

Do You Feel How I Feel?

Developmental Differences in Neural Representations of Affect

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Background

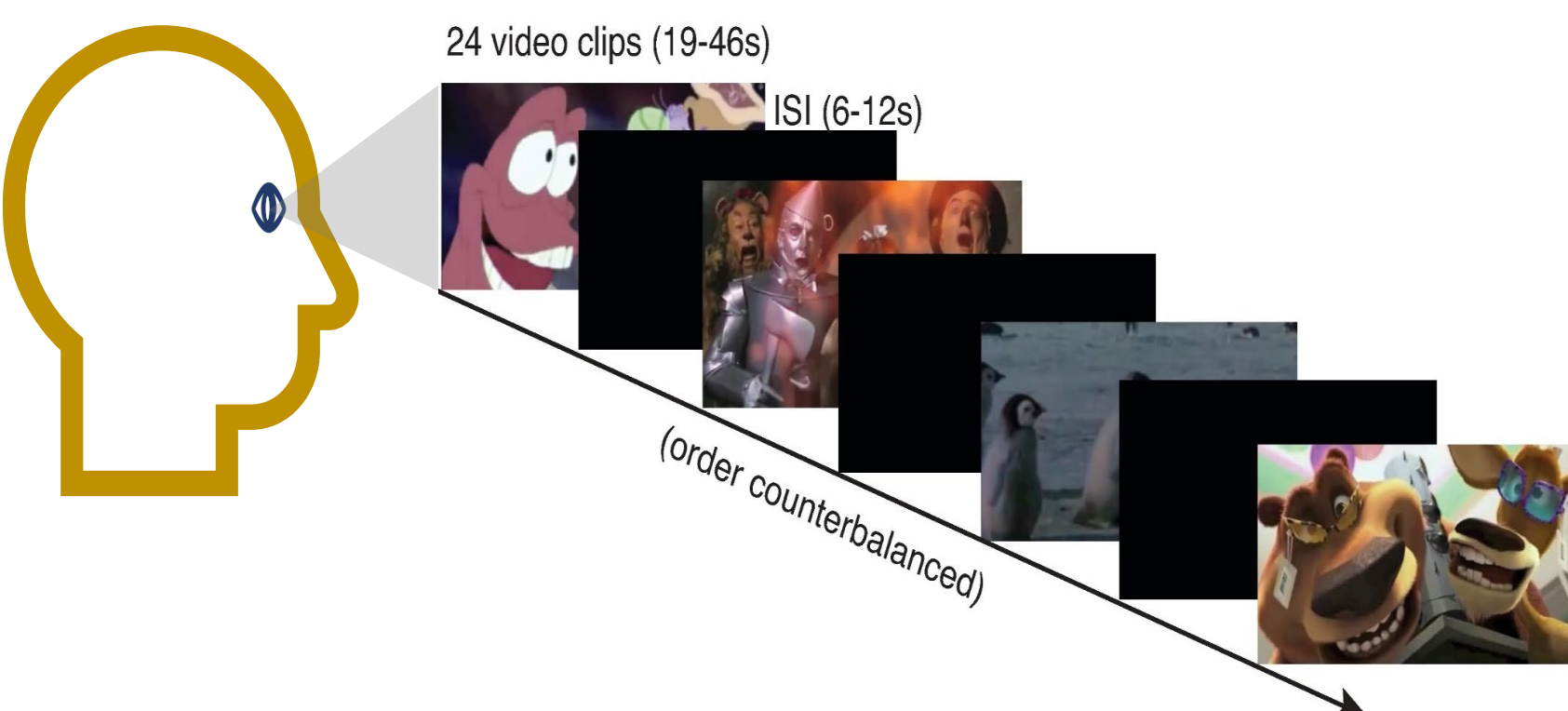
- Maturations in affective behavior correlate with network developments in key affective regions ¹⁻².
- It's unclear if these developmental differences are reflected within neural representations.
- Naturalistic stimuli offer a more ecologically sound approach to exploring these developmental neural differences.

