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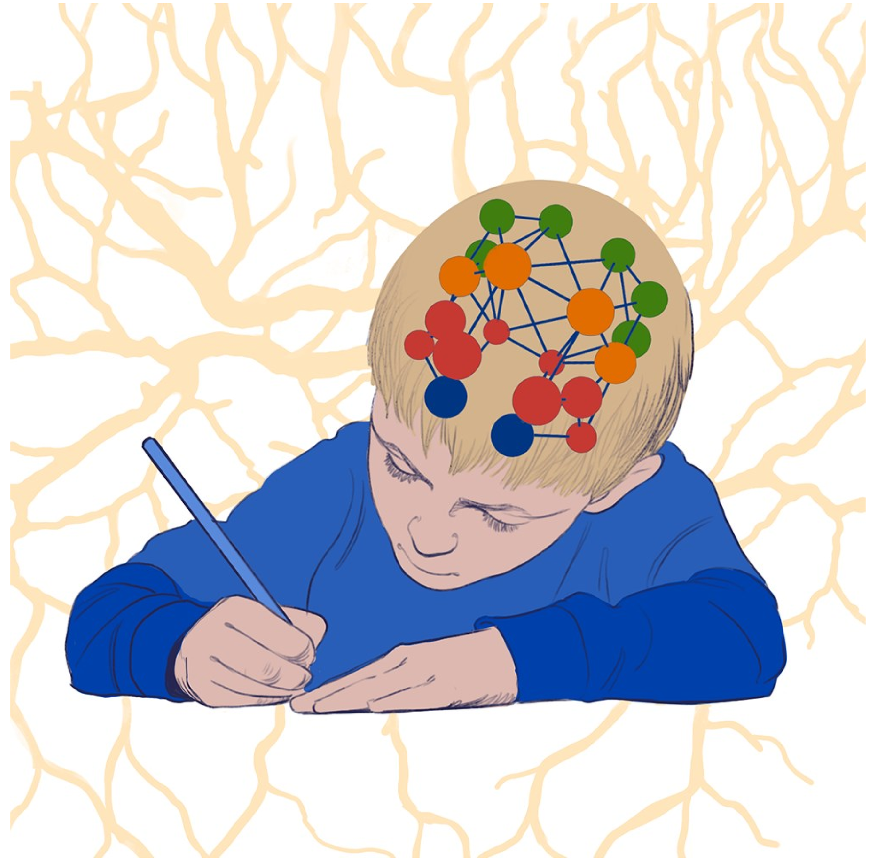
Developmental Changes in Processing Audiovisual Congruence and Incongruence across Childhood



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INTRODUCTION

- Audiovisual (AV) processing and integration is crucial for language development and comprehension and continues to mature throughout childhood [1].
- Knowledge about the developmental trajectory of AV conflict processing and its underlying mechanisms remains limited.
- In this study, we used an fMRI-based movie watching paradigm to characterize developmental changes in the brain during the processing of AV congruent and incongruent information.

CONCLUSION

- Activation in the posterior cingulate cortex during AVinc>AVcon was positively correlated with age, suggesting increased suppression of internal oriented processes in younger children [2].
- During AVinc>AVcon, age positively correlated with activation in the angular gyrus, anterior cingulate cortex and frontal regions, indicating stronger reliance on higher-order semantic integration [3,4] and cognitive control mechanisms [5, 6] to detect and resolve AV conflict.
- With development, AV incongruence processing shifts from perceptually driven to cognitively controlled strategies, reflecting the maturation of higher order integration and cognitive control.
- Our results suggest a developmental shift from broad suppression of internally oriented networks and limited engagement of higher-order control areas in younger children, toward a more mature strategy engaging regions for efficient semantic integration and conflict resolution during audiovisual incongruency in older children.

METHODS

Participants

95 children (age = 8.7y [5.7 – 13y]; 48♀)

- Healthy, native German speaking

Data acquisition

- 3T echo-planar imaging sequence (TR=1.395s, TE=35ms, voxel size=3.0x3.0x3.0mm, slices=44).
- Whole-brain fMRI analyses were conducted to examine correlations between brain activation and age using a cluster-based family-wise error corrected (FWEc) threshold of p<0.05 (cluster defining threshold (CDT) p<0.001).
- Clusters where activation significantly correlated with age were subsequently used as functional regions of interest for further investigation.

fMRI movie watching paradigm

- The movie watching paradigm presented an adapted and self-narrated version of "The Snail and the Whale" with visual only, audiovisual congruent, audiovisual incongruent and manipulated narration (time-reversed) scenes (Figure 1).

