

# The dyslexic brain before and after literacy - unifying structural signs

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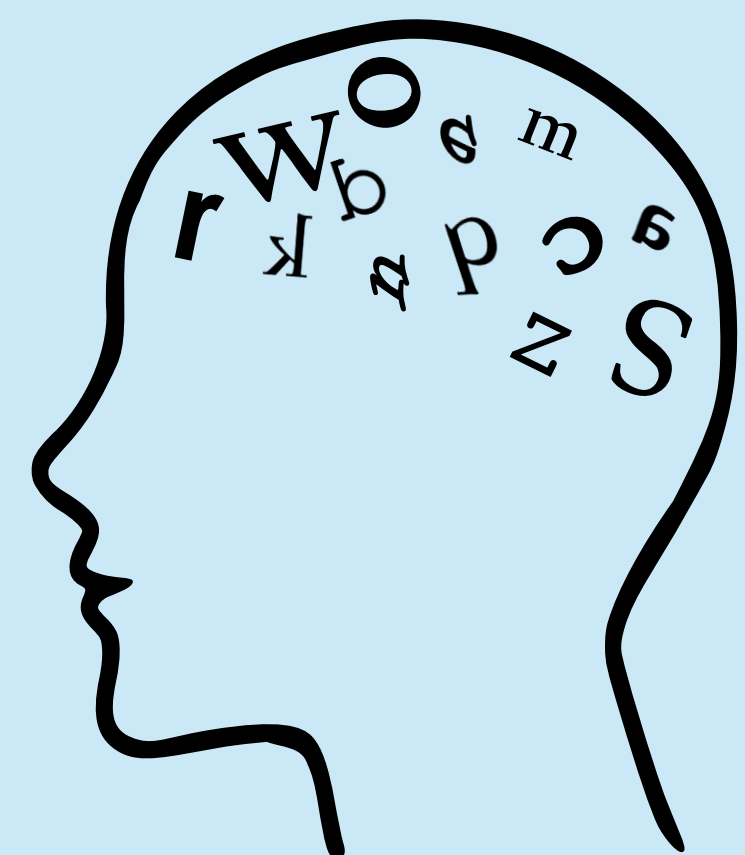
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## Introduction

Disentangling **neurobiological predisposition** from the **effect of literacy instruction**:

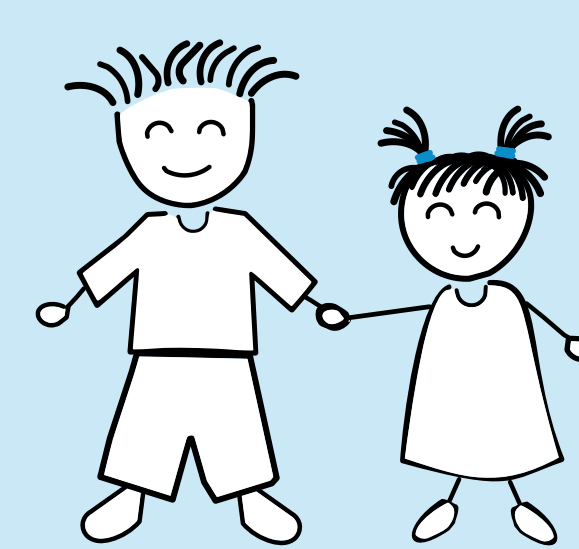
Which cortical features classify as **cause for developmental dyslexia**?



Changes in which cortical measures are a **consequence of being dyslexic**?

