

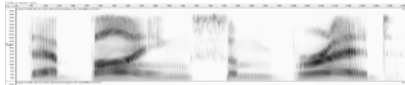
The Neurobiology of Speech Perception

Dr. Sophie Scott

Disorders of Language Module
MSc Cognitive Neuropsychology



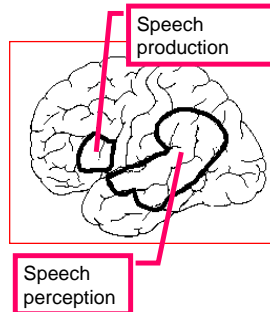
They're buying some bread



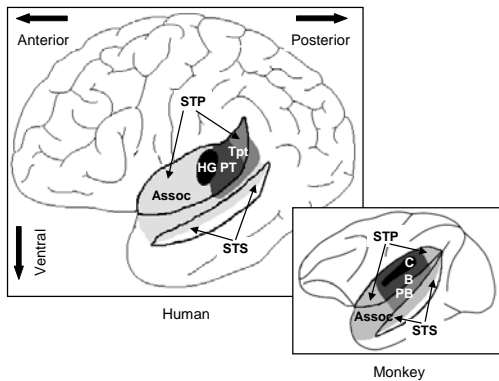
Speech is a very complex signal.

- Noise
- Silence
- Quasi-periodic
- Formant structure
- Formant change
- Dynamic pitch variation

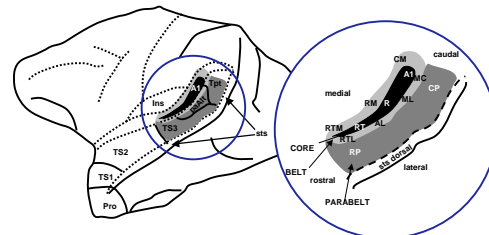
Streams of processing in the auditory system

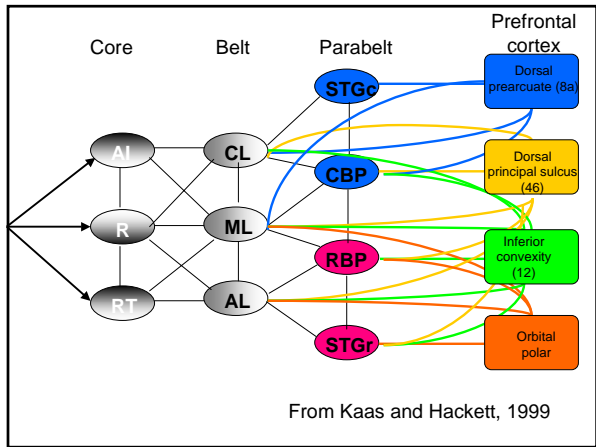
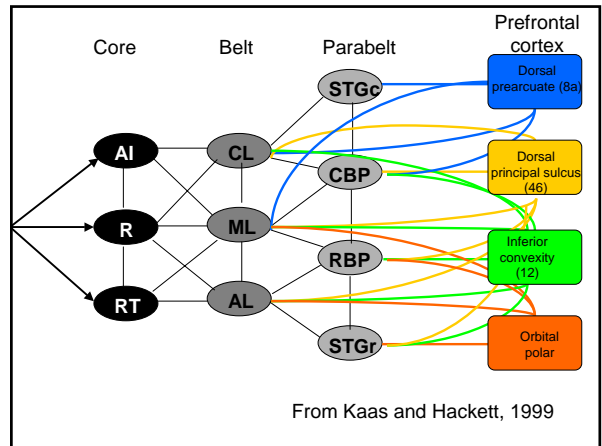
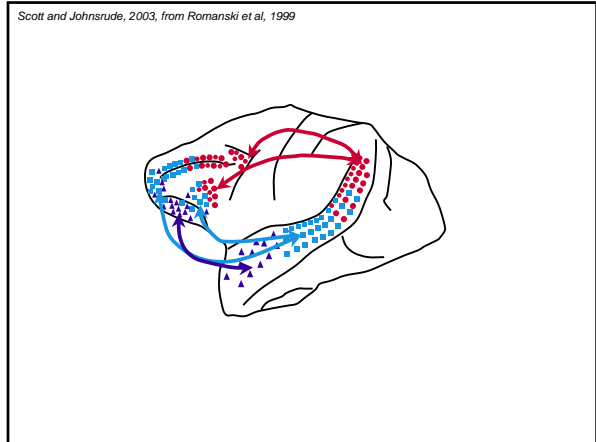


The evidence from human patient studies has identified a prefrontal region involved in speech production (Broca's area) and a large temporo-parietal region involved in speech perception (Wernicke's area). This latter region encompasses a very large area of cortex: these studies investigate functional specialisation within this system, and any potential processing streams within this.



