

The interplay between information status and prosody in the brain

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BACKGROUND

Information Status (IS) distinguishes between given (old) and new information in discourse. This distinction supports efficient communication, but its neural basis remains poorly understood. This study aims to contribute to a better understanding of how IS is represented and processed in the brain and how it interfaces with prosodic prominence.

METHODS

Using fMRI, we examined the neural mechanisms underlying IS and its interaction with prominence, defined phonologically (PP) or acoustically (AP). 205 Dutch participants passively listened to 2 narratives annotated for IS, PP, and AP (Fig 1).

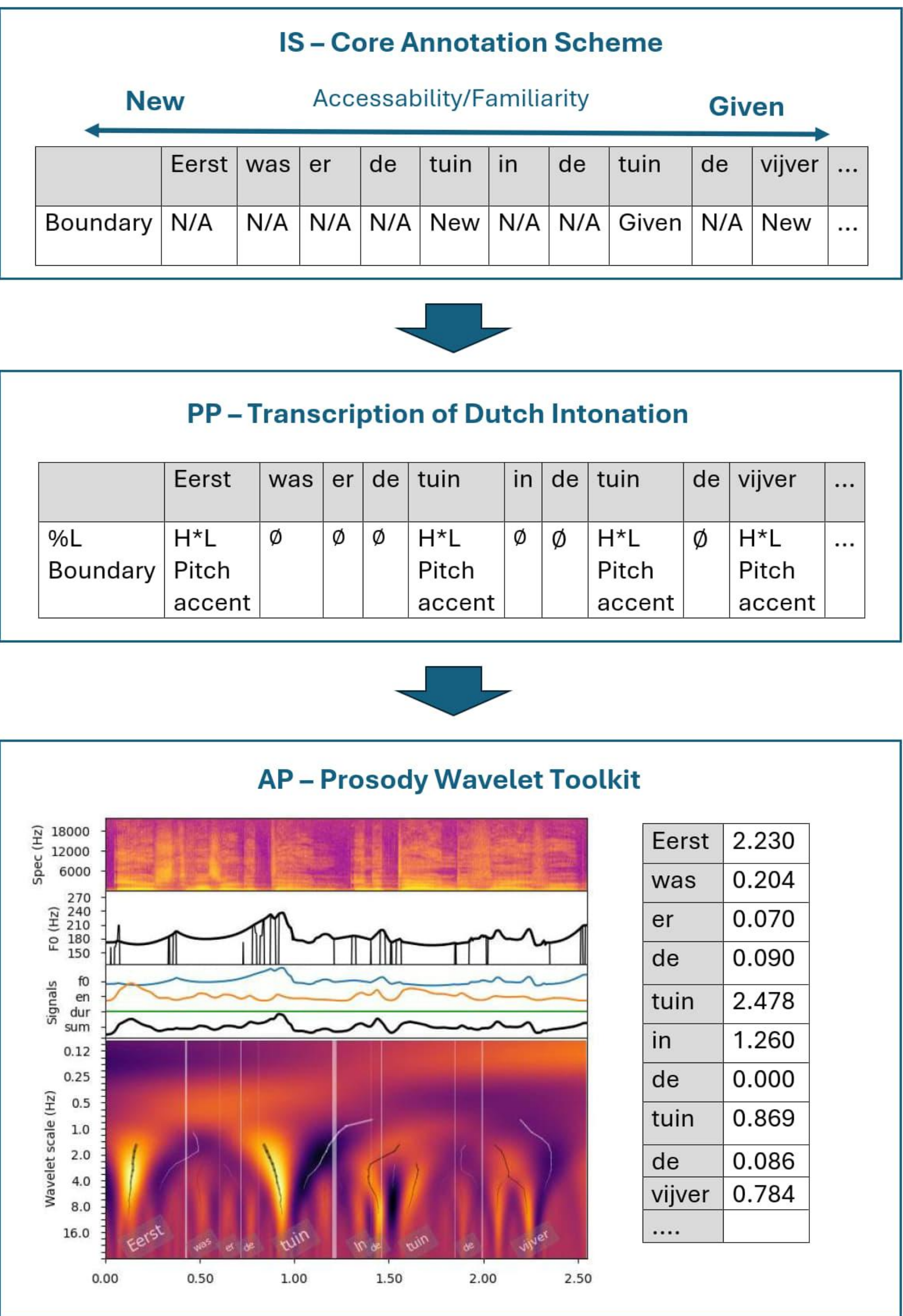


Fig 1. Top: Referents annotated as new vs. given (IS); Middle: Referents transcribed as pitch-accented vs. non-accented (PP); Bottom: Acoustic measures extracted for each referent (AP)

RESULTS

Across both narratives, new information consistently showed greater prosodic prominence than given information, with higher AP and a higher likelihood of PP (Fig 2).