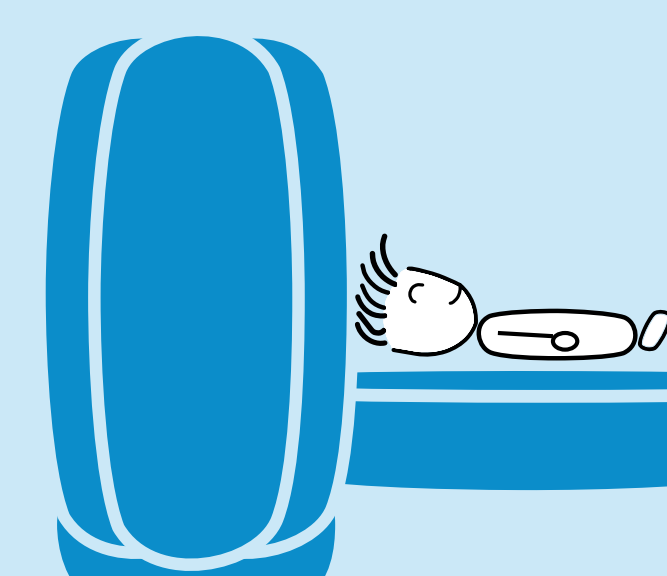
Goswami, 2015

## Design



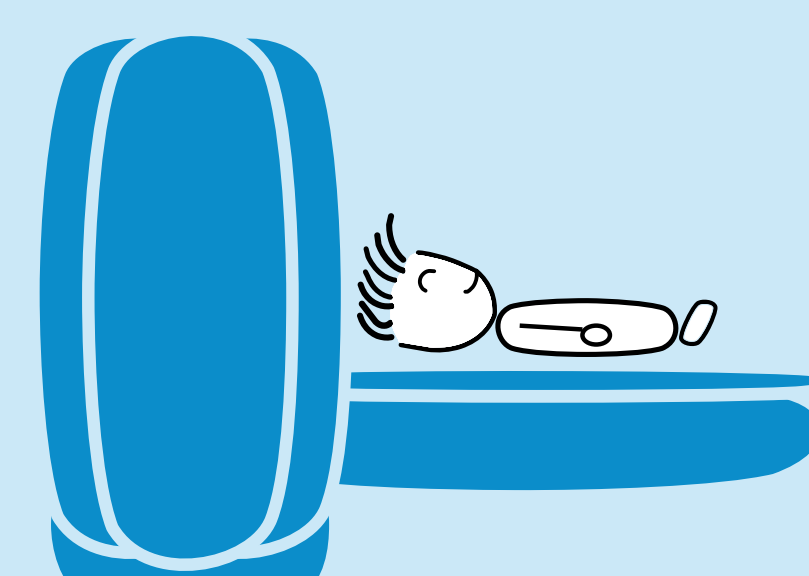
$N_{DD} = 16$   
 $N_{Con} = 16$

**Before literacy instruction**



5y;7mo ± 4

**After literacy instruction**

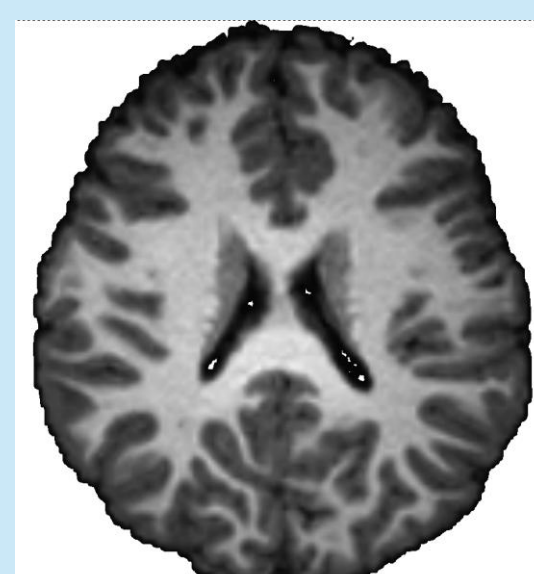


8y;6mo ± 3

**Covariates:** Sex, Age, IQ, handedness, parental education, arithmetic ability

## Data processing

MP2RAGE



CAT12

Gaser & Dahnke, 2016

Cortical thickness (CT)

Cortical folding complexity (CF)

Yotter et al., 2011

Gyrification index (GI)