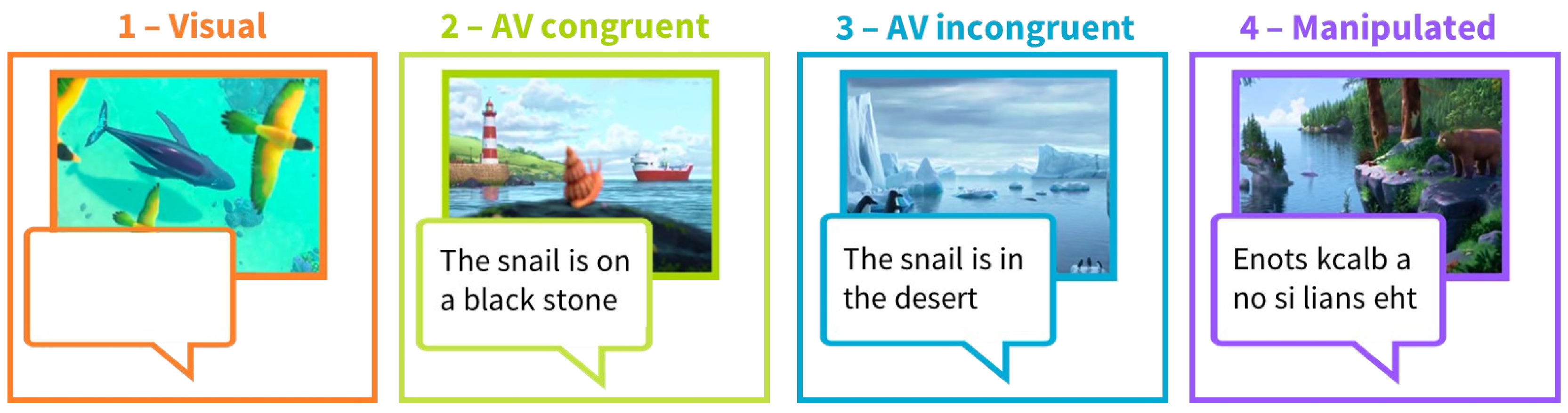

Figure 1. Movie watching paradigm with four conditions: Visual scenes presented without narration (1), with congruent narration (AVcon) (2), with incongruent narration (Avinc) (3), and with unintelligible manipulated narration (4). Conditions were presented blockwise for 15 seconds, in a pseudorandomized order. Each condition was presented 8 times, leading to a total duration of 8 minutes.

RESULTS

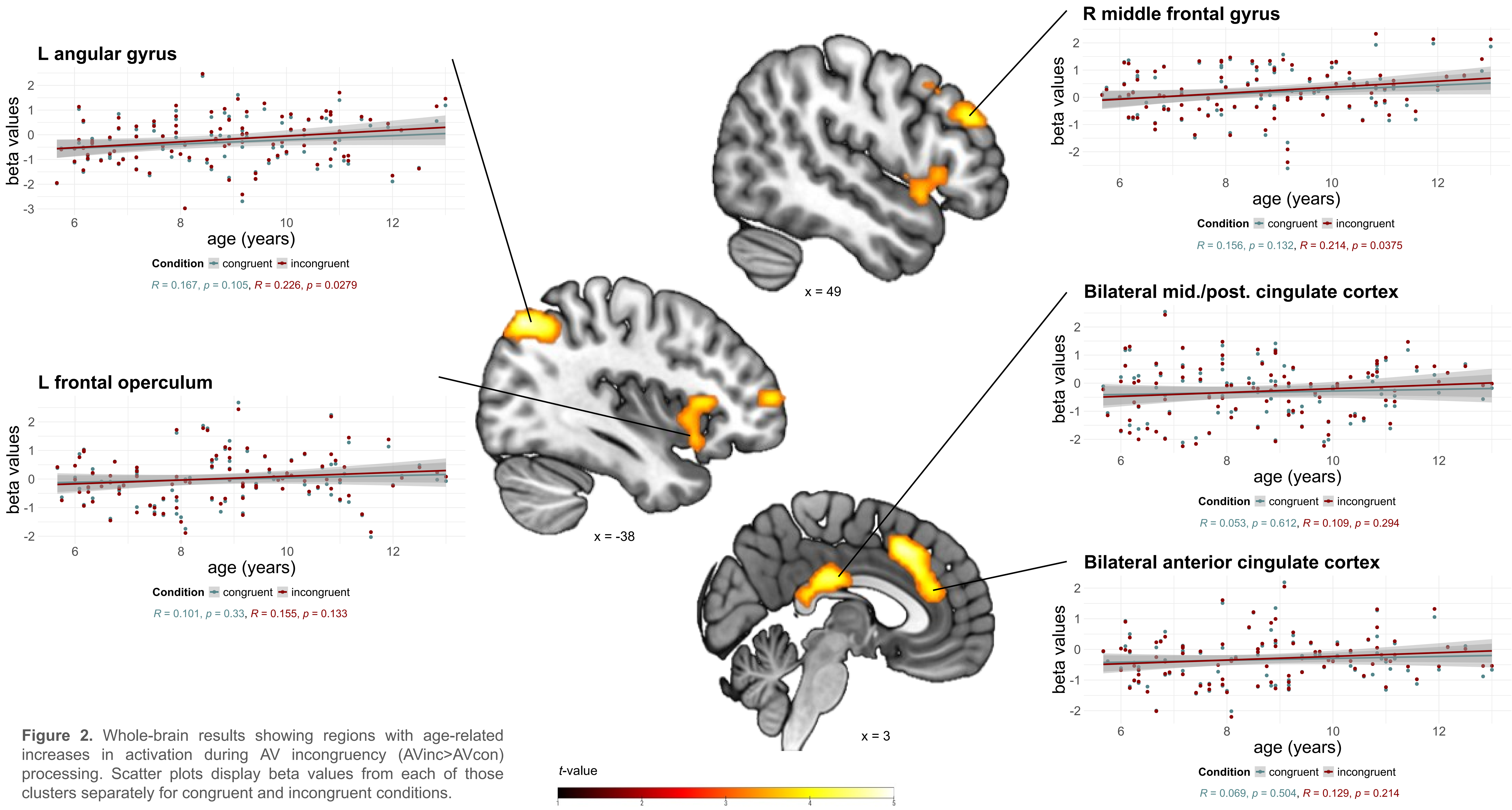

Figure 2. Whole-brain results showing regions with age-related increases in activation during AV incongruency (AVinc>AVcon) processing. Scatter plots display beta values from each of those clusters separately for congruent and incongruent conditions.

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