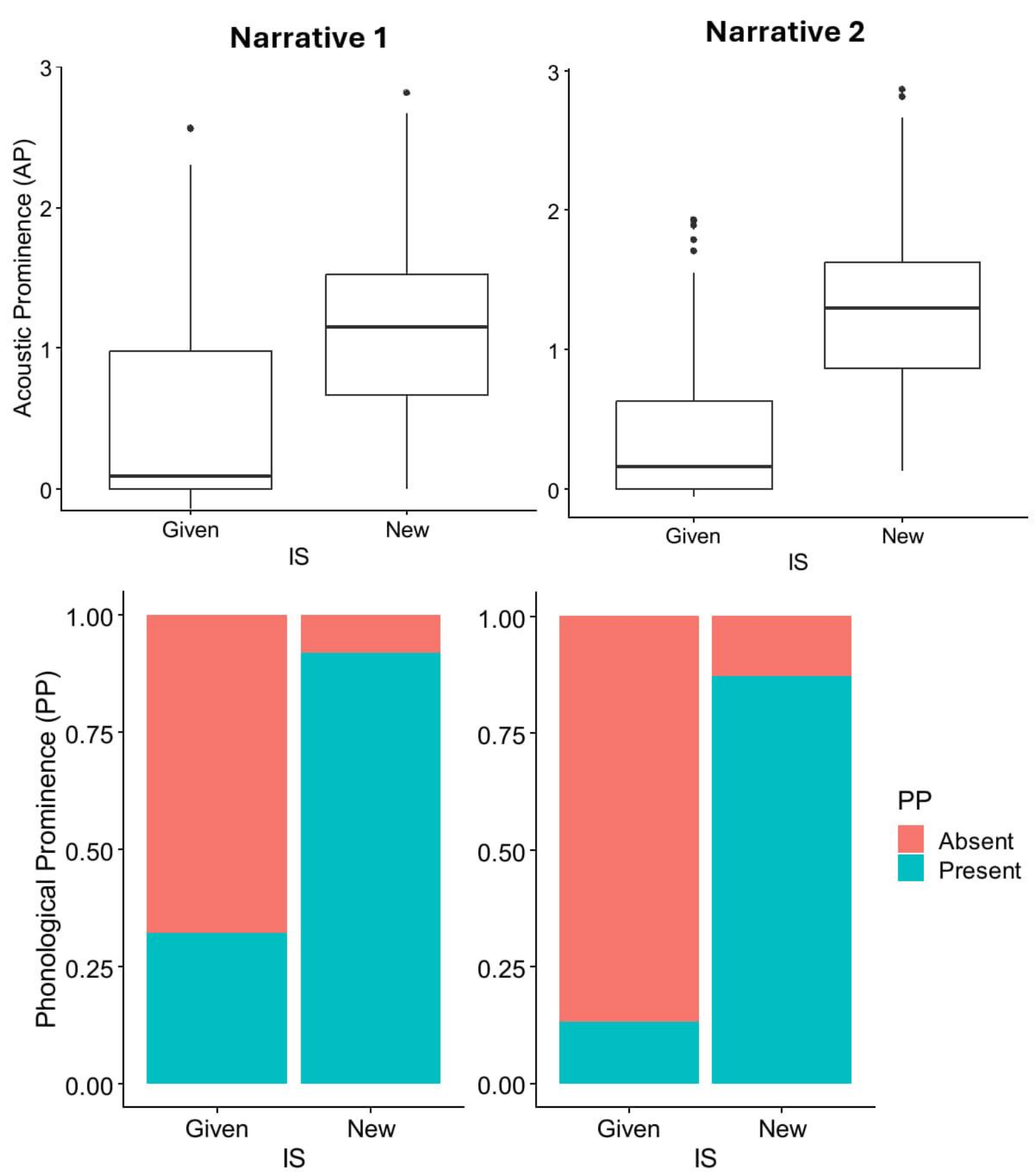


Fig 2. Boxplots show acoustic prominence (AP) distributions, and stacked bars show the proportion of phonological prominence (PP) for given and new words.

Whole-brain analysis showed widespread bilateral activation in classical language areas during word comprehension.

PP activated areas similar to baseline word processing. In contrast, new information elicited a broader network, including a major dorsolateral prefrontal cortex (DLPFC) cluster, while AP showed similar activation with greater involvement of the angular gyrus (AG) (Fig 3).

Large-scale cortical network analysis indicated that AP is predominantly associated with activation of the dorsal attention network (DAN) and IS with the frontoparietal control network (FPN) (Fig 4).

