Correlation between brain and behavior: insights into the processing of statistical information

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Introduction

The processing of continuous and complex auditory signals such as speech relies on the ability to use statistical cues, such as transitional probabilities (TP). Prior work using functional neuroimaging has identified the inferior frontal gyrus, the superior temporal plane, and the inferior parietal cortex as being sensitive to auditory statistical information, such as TP [1-5]. The current study seeks to identify regions in which cortical thickness (CT) correlates with sensitivity to statistical structure.

Method

Stimuli and task: 8.8sec sequences of 32 syllables or non-speech sounds (bird songs).

- The statistical regularity of auditory sequences (3 levels) was manipulated by varying the mean strength of transition probabilities between sounds.
- Participants rated the degree of regularity perceived in the sequences (scale of 1 [low regularity] to 7 [higher regularity])

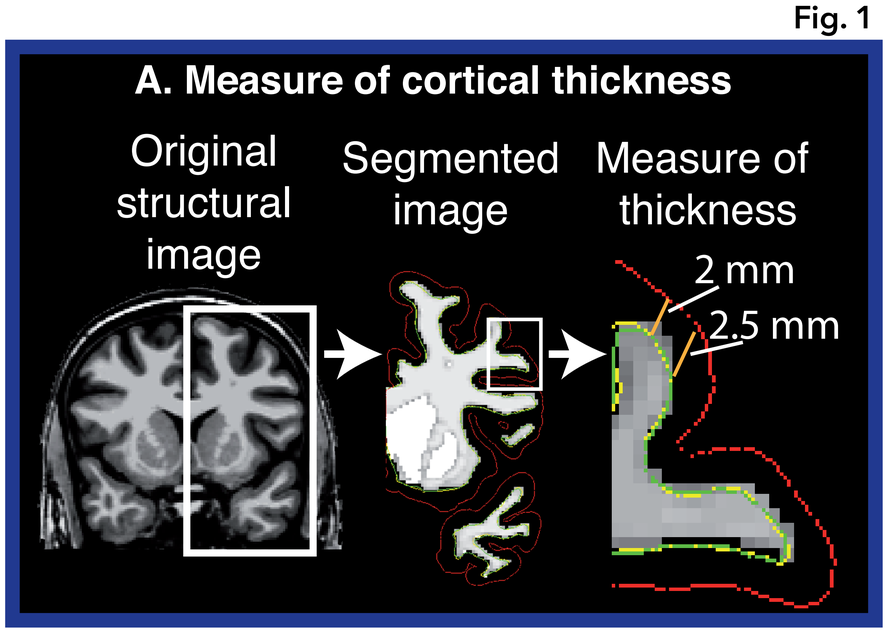
Image acquisition: High resolution anatomical scan (4T Bruker MRI system).

Behavioral data analyses: We defined each person's sensitivity to regularity as the correlation between sequence entropy and ratings.

Image analyses: Whole-brain CT measures were obtained by calculating the closest distance from the grey/white boundary to the grey/CSF boundary at each vertex[6](Fig. 1).

- Whole-brain linear regressions with index of sensitivity as covariate.

Fig. 1



Results

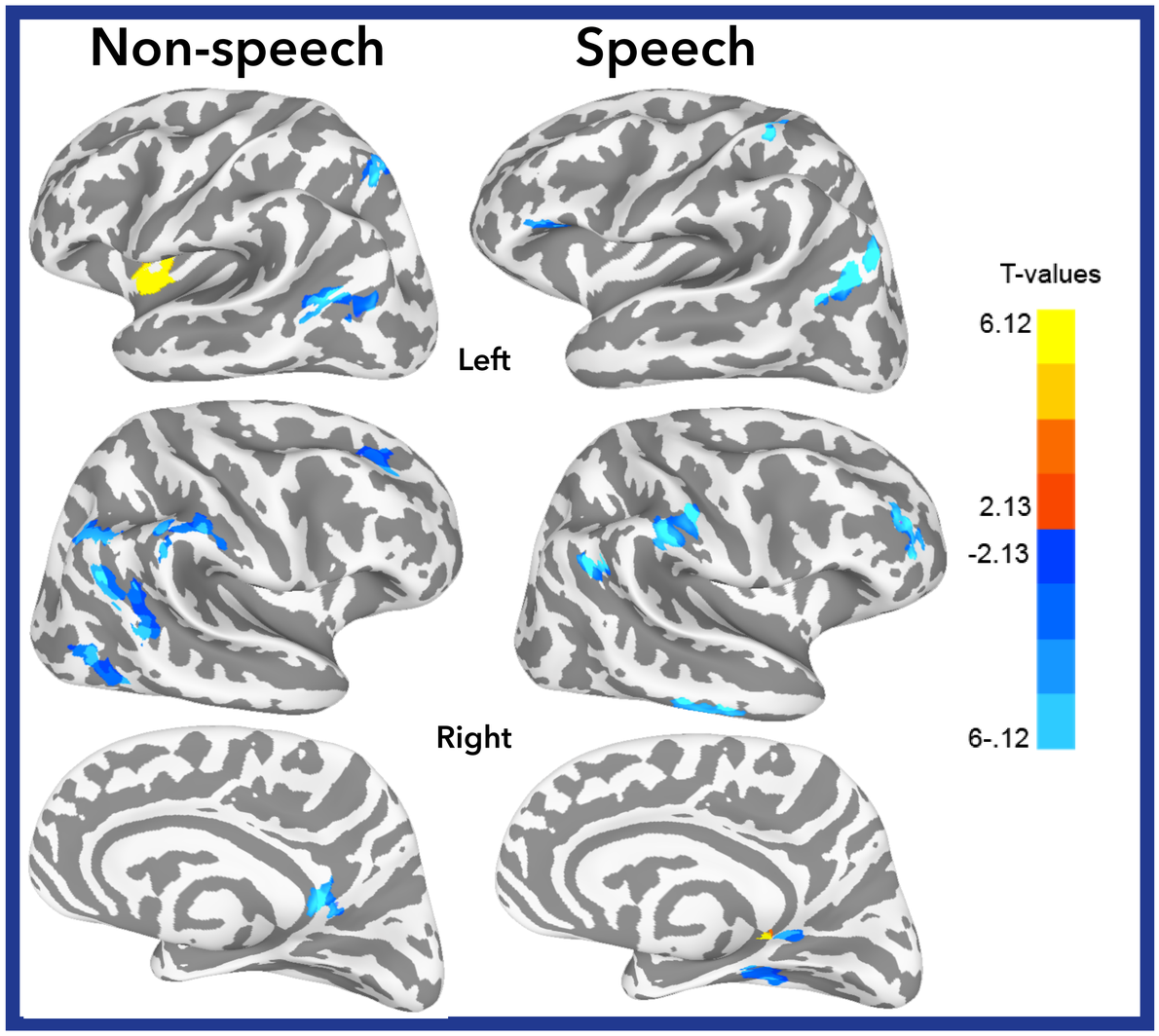


Fig.2

Conclusions

Inter-individual differences in the anatomy of specific cortical structures correlate with sensitivity to statistical information in auditory stream. We identified regions that are typically associated using fMRI with statistical processing (STS, IFG) and regions that are not (SMG, SFS). This highlights the strength of the morphometric approach, namely that it can link regional structural variations to cognitive mechanisms, even when these regions might not discriminate between different levels of statistics as measured using BOLD fMRI.

References

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