Anatomical Connectivity of Temporal Voice Areas

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ANATOMICAL CONNECTIVITY OF TEMPORAL VOICE AREAS

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Objective

We used a combination of functional Magnetic Resonance Imaging (**fMRI**) and diffusion Magnetic Resonance Imaging (**dMRI**) to investigate structural connectivity of voice sensitive areas located along and within the superior temporal sulcus. These **temporal voice areas (TVAs)** are grouped in three clusters of functional activation in each hemisphere, with an anterior TVA (**aTVA**), middle TVA (**mTVA**), and posterior TVA (**pTVA**). A lateralisation with greater activity in the right hemisphere was observed in previous fMRI studies (Belin et al. 2000). Structural connectivity was investigated for each cluster individually.

Fibre Tracking

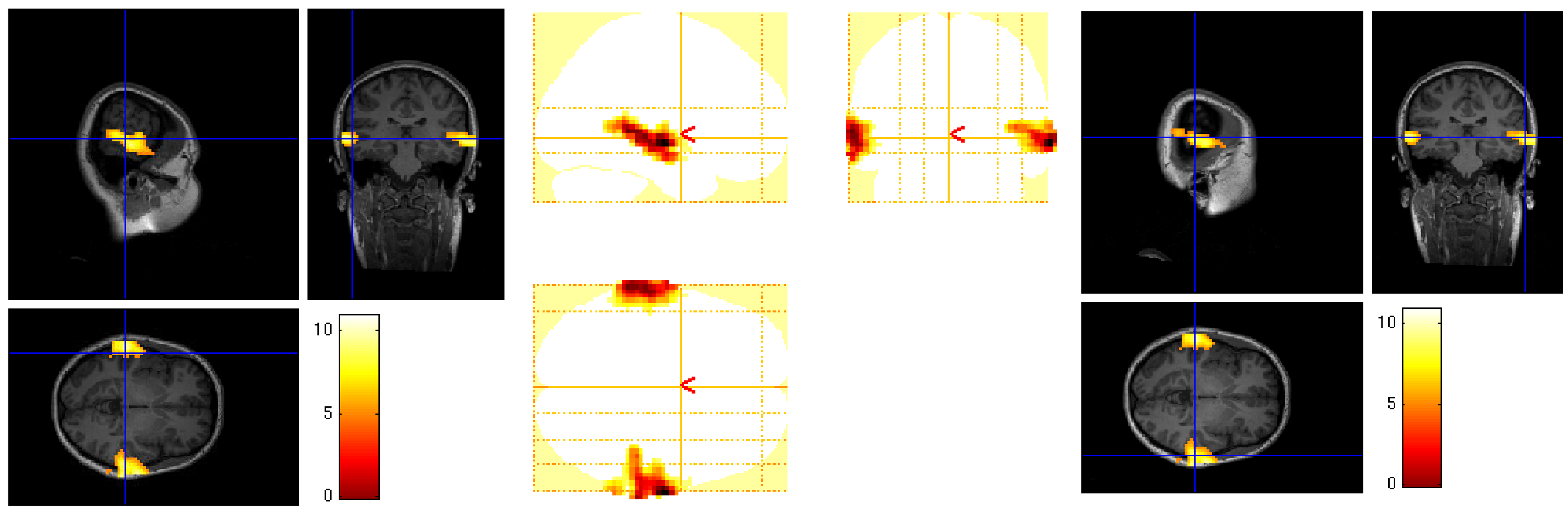
Connectivity was estimated using FDT (FMRIB Toolbox) and a local model of fibre bundles orientation in each voxel was derived using BEDPOSTX . Probabilistic fibre tractography was computed for each subject, using PROBTRACKX with seed masks (radius = 5mm). Coordinates previously reported (Pernet et al., in review) were used as seed regions to create the group connectivity maps displayed on the right: *aTVA* (MNI coordinates, left: -55, -8, -3; right: 55,-2,-7), *mTVA* (left: -55, -18, -3; right: 53, -18, -3) and *pTVA* (left: -46, -38, 2; right: 55, -2, -7).

Voice Localizer

The voice localizer sequence consists of 60 8-second blocks (16 bit, mono, 22050 Hz sampling rate), including 20 blocks of silence, 20 blocks of only human vocal sounds (speech and non-speech), and 20 blocks of only non-vocal sounds (industrial sounds, environmental sounds, animal vocalizations).