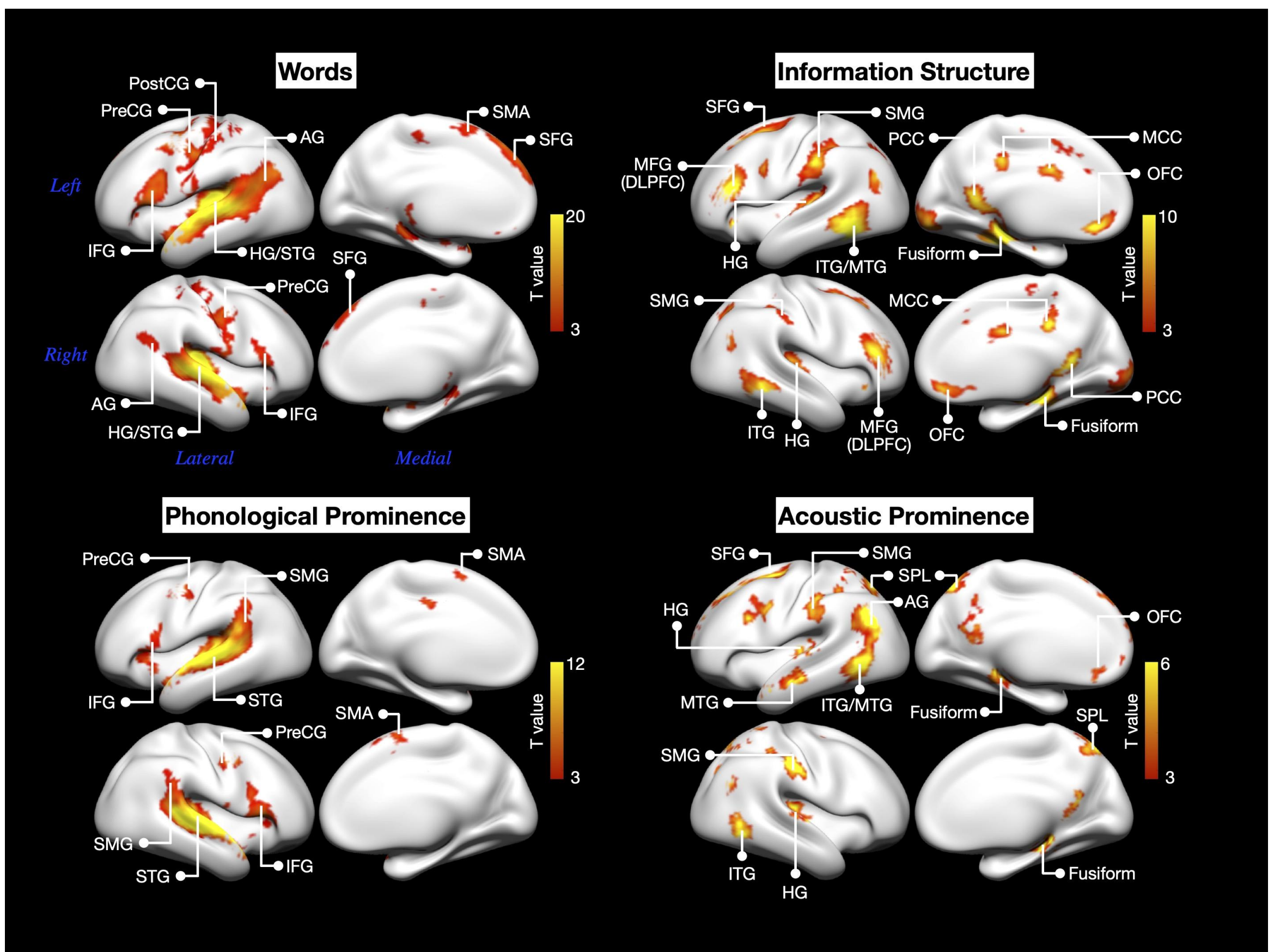


Fig 3. Whole-brain fMRI activations for words, information status (IS), acoustic prominence (AP), and phonological prominence (PP) in the left and right hemispheres, with major activations clusters marked. Pre/Post CG: Pre/Post Central Gyrus, AG: Angular Gyrus, IFG: Inferior Frontal Gyrus, HG: Heschl's Gyrus, STG: Superior Temporal Gyrus, SMA: Supplementary Motor Area, SFG: Superior Frontal Gyrus, MFG: Middle Frontal Gyrus, DLPFC: Dorsolateral Prefrontal Cortex, SMG: Supramarginal Gyrus, ITG: Inferior Temporal Gyrus, PCC: Posterior Cingulate Cortex, MCC: Middle Cingulate Cortex, OFC: Orbitofrontal Cortex, SPL: Superior Parietal Lobule