Sample

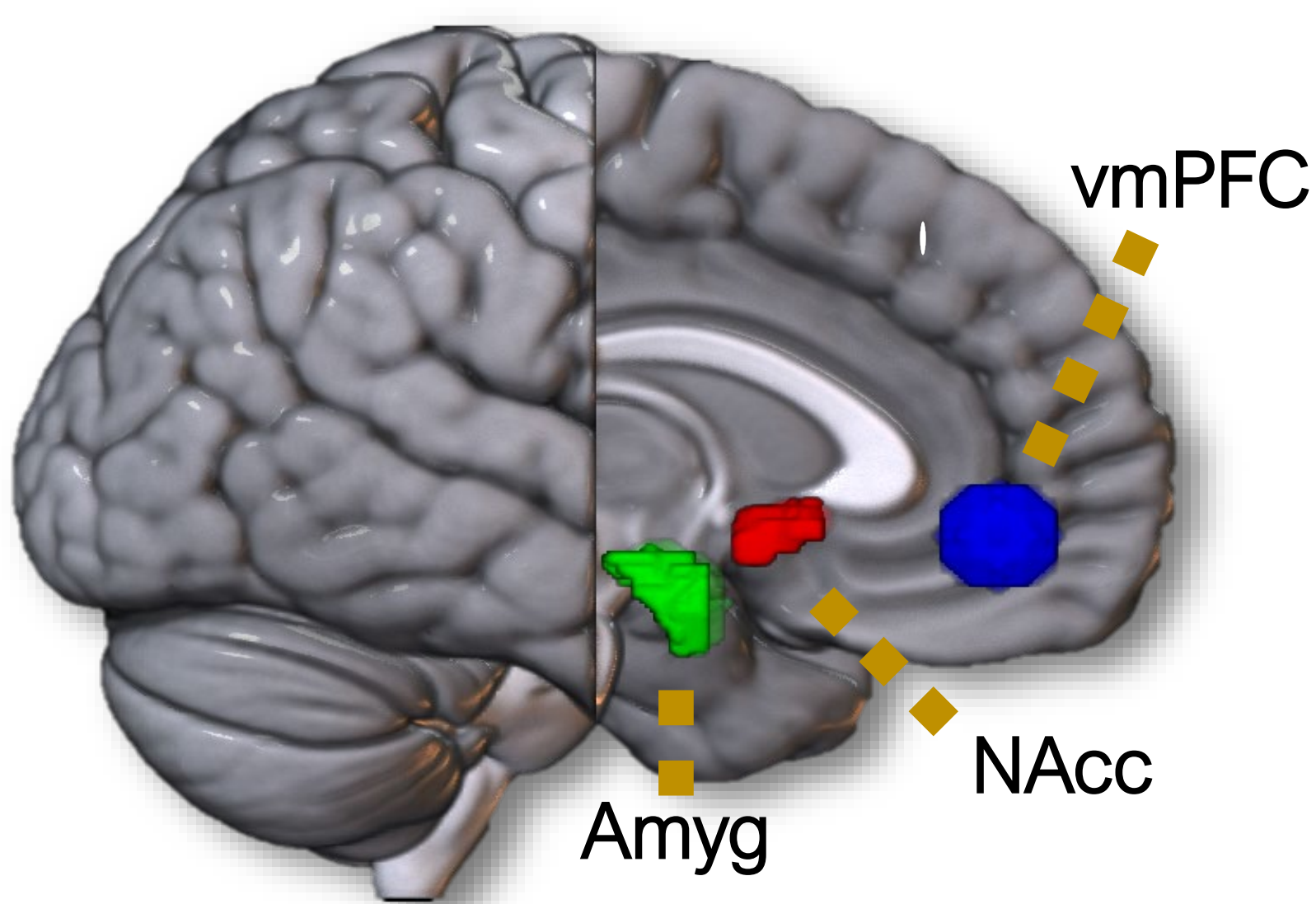
	Child	Adult
Male (n)	11	11
Female (n)	14	09
Age Range	04 – 10 yrs	20 – 44 yrs
Mean Age	07.4 yrs	26.7 yrs
Std. Dev.	01.9 yrs	05.2 yrs

Methods

Children and adults passively watched 24 film clips (8 Pos, 8 Neg, 8 Neut) during an fMRI scan ³. The neural patterns evoked within the vmPFC, NAcc, and Amyg were analyzed using an RSA approach.