Luders et al., 2006

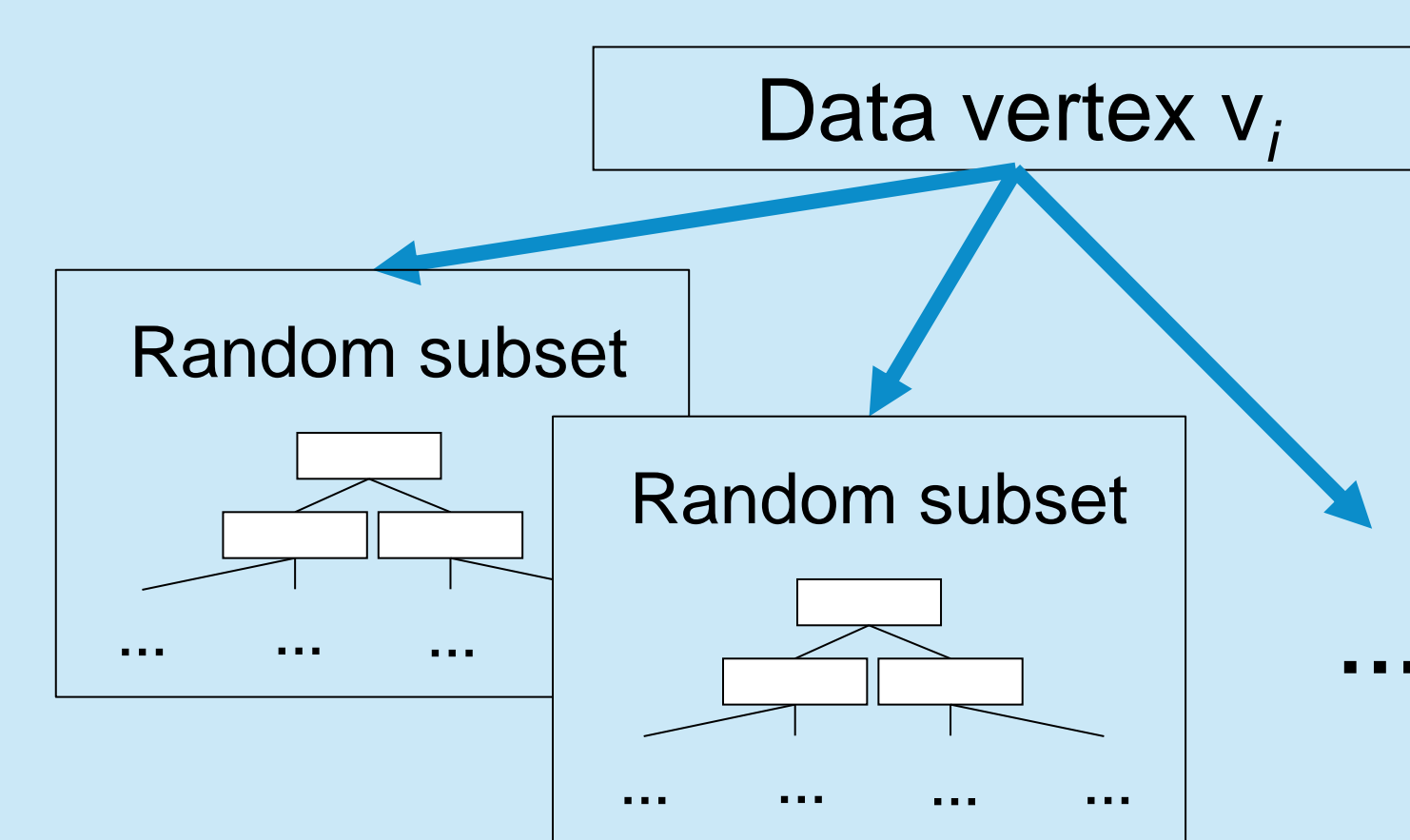
Sulcus depth (SD)

Quantitative T1 (T1w)

adjusted for covariates

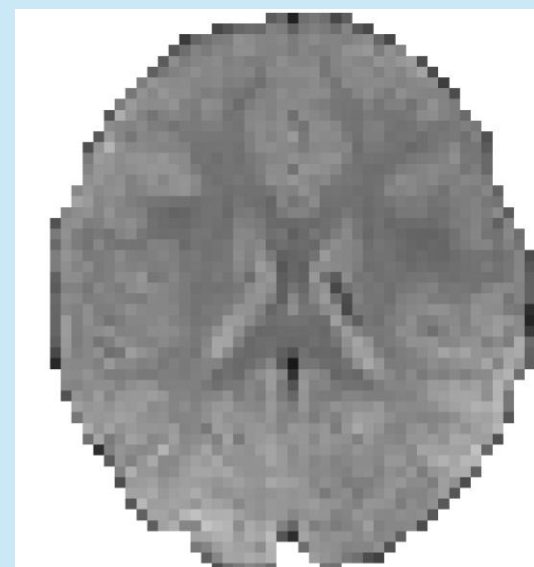
**Vertex-wise random forest classification**