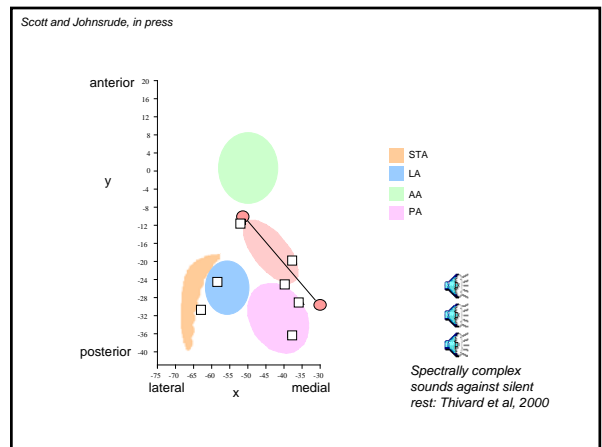
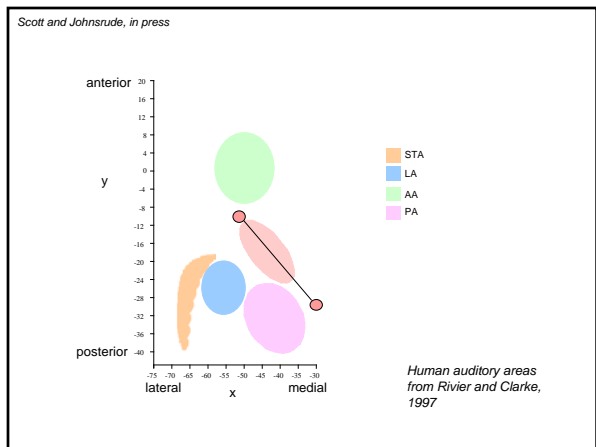
Scott and Johnsrude, 2003, from Romanski et al, 1999

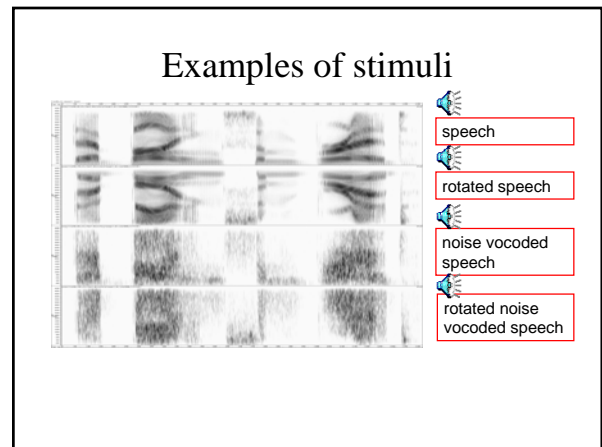
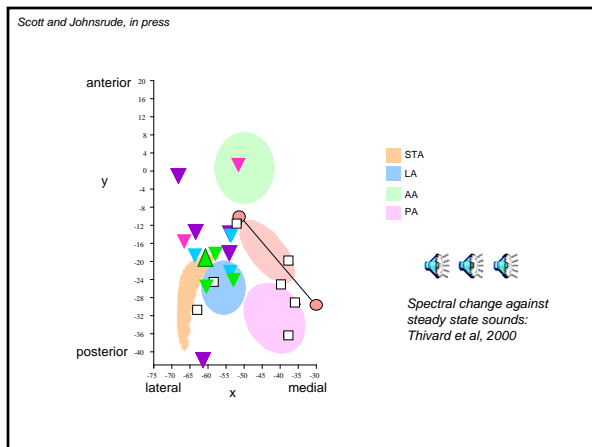
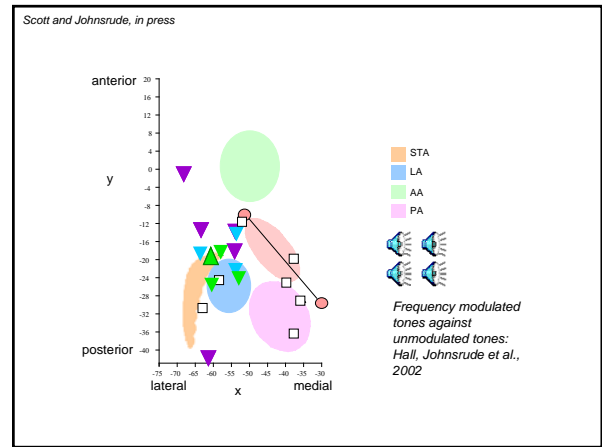
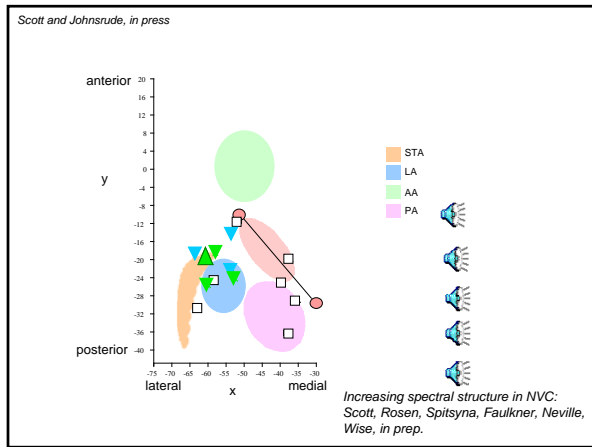
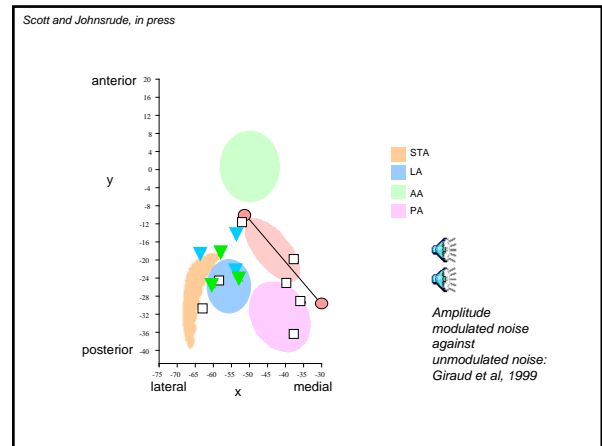
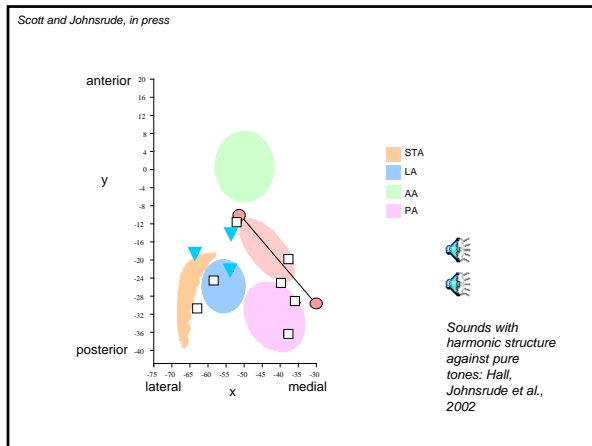