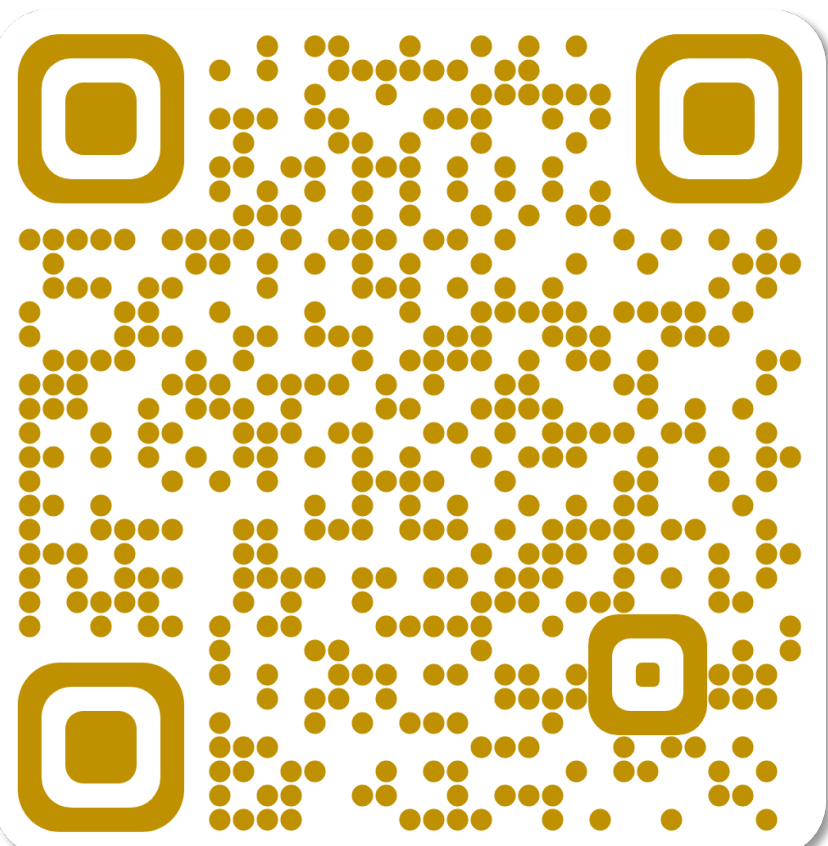
Regions of Interest



Analyses

- Intravalence pattern similarity was calculated using the Spearman's rank method. Correlative values were transformed using Fisher's Z.
- Differences in mean pattern similarity were assessed using a 3 (ROI) x 3 (Valence) x 2 (Age Group) Mixed Effects ANOVA with Bonferroni-adjusted post-hoc contrasts.

