

# BRAIN ACTIVATION DURING AUDITORY STATISTICAL LEARNING PREDICTS ADULTS' VOCABULARY

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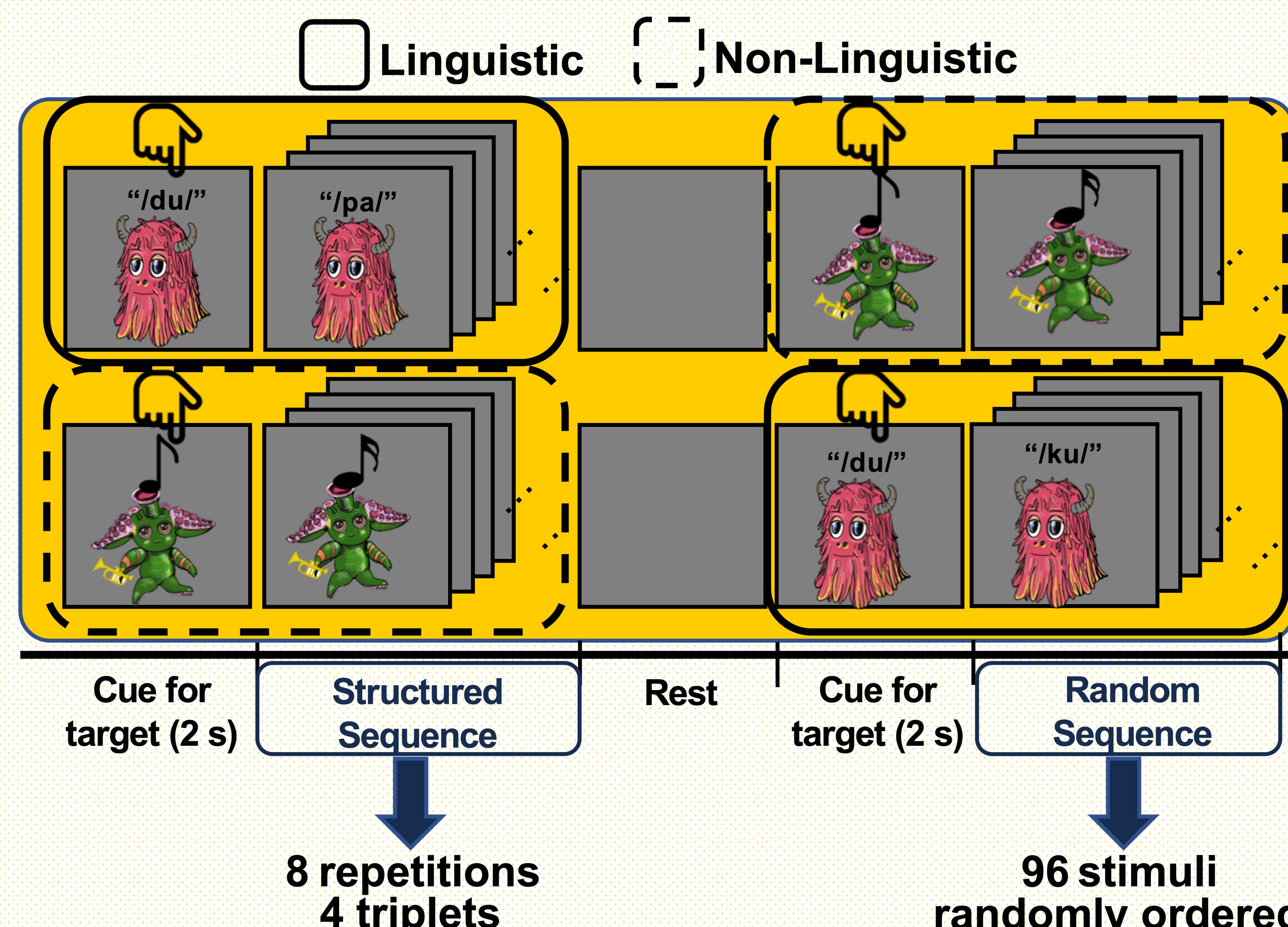


The ability to recognize and extract statistical regularities from the environment, known as statistical learning (SL), is critical for first language development.

The current study investigates how individual differences in linguistic knowledge relate to variability in brain activation across domains during auditory SL.

