# Task-dependent functional connectivity of language-selective regions



## Arielle Moore<sup>1</sup>, Terri Scott<sup>1,2</sup>, Emily Stephen<sup>3</sup>, Tyler Perrachione<sup>4</sup>

<sup>1</sup>Graduate Program for Neuroscience, Boston University; <sup>2</sup>Weill Institute of Neurosciences, University of California – San Francisco; <sup>3</sup>Department of Mathematics & Statistics, Boston University; <sup>4</sup>Department of Speech, Language, & Hearing Sciences, Boston University

## Summary

What dynamics characterize the language network during speech processing, and how does it interconnect with activity in the broader brain? Conventional studies on cortical speech processing customarily examine brain activations to speech averaged at the group level and over time<sup>1</sup>. Here, we examine changes in functional connectivity that occur when listening to meaningful speech. We first identify maximally language-selective brain regions using GCSS<sup>4,5</sup>. Then, using gPPI<sup>2,3</sup> we analyze changes in task-dependent functional connectivity both within the language network and to the rest of the brain. Overall, these results indicate increased functional coupling among individually-defined language areas when listening to speech but decreased functional coupling to regions outside of the core language network.

## Language Network Task-Dependent Connectivity

Key Result: Primarily *increased functional coupling* from individually-defined seed fROIs (yellow) to other language fROIs during language processing.



### Methods

**Participants**: N = 28; 16 female, 12 male; age 19-32, mean = 23 years; native English speakers with normal speech, language, hearing, and reading abilities. Task design: Participants listened passively to audio recordings of meaningful, intact speech and unintelligible, degraded speech across two runs. Each run included 16, 18-s blocks of each condition.

## Whole Brain Task-Dependent Connectivity



**fMRI data acquisition**: Block design; TR = 750 ms, 45 axial slices, 5-slice SMS, 3mm<sup>3</sup> voxels, 484 TRs. Task Activation and Parcellation of the Language **Network:** Group-constrained, subject-specific analyses<sup>4,5</sup> yielded parcellation of the *intact* > degraded speech contrast across participants. Individual functional regions of interest (fROI) were defined as the top 10% of active voxels within each parcel and served as seed regions for gPPI analysis.

# Key Result: Exclusively *decreased coupling* between language fROIs and the rest of the brain during language processing (whole-brain group-average). L aSTG L pSTG L MFG **R** Cerebellum L SMA L Hippocampus L SFG L IFG pars orbitalis **R** Temporal pole

#### Parcels

#### **Example fROIs**



fMRI Analysis: Lyman v1.0.0<sup>[X]</sup>, FreeSurfer v6.0.0, FSL v6.0.4; gPPI model terms included: seed, intact and *degraded* task regressors, both seed x task interactions, and motion and outlier nuisance terms.

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