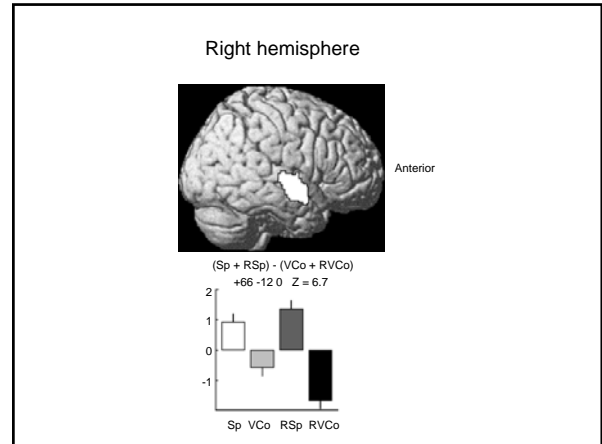
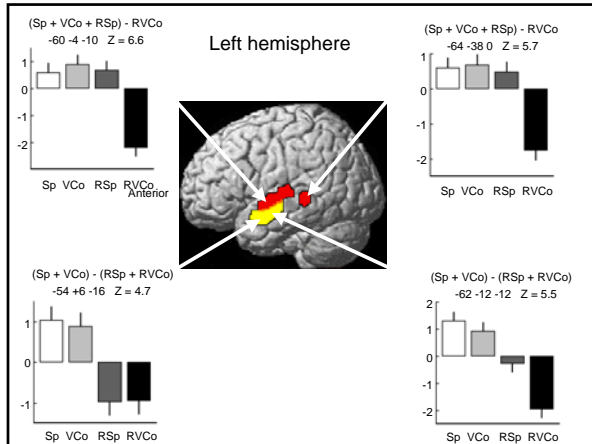