MANUSCRIPT



Hypotheses

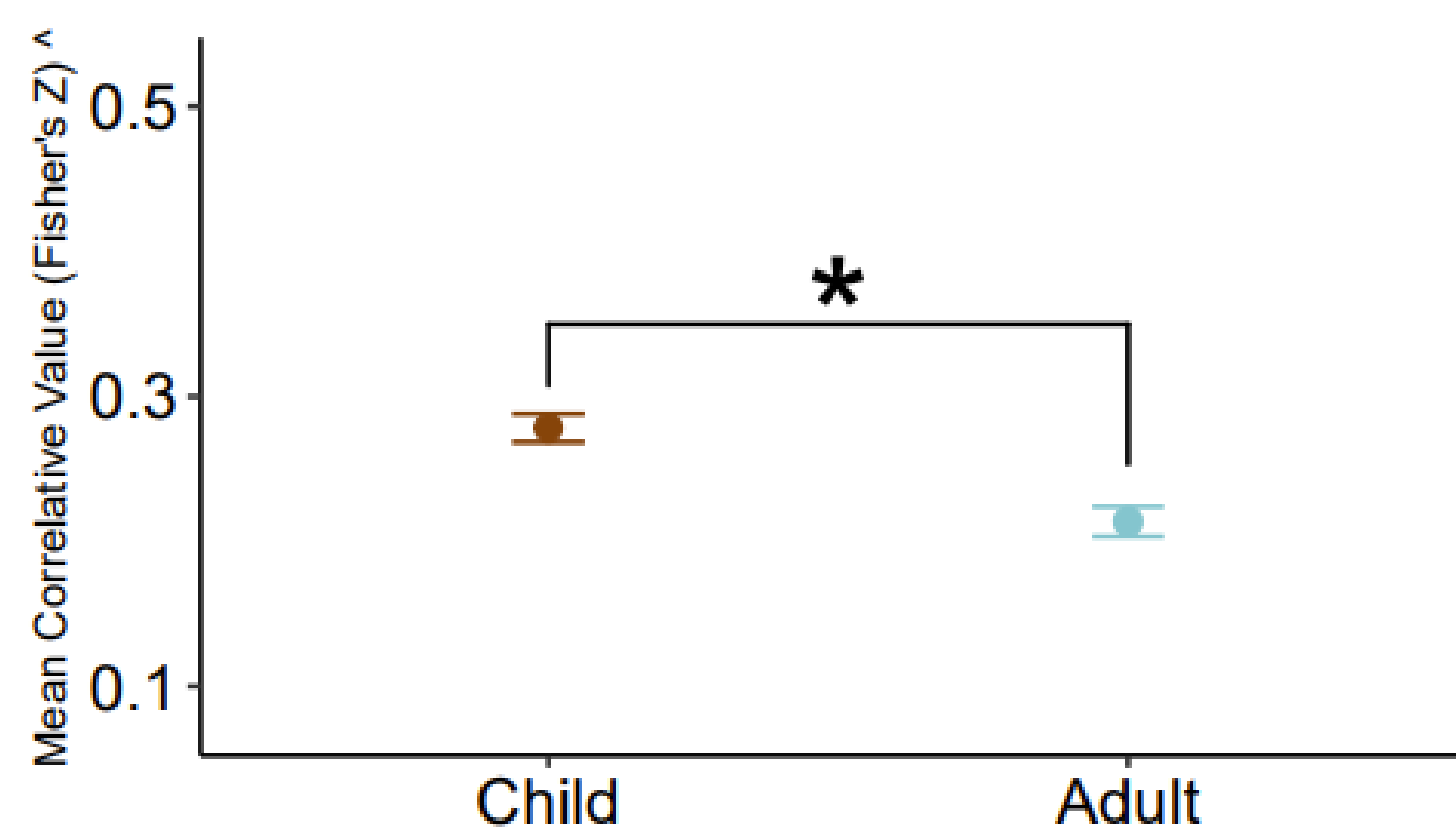
- Children will generate more similar patterns than adults, suggesting less **complexity**.
- Children will generate more similar valenced patterns than adults, suggesting less **differentiation**.
- vmPFC patterns will be more similar than subcortical regions in children but not adults, suggesting greater recruitment in **meaning-making** tasks.

Results

[^] Note: Full range (-1.77 to 1.76) of Y-Axis restricted in visuals for comprehension sake. Error bars represent 95% confidence intervals.
> 0.05 = N.S. | < 0.05 = * | < 0.01 = ** | < 0.001 = ***