## fMRI Statistical Learning Paradigm<sup>1</sup>

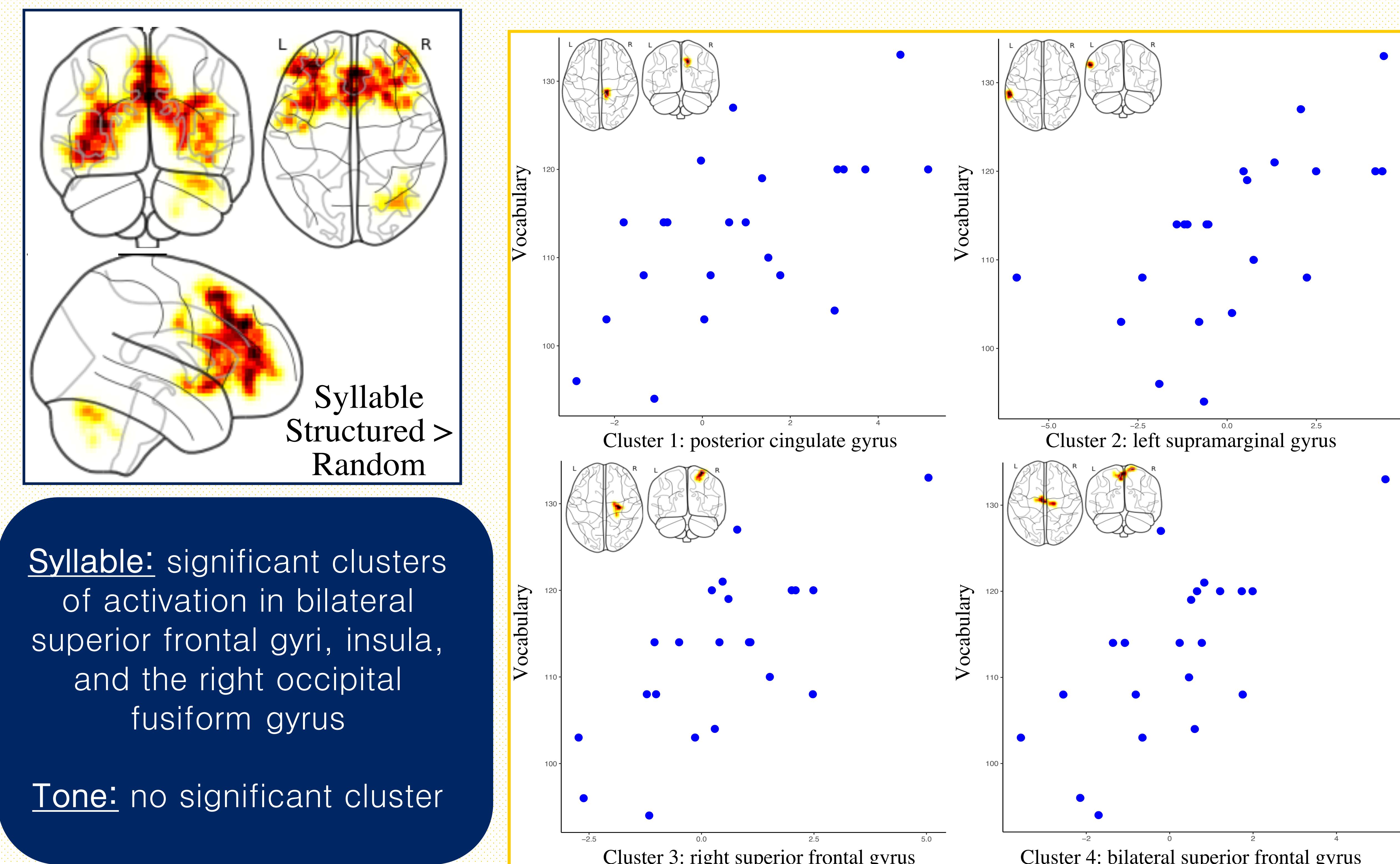
- Stimuli was presented auditorily
- Participants were assigned a triplet final target to attend to
- Response time across the exposure period was recorded



- Behavioral data analysis was executed in R<sup>2</sup>
- Functional MRI data preprocessing was executed with fMRI prep<sup>3</sup> and higher-level analyses utilized FSL Version 5.0.10<sup>4</sup>
- Voxel-level and cluster-level thresholds were set at  $p < .01$

Twenty-two right-handed, monolingual adults participated in this study ( $M_{age} = 20.75$ ,  $N$  males = 8). Participants completed the Picture Vocabulary Test (NIH Toolbox) before entering the scanner.

	Structured Mean (SD)	Random Mean (SD)	Paired Samples T-test
Syllable (Linguistic)	632.3 (98.9)	680.9 (48)	$t(21) = -2.36, p = 0.03$
Tone (Non-linguistic)	433.8 (176.4)	444.3 (158.1)	$t(21) = -0.28, p = 0.78$



**Syllable:** significant clusters of activation in bilateral superior frontal gyri, insula, and the right occipital fusiform gyrus

**Tone:** no significant cluster

Greater activation at the following four clusters for the syllable task, rather than the tone task, is associated with vocabulary size: posterior cingulate gyrus, left supramarginal gyrus, and bilateral superior frontal gyri.

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- Our findings elucidate the neural substrates of auditory statistical learning including bilateral superior frontal gyri.
- Greater activation in bilateral superior frontal gyri in the speech condition is related to higher vocabulary in adult learners.

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2. RStudio Team, 2016. 3. Esteban, O., Markiewicz, C. J., Blair, R. W., Moodie, C. A., Isik, A. I., Erramuzpe, A., ... & Oya, H. (2019). fMRIprep: a robust preprocessing pipeline for functional MRI. *Nature methods*, 16(1), 111–116. 4. Jenkinson, M., Beckmann, C. F., Behrens, T. E., Woolrich, M. W., & Smith, S. M. (2012). Fsl. *Neuroimage*, 62(2), 782–790. 5. Mestres-Missé, A., Camara, E., Rodriguez-Fornells, A., Rotte, M., & Münte, T. F. (2008). Functional neuroanatomy of meaning acquisition from context. *Journal of Cognitive Neuroscience*, 20(12), 2153–2166. 6. Cunillera, T., Càmara, E., Toro, J. M., Marco-Pallares, J., Sebastián-Galles, N., Ortiz, H., ... & Rodríguez-Fornells, A. (2009). Time course and functional neuroanatomy of speech segmentation in adults. *Neuroimage*, 48(3), 541–553.