Vocal communication

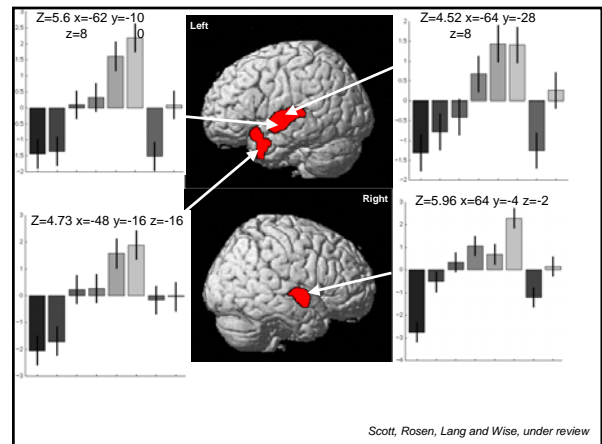
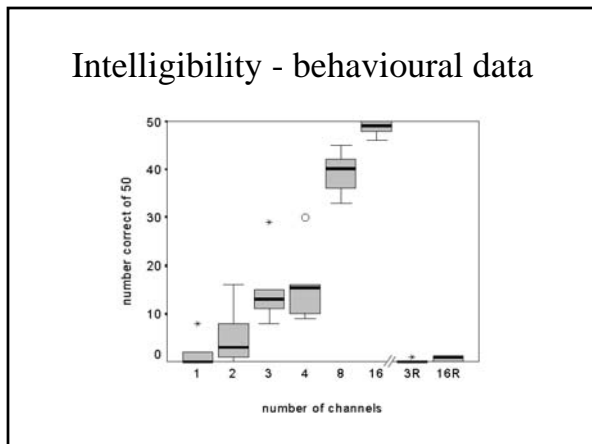
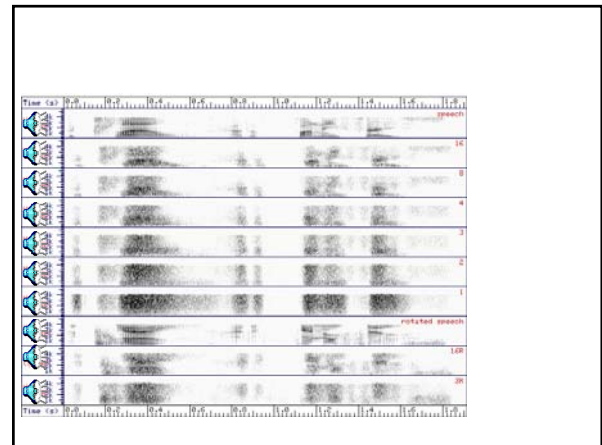
- Is there any evidence for streams of processing in auditory perception?
- Is there any relevance for the understanding of the neural basis of speech perception?

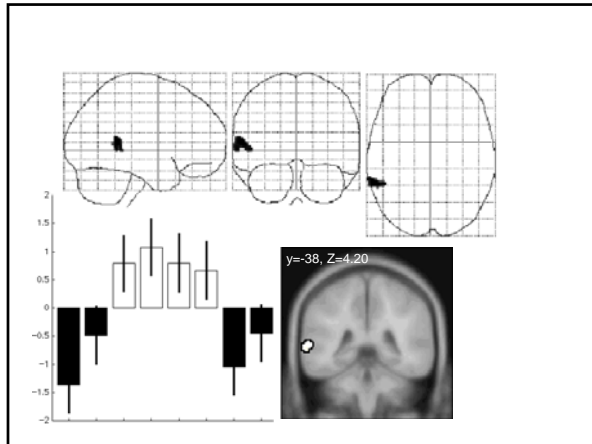






- ### Conclusions
- Phonetic cues and features - lateral and anterior to PAC, and in posterior STS.
 - Intelligibility - anterior to PAC, in left superior temporal sulcus
 - Stream of intelligibility running antero-lateral to PAC?
 - Right STG/STS - signals with dynamic pitch variation





Anterior/posterior streams

- Evidence for an anterior stream associated with intelligibility.
- Posterior regions not (a) specific to intelligibility or (b) speech specific.
- Planum temporale responds to many sounds.
- Posterior STS not intelligibility specific.

What is the function of the core of Wernicke's area ?



This region respond asymmetrically to speech over SCN, but does not respond solely to intelligible speech: it is also sensitive to sequences which could be perceived as speech after training.

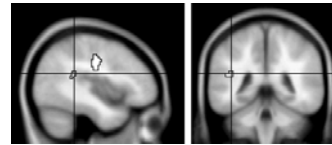


This same region in posterior superior temporal sulcus is activated when subject silently generate words in a verbal fluency task

Is 'Wernicke's area' involved in the transient representation of sequences, both heard and internally generated?

Speaking and mouthing

Wise, Scott, Blank, Murphy, Mummery and Warburton, 2001



This region, in the left posterior temporal-parietal junction, responds when subject repeat a phrase, mouth the phrase silently, or go 'uh uh', over mentally rehearsing the phrase

Role of this region?

- Thus there is a region posterior to primary auditory cortex which is activated when the subjects move their articulators, regardless of whether or not they make a noise - a region of sensori-motor integration?
- Secondary face area?