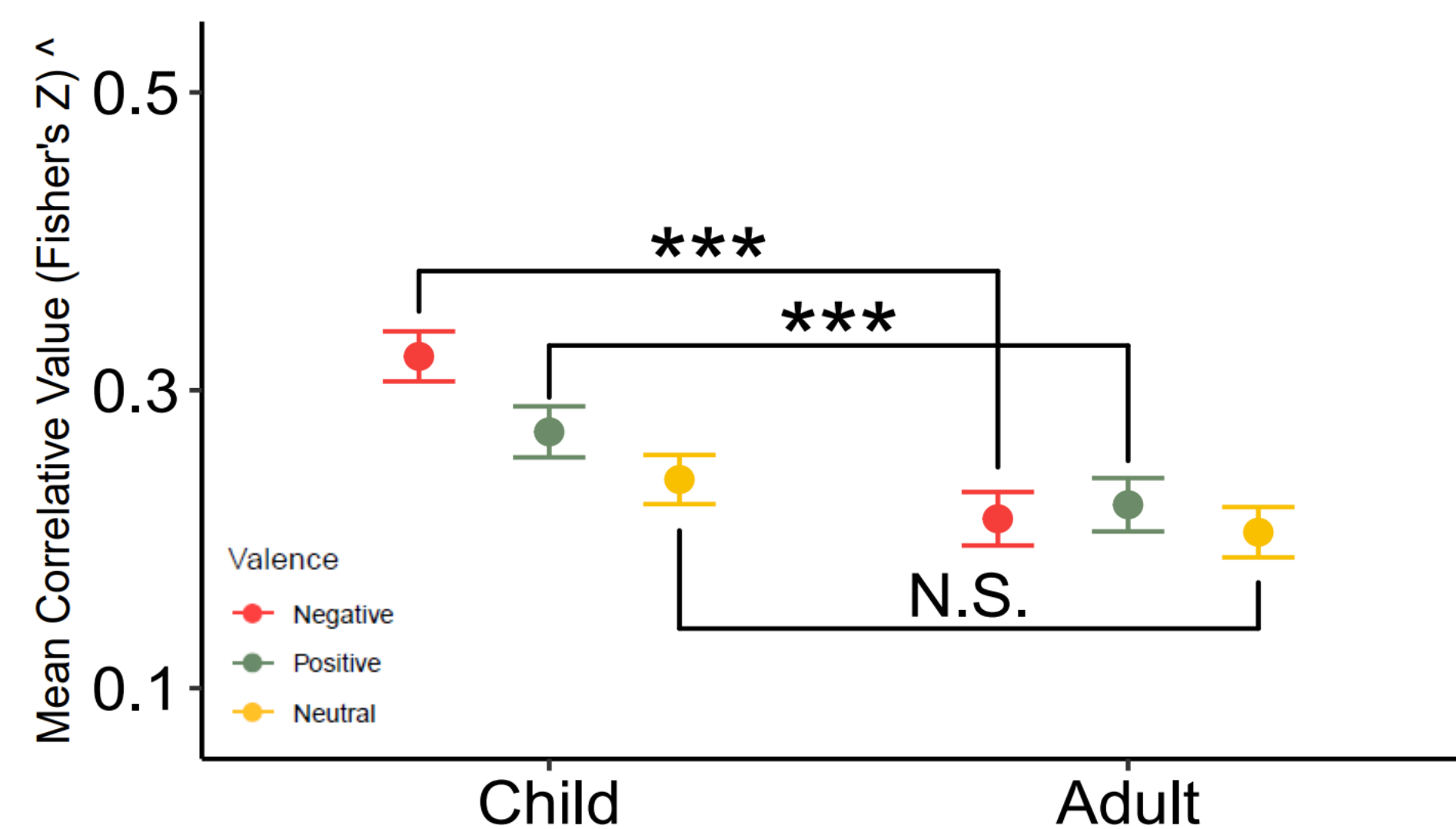
COMPLEXITY

- Children demonstrated greater pattern similarity overall



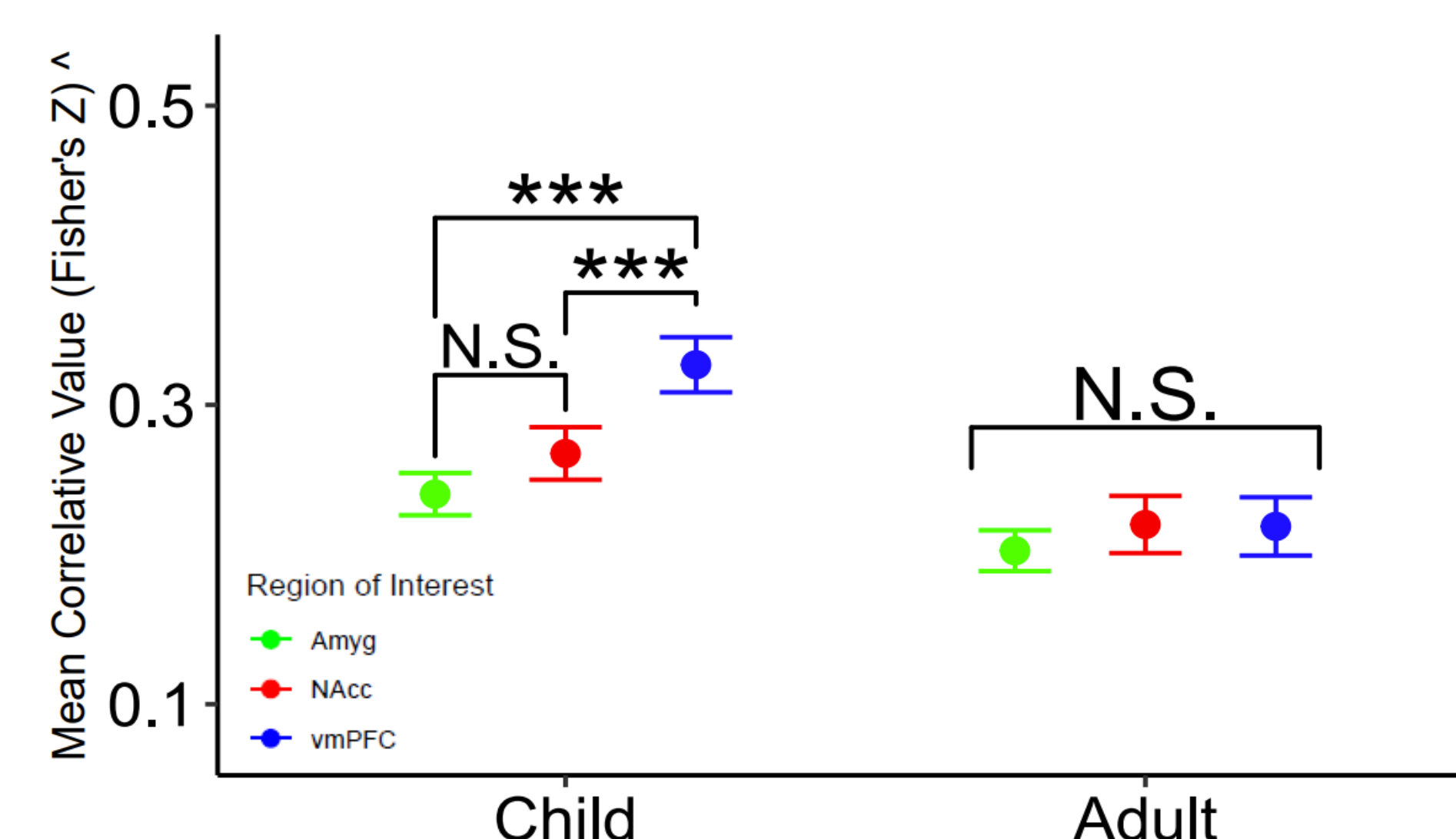
DIFFERENTIATION

- Children generated more similar patterns for positive and negative, but not neutral, stimuli



MEANING-MAKING

- Child vmPFCs demonstrated greater pattern similarity than subcortical regions; adults did not