Breiman, 2001



**Vertex-wise whole brain accuracy map**

rsfMRI



DPARFS

Chao-Gan & Yu-Feng, 2010

Fractional amplitude of low frequency fluctuations (fALFF)

Zou et al., 2008

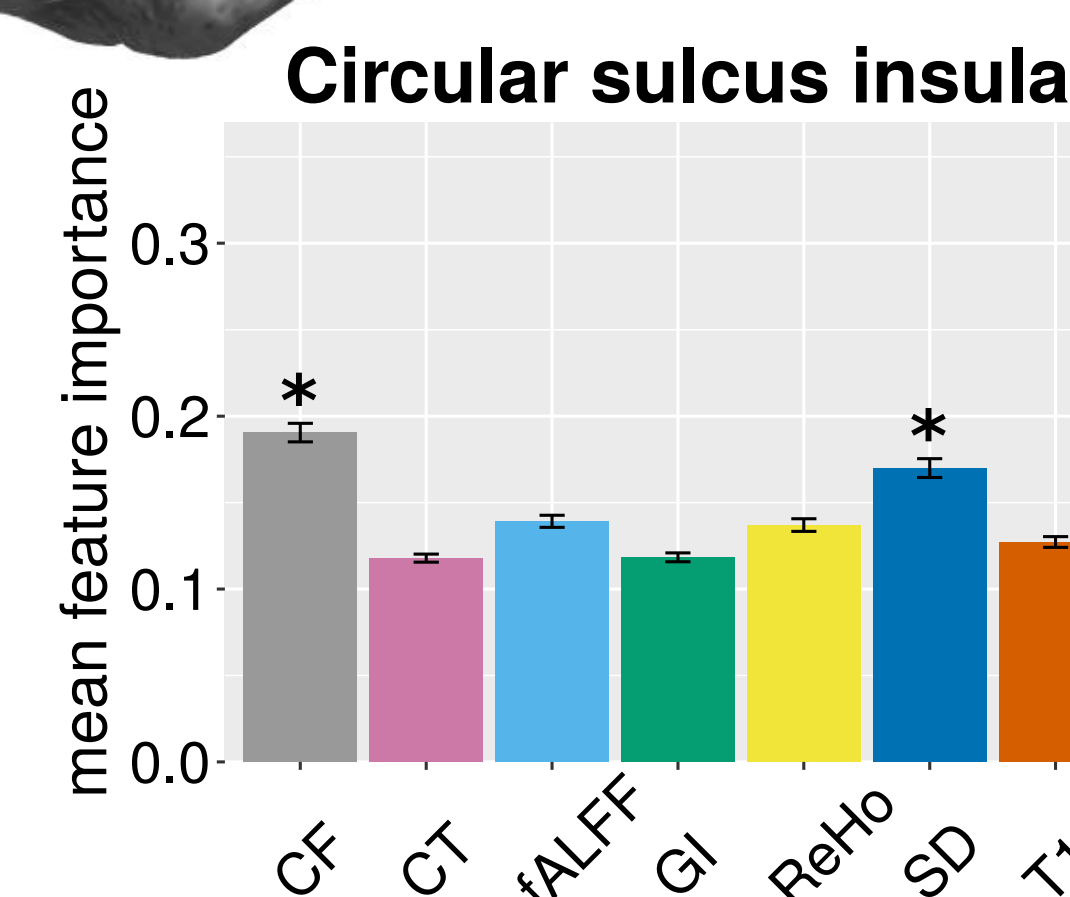
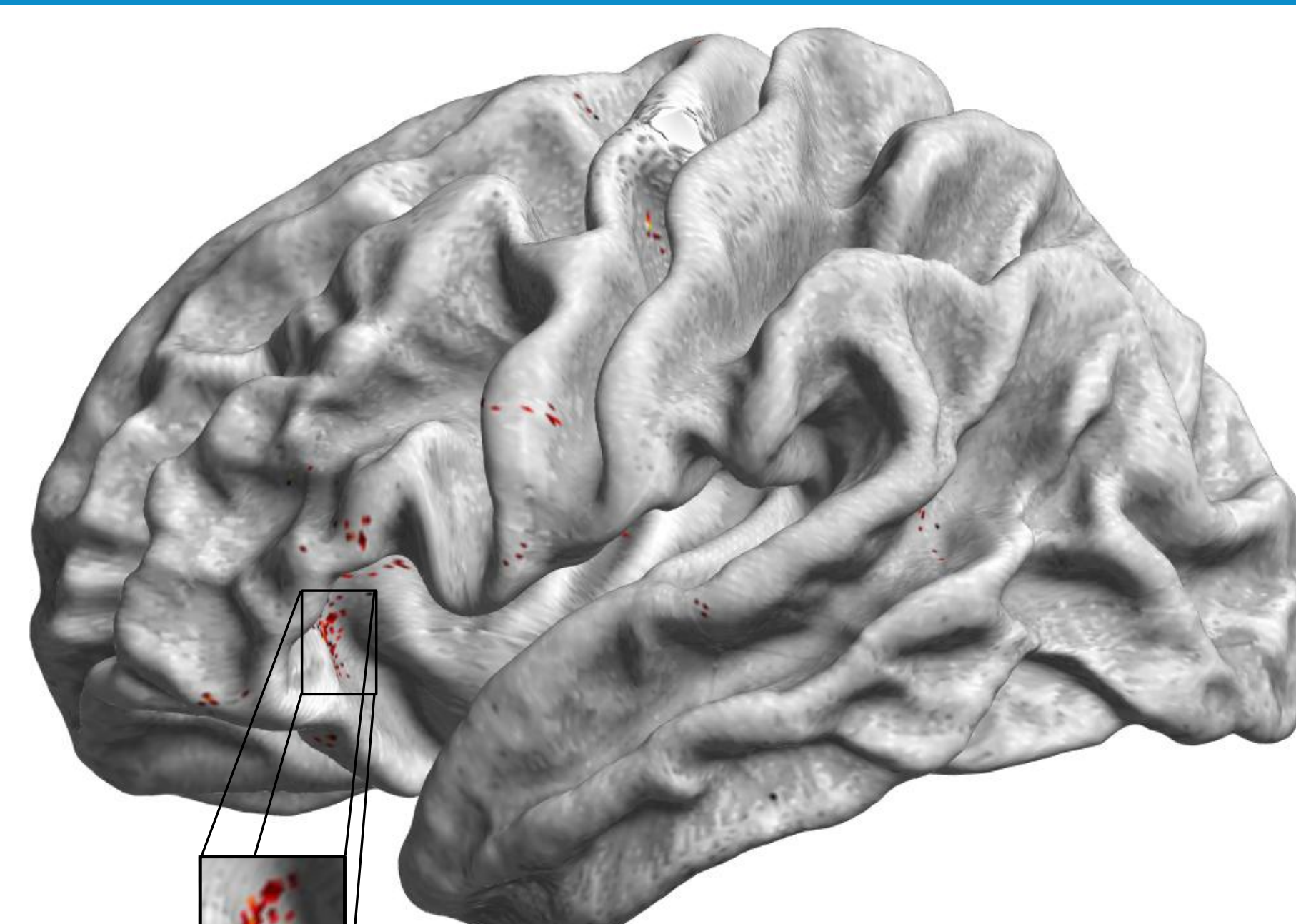
