Do You Feel How I Feel?

Developmental Differences in Affective Representation

William Mitchell*, Lindsey Tepfer, Nicole Henninger, Susan Perlman, Vishnu Murty, Chelsea Helion

***Contact:** Billy.Mitchell@temple.edu

Background

- It is unclear how affective neural representations may differ between children and adults in select regions which are implicated in behavioral responses[1-2].
- Differences in neural activation patterns may reflect differences in cognitive representations, which may motivate the observed developmental differences in behavioral phenomena.

Hypotheses

A. Children will demonstrate **greater representational similarity** than adults.
B. Children will generate **greater discrepancies** in valenced representational similarity than adults.
C. Children and adult subcortical ROI representations will be **more similar** than representations in the vmPFC.

Analyses

- Intravalence pattern similarity was calculated using RSA. Spearman's rank methods and Fisher's Z transformation were used to calculate correlations.
- Differences in pattern similarity were assessed using a 3 (ROI) x 3 (Valence) x 2 (Age Group) Mixed Effects ANOVA with Bonferroni-adjusted post-hoc contrasts.

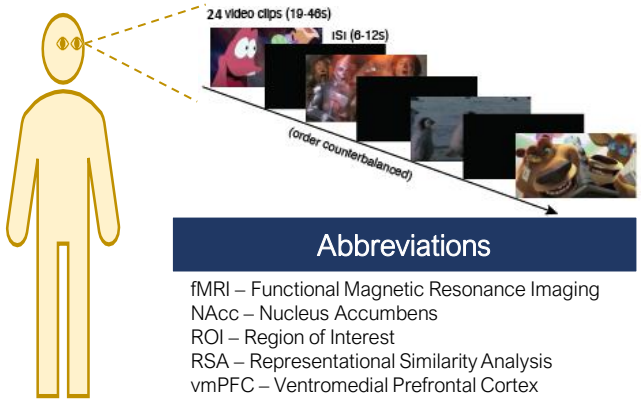
Sample

	Male	Female	Age Range	Mean Age	Std. Dev.
Children	11	14	04 - 10 yrs	7.4 yrs	1.9 yrs
Adults	11	9	20 - 44 yrs	26.7 yrs	5.2 yrs

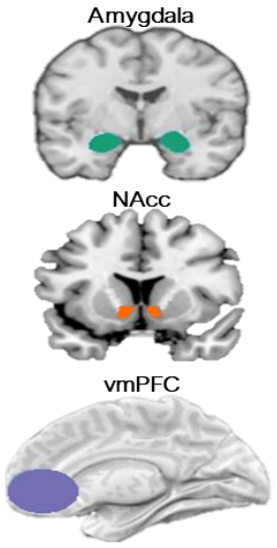
Methods

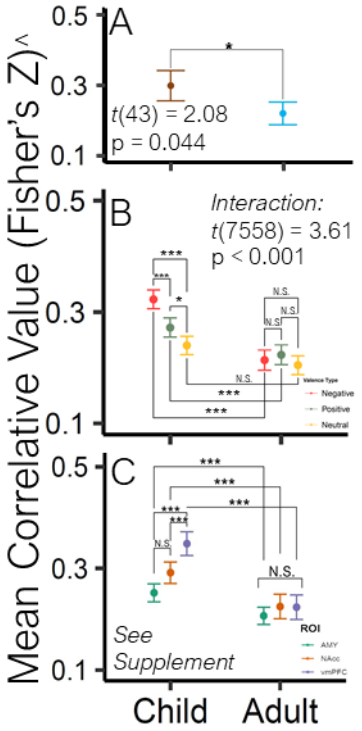
We explored differences in neural activation pattern similarity measured using fMRI between children and adults across the amygdala, NAcc, and vmPFC, while passively viewing 24 affectively valenced film clips (8 Pos, 8 Neg, 8 Neut), which were counter-balanced for affect, time, social stimuli, and luminosity [3].

Task Design



ROIs

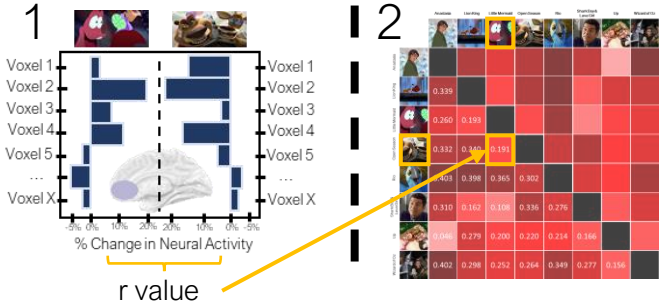




^ **Note**: Full range (-1.77 to 1.76) of Y-Axis restricted in visuals for comprehension sake. Error bars represent 95% confidence intervals.

RSA Calculation Example

Calculating RSA: Correlations were performed within individual and ROI, between stimuli of the same valence type (1). Matrices house the mean correlative values across participants of the same age group for stimuli pairs in any one ROI (2), which required the construction of 12 separate matrices. The average correlative value of a matrix symbolizes representational similarity of a valence type for one ROI and age group. Higher values suggest greater similarity. Mean values and variances can be analyzed in traditional ANOVA to measure representational pattern differences.



Pattern Similarity [4]

What is it?: When different stimuli generate overlap in neural activity patterns, we assume this is in response to a characteristic which those stimuli have in common that that ROI is processing. **Why does it matter?:** We can better infer how representations are structured which may have downstream effects on cognition and behavior.

Discussion

- Our results suggest that affective representations decrease in pattern similarity over development.
- The differences between subcortical and prefrontal structures in adults and children may suggest a maturation from visceral affective responses which merely assess how evocative an affective experience is, to more evaluative analyses which modulate affective responses.
- More research is needed before these analyses can directly be linked to behavioral differences.

Abbreviations

fMRI – Functional Magnetic Resonance Imaging
NAcc – Nucleus Accumbens
ROI – Region of Interest
RSA – Representational Similarity Analysis
vmPFC – Ventromedial Prefrontal Cortex

Results

A. Children demonstrated **greater representational similarity** than adults.
B. Children **demonstrated** valence-specific **differences**, but adults did not.
C. Children **showed differences** between subcortical ROIs and vmPFC, but adults failed to demonstrate differences.

References

1. Nook, E. C., Sasse, S. F., … & Somerville, L. H. (2017). Increasing verbal knowledge mediates development of multidimensional emotion representations. *Nat. Human Behav.*, *1*(12), 881–889.
2. Silvers, J. A., McRae, K., … & Ochsner, K. N. (2012). Age-related differences in emotional reactivity, regulation, and rejection sensitivity in adolescence. *Emotion*, *12*(6), 1235–1247.
3. Karim, H. T., & Perlman, S. B. (2017). Neurodevelopmental maturation as a function of irritable temperament. *Human Brain Map.*, *38*(10), 5307–5321.
4. Popal, H. S., Wang, Y., & Olson, I. R. (2019). A Guide To Representational Similarity Analysis for Social Neuroscience. *Social Cog. Affect. Neurosci.*, *14*(11),1243–1253.