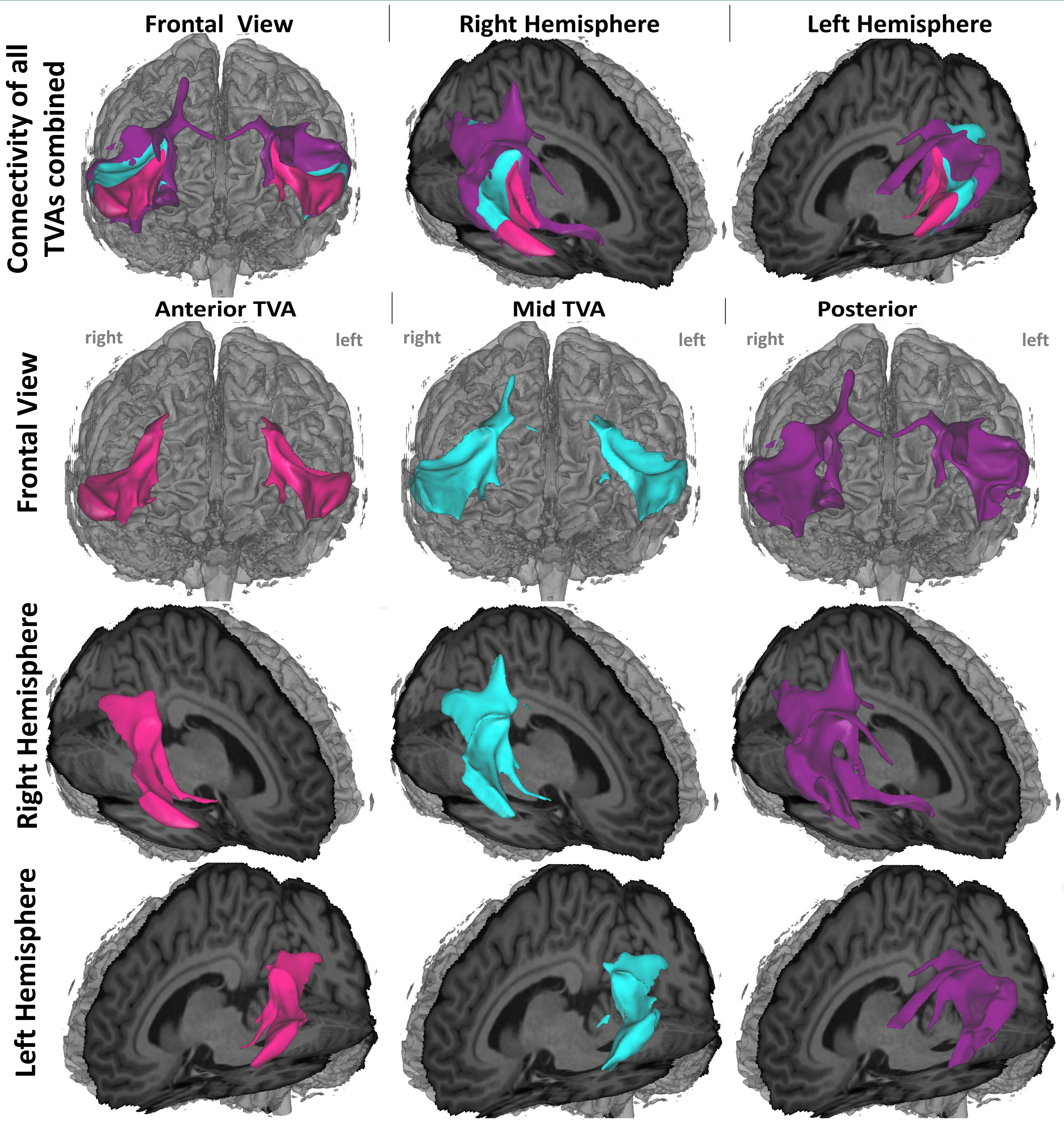
The localizer lasts about 10 minutes and is based on the contrast of vocal vs. non-vocal sounds (Belin et al., 2000). The stimuli can be retrieved from: **http://vnl.psy.gla.ac.uk/resources.php**

RESULTS: Functional MRI



Voice > Non-Voice contrast for one example subject. Areas with significantly ($p < 0.05$, FWE corrected) greater BOLD activity in the vocal vs. non-vocal condition. Activation is greatest along the STS, as expected based on previous studies. Significant voxels were superimposed on the subjects own anatomical scan on the right (left hemisphere in sagittal view) and left (right hemisphere in sagittal view). The middle figure is a glass brain representation of significant voxels.

RESULTS: Diffusion MRI



Group connectivity maps based on the mean of all participants, displayed with a single subject template anatomy. The posterior cluster (purple) shows greater long-range connectivity to the frontal lobes than the anterior (pink) and middle (blue) cluster (FA = 0.5, Visualisation Threshold = 0.4); 3D view available at: http://bit.ly/1KYLgHr

REFERENCES

- Belin, Zatorre, Lafaille, Ahad, & Pike (2000). *Nature, 403*, http://dx.doi.org/10.1038/35002078
- Pernet et al., (in review). *The Human Temporal Voice Areas: Spatial Organisation and Inter-Individual Variability.*