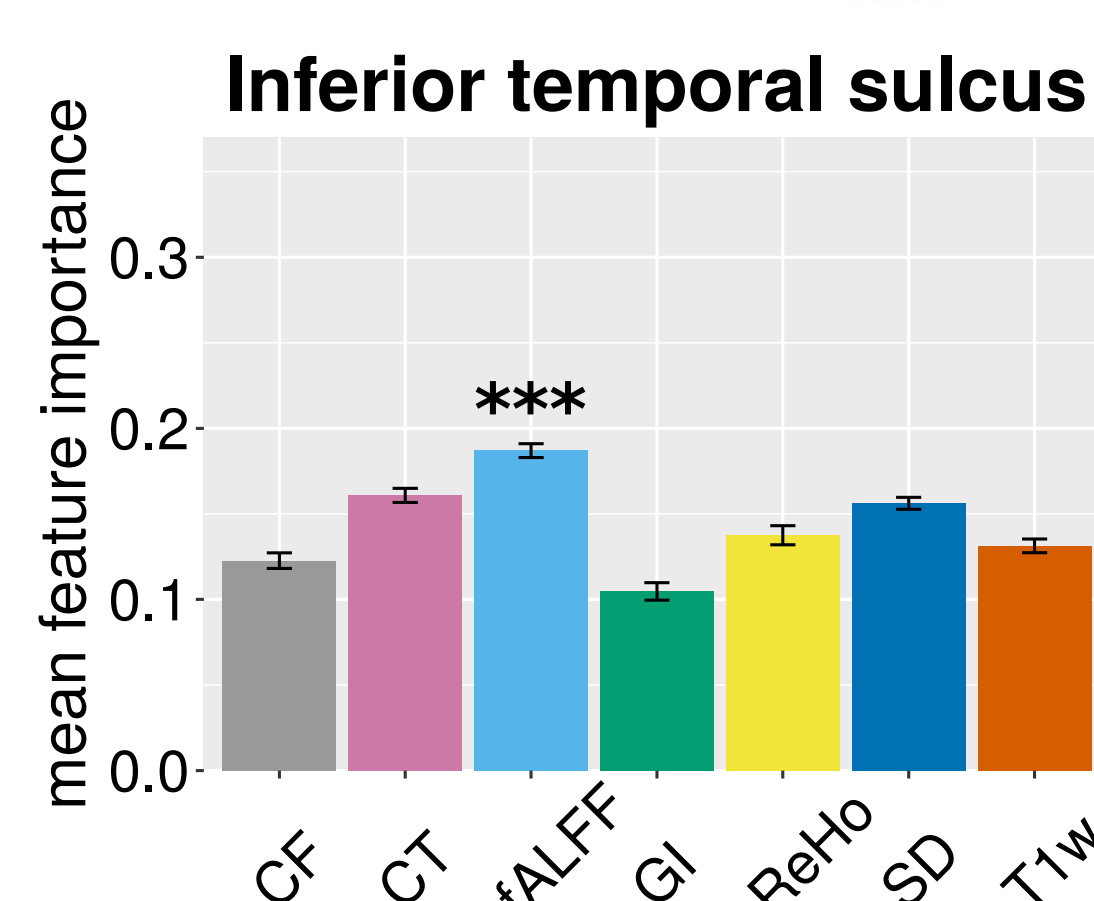
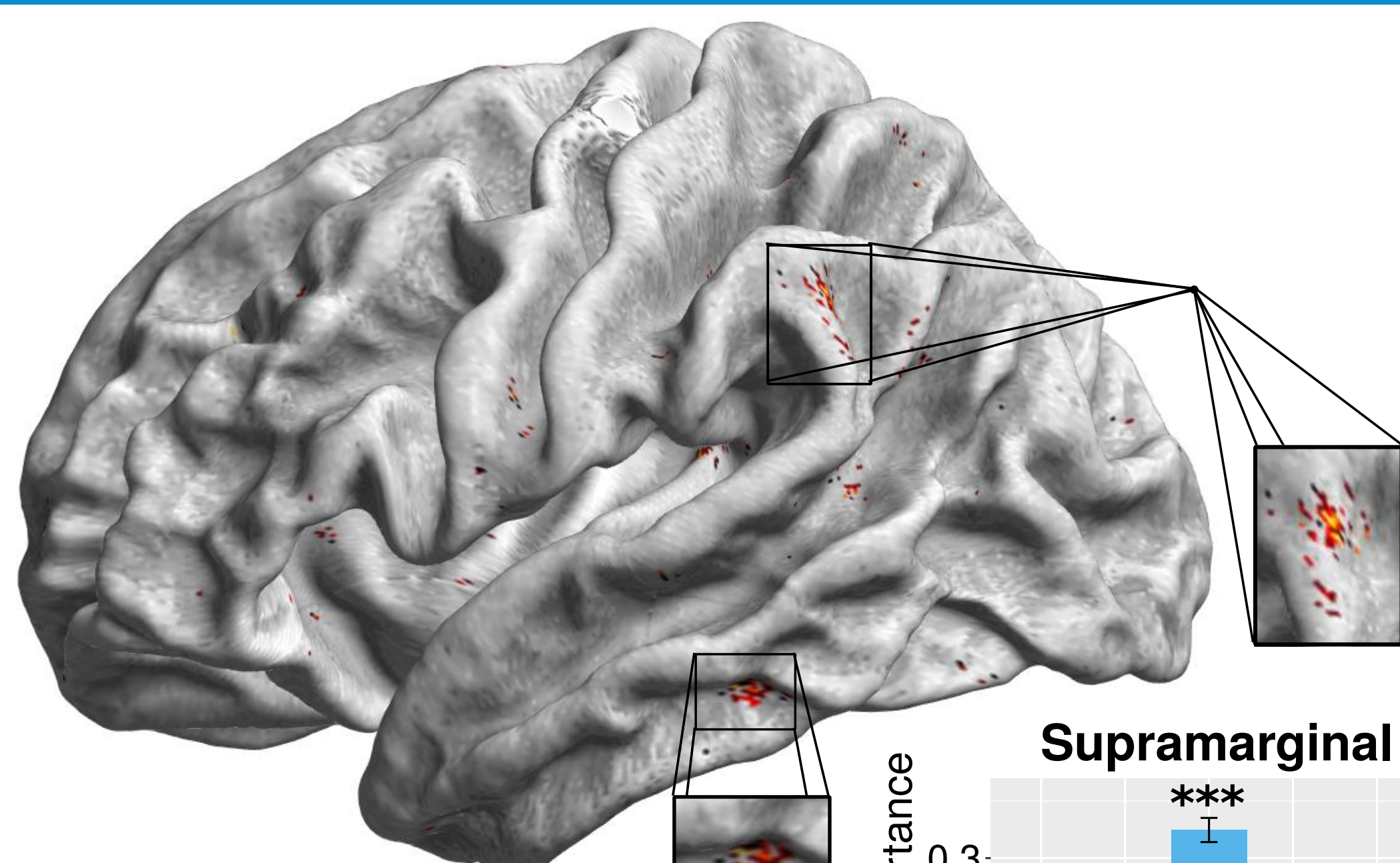
Regional functional homogeneity (ReHo)

