

## Introduction

- Tonically activated "default mode" networks have been observed in functional imaging resting state data <sup>1,2</sup>.
- Resting state activity exhibits robust coupling between homologous regions across the cerebral hemispheres <sup>3</sup>.
- This correlated activity is disrupted in cases of corpus callosum agenesis, suggesting the presence of direct connections between coupled areas <sup>4</sup>.
- We asked if auditory system networks could be identified in resting state data.
- We observed significantly correlated activity across auditory regions, as well as between auditory and visual cortex using anatomically defined regions of interest (ROIs).

## Methods

### Participants

- 31 adults (17 females, 14 males).
- Mean age = 21.13 +/- 2.16 years.

### Structural Imaging

- Acquired at the Stanford Lucas Center 1.5T GE scanner (TR 11 ms; TE 2 ms; flip angle, 15°; 124 x 256 x 256 matrix; 1.5 x 0.9 x 0.9 mm axial sections).
- Left and right hemisphere auditory and visual cortex ROIs were defined for each participant on SPM2 normalized T1 images using anatomical landmarks and MRICRO to create the ROIs.
- Figure 1 shows the ROIs correspond to primary auditory (A1) and visual cortex (V1).
- The ROIs were multiplied by the gray matter segmented image to limit the masks to gray matter regions.

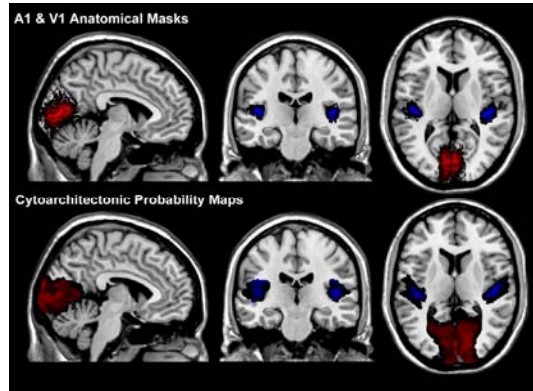


Figure 1. Averaged auditory and visual cortex ROIs (top row) in comparison to cytoarchitectonic probability maps (1-99%) for auditory cortex (Te1.1 and Te1.0) and visual cortex (BA 17) (bottom row). Note the overlap between the auditory and Visual ROIs used in this study and the cytoarchitectonic probability maps <sup>5</sup>.

## Methods (cont.)

### Functional Imaging

- Participants rested with eyes closed for 4 minutes.
- Acquired on the Stanford Lucas Center 3T GE scanner (TR 2,000 ms; TE 30 ms; flip angle, 80°; 1 interleave; 28 4mm thick slices; 0.5-mm skip).
- Averaged activation time series were collected from each co-registered anatomical ROI and used as covariates for a whole brain linear regression.
- Significant correlations between activity in an ROI and regions across the brain were identified based on a peak voxel threshold of  $p < .05$  FDR & cluster extent of  $p < .05$  corrected, after controlling for global gray and white matter signal.
- This activity is typically low frequency signal ( $< .1$  Hz), also observed in optical imaging studies <sup>6</sup>.
- Please refer to Greicius et al. (2003) for additional details regarding the scanning and pre-processing steps.

## Results

- Figures 2, 3, and 4 present functional connectivity results for the auditory and visual cortex ROIs, respectively. Similar left and right visual cortex ROI results were observed (right hemisphere ROI results not shown).

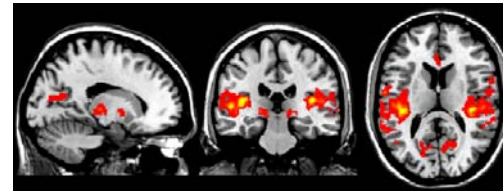


Figure 2. Group results for the left auditory cortex ROI. Note the correlated activity in bilateral superior temporal gyrus, the posterior thalamus, and anterior calcarine sulcus.

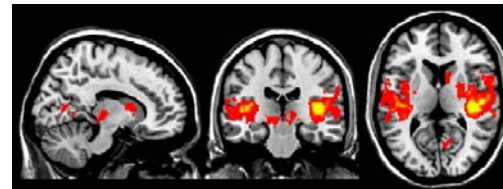


Figure 3. Group results for the right auditory cortex ROI. Note the correlated activity in bilateral superior temporal gyrus, the posterior thalamus, and anterior calcarine sulcus. Also note the similarity to the left hemisphere auditory cortex ROI results above.

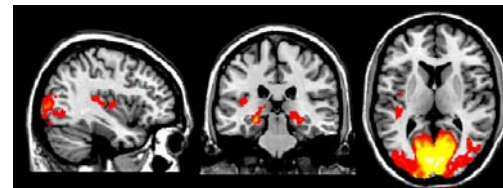
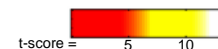


Figure 4. Group results for the left visual cortex ROI. Note the correlated activity in the medial Heschl's gyrus. The left and right hemisphere visual cortex ROIs exhibit bilateral correlations with medial auditory cortex lower statistical thresholds.



## Results & Discussion

- Consistent with previous resting state studies, we observed 1) correlated activity in the homologous contralateral region of each ROI, and 2) correlated activity in close proximity to the ROI.
- Correlated activity was observed between auditory cortex and the posterior thalamus. The thalamic activity appears to include the medial geniculate nucleus.
- Auditory and visual cortex activity was surprisingly correlated. This association was verified using visual cortex ROIs.
- Because the anterior visual cortex activity likely represents peripheral visual field in our subjects, we predict that the auditory and visual cortex activity represents a system primed for detecting new stimuli entering the environment.

## References

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