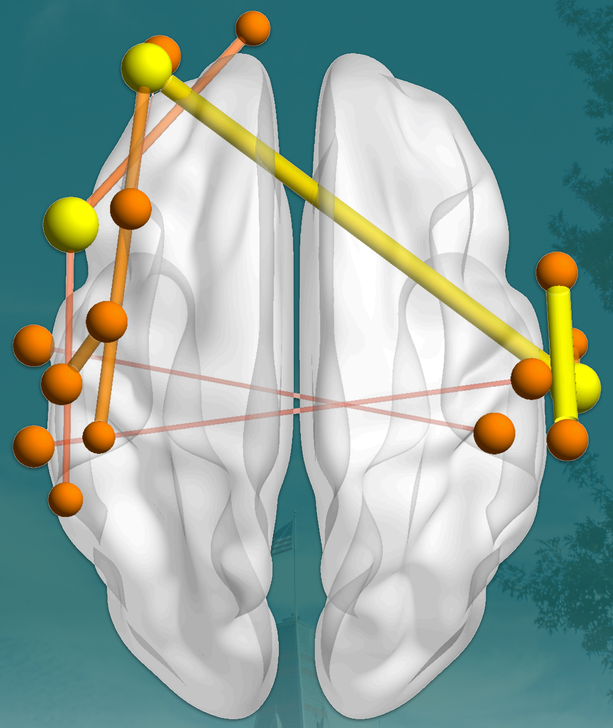
Middle frontal gyrus involved in degraded speech processing



Hierarchical neural networks for degraded speech processing

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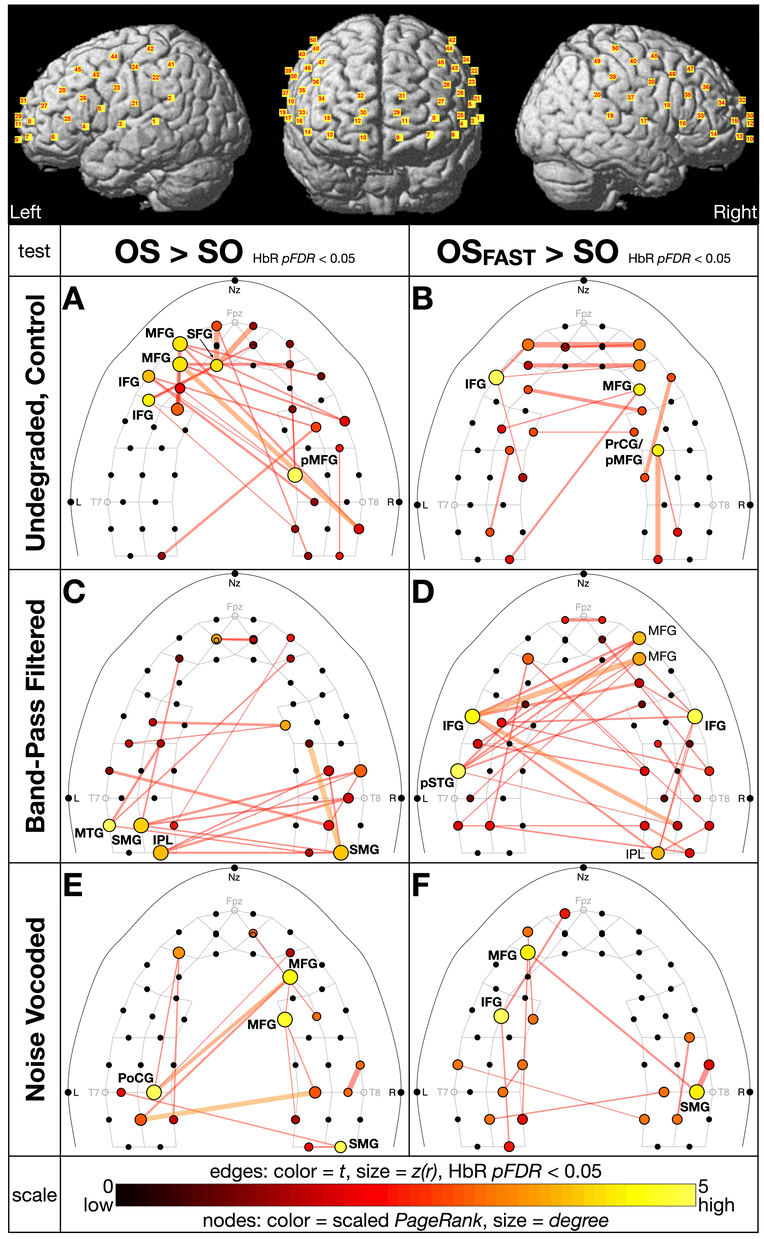
Introduction

Decades of research have implicated a wide range of cortical areas involved with degraded speech processing[1,2] and listening effort[3,4], but exactly how these areas are functionally organized to perform such complex tasks is not well understood. We studied how degraded speech impacts neural networks between **attention** (prefrontal, PFC) and **language** (left temporal-parietal, LH) brain areas in humans.

Methods

- **fNIRS** brain imaging data from **N = 29** young adults
- **Coverage** of frontal and L/R temporal-parietal cortices
- **Syntax** plausibility judgment (auditory only + behavior)
- **2x2x3**: syntax, rate, clarity
- **Functional connectivity** (FC) NIRS Brain AnalyzIR Toolbox
- **Corrected** for multiple comparisons

White & Langdon (2021)



Results

- Band-pass filtered and noise vocoded degraded speech impacted FC **differently**.
- FC was sensitive to **multiple challenges** (adding speed).
- **MFG not FC to LH** during control and disengagement.
- **MFG FC to LH** during active degraded speech processing.

Discussion

These findings inform us about the cortical organization that subserves degraded speech processing, the computational demands required for success, and how networks in the PFC and LH come together to overcome listening challenges.

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1. Mattys, Davis, Bradlow, & Scott (2013). Speech recognition in adverse conditions: A review. *Lang Cognitive Proc.*
2. Alain, Du, Bernstein, Barten, & Banai (2018). Listening under difficult conditions: An activation likelihood estimation meta-analysis. *Hum Brain Mapp.*
3. Peelle (2018). Listening effort: How the cognitive consequences of acoustic challenge are reflected in brain and behavior. *Ear Hear*.
4. White & Langdon (2021). The cortical organization of listening effort: New insight from functional near-infrared spectroscopy. *NeuroImage*.