Zang et al., 2004

## Results

**Before literacy instruction (5 years)**

**After literacy instruction (8 years)**

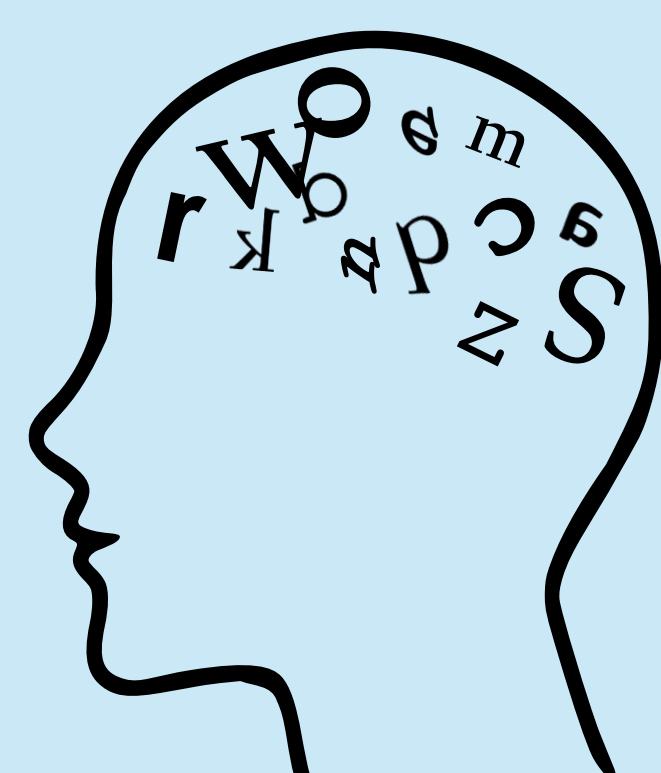


\*\*\* = significantly different from all ( $p < 0.001$ ); \* = significantly different from all ( $p < 0.05$ )

## Discussion & Conclusion

### Before literacy instruction

- Left occipito-temporal cortex
  - close to the 'visual word form area' Skeide et al., 2016
- Left supramarginal gyrus
  - grey matter increase with literacy Carreiras et al., 2009
- Left superior temporal sulcus
  - integration of letters and speech sounds van Attefeldt et al., 2004



### After literacy instruction

- Left circular sulcus of the insula
  - deficient temporal processing of speech and non-speech sounds Steinbrink et al., 2009
- Left superior temporal sulcus
  - integration of letters and speech sounds van Attefeldt et al., 2004

Classification performance is **differentially driven by various cortical features.**

Discriminative of dyslexia outcome prior to reading: **Regions later forming the reading network**

## References

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