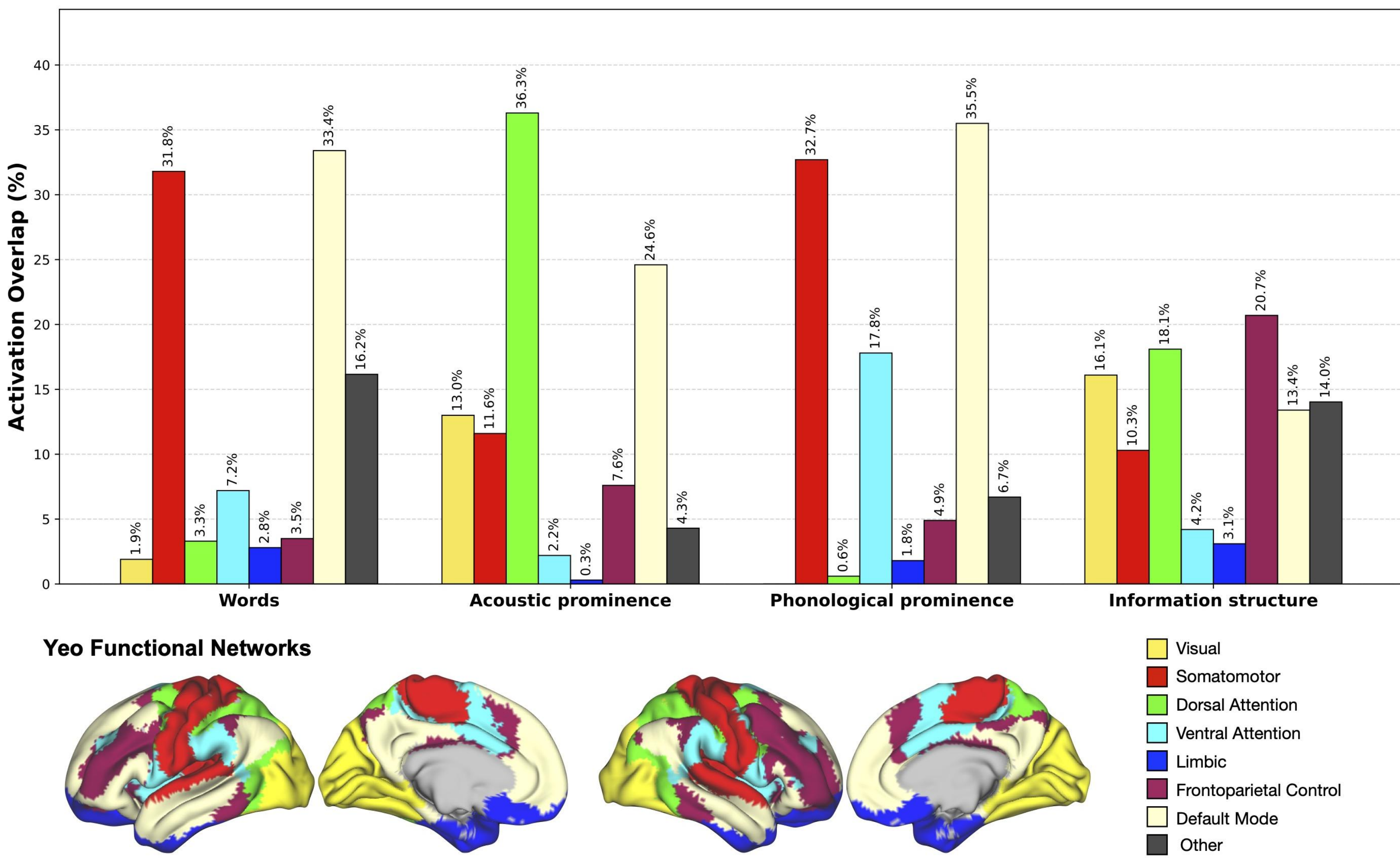


Fig 4. Overlap of activations with functional networks defined by the Yeo atlas.

SUMMARY

- Processing new information is cognitively demanding. It requires updating the discourse model and reallocating attention.
- The DLPFC supports pragmatic functions such as discourse management, while the AG contributes to reorienting attention toward salient information. Together, the DLPFC and AG, and correspondingly IS and AP, may interact to modulate discourse comprehension in response to new information.
- The FPN and DAN support this cognitively demanding process through complementary roles in information integration and attentional orienting, respectively.
- In short, new information demands cognitive effort, and prosody directs attention to what matters.