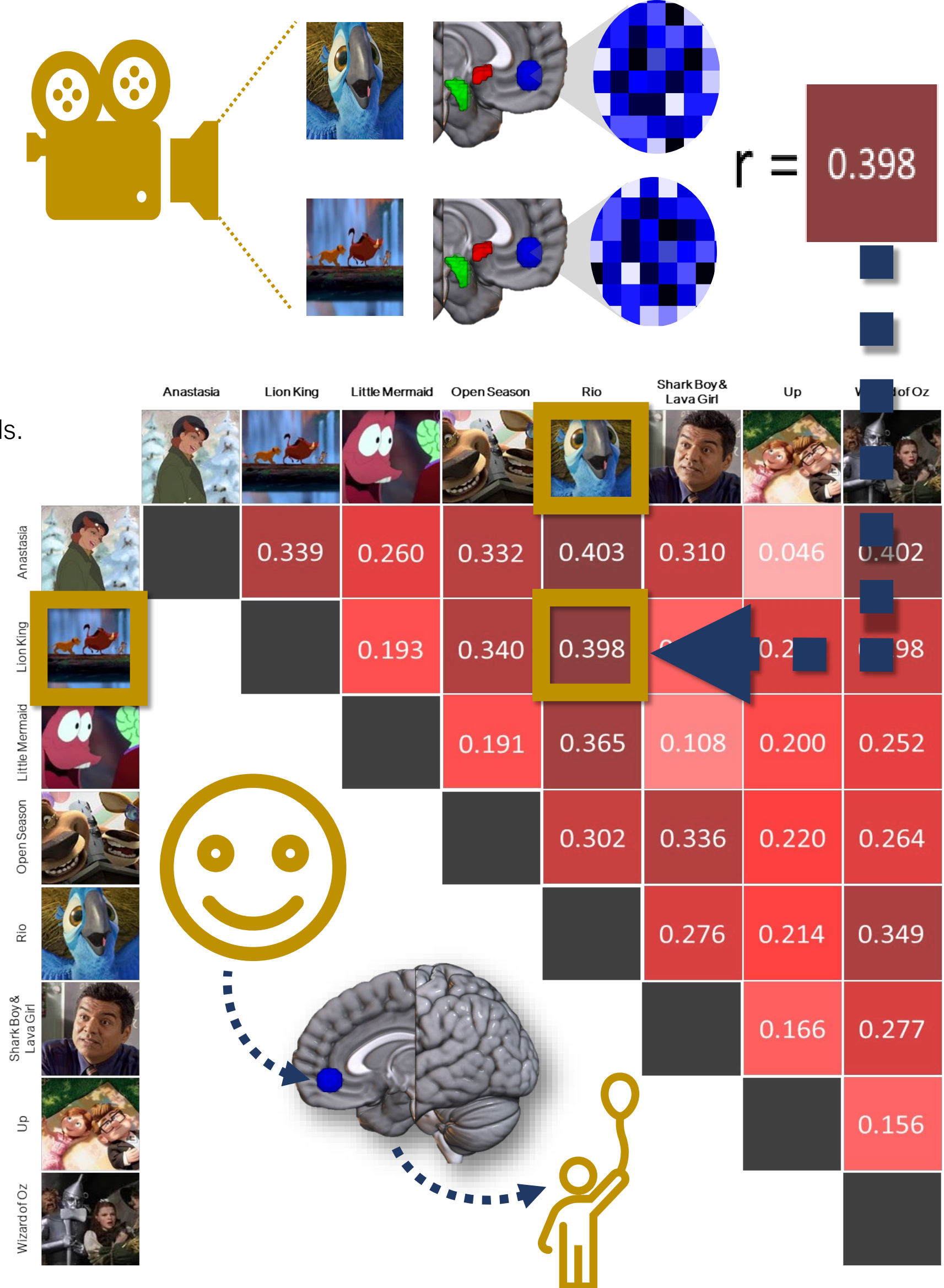
References

1. Nook, E. C., ... & Somerville, L. H. (2017). Increasing verbal knowledge mediates development of multidimensional emotion representations. *Nat. Human Behav.*, 1(12), 881–889.
2. Silvers, J. A., ... & 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.

Representational Similarity ⁴

What is it? Watching film generates observable neural patterns. When stimuli with *similar features* elicit *similar patterns*, we learn about how those features are represented in the brain.

Why does it matter? Behaviors and cognitions reference representations. Understanding normative representational development can inform our understanding of non-normative outcomes.



Calculating RSA

We correlated neural response patterns within valence, within region, and within participant, resulting in the construction of a matrix for each unique ROI-valence-age group combination (18 in total). The average correlative value of a given matrix symbolizes how similarly neural patterns are in response to content of a given valence within a given region for a specific age group. Higher values suggest more similar patterns. Mean values and variances can be analyzed in traditional ANOVA to measure representational pattern differences.

Discussion

- Results suggest neural affective representations demonstrate predictable patterns in line with known behavioral developmental differences.
- Importantly, this research cannot comment upon the contents of representations, does not include adolescents, and has a relatively small sample size.
- This is the first application of a representational similarity approach on a developmental population using naturalistic stimuli to document affective differences.

