➢ More positive over time for negative stimuli during explicit ER (“Far”) with no change in reactivity (”Close”)

Summary & Discussion

- Both Implicit and Explicit ER show changes in the Salience/Ventral Attention (SVA) network[3,5], but with different patterns of change
  - Rolandic operculum & dorsal insula in Implicit ER
  - Rolandic operculum & right supplementary motor area in Explicit ER
- **Implicit ER**: Disengagement of the SVA suggests increased cognitive efficiency by making stimuli less salient
- **Explicit ER:** SVA activity between negative and neutral stimuli converge, resulting in similar responses to both
- These results highlight the importance of studying adolescent developmental to better inform clinical applications

References

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