



Investigation into the Neural Networks of Language

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Specific Aims

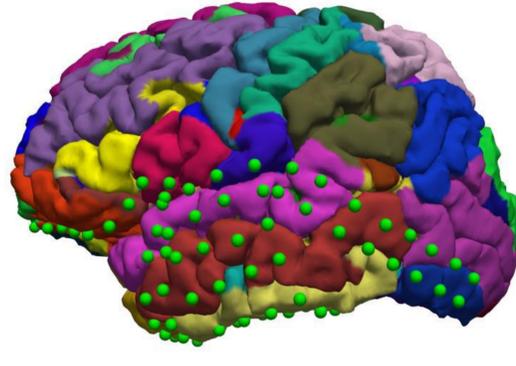
To gain more knowledge of the cortical areas involved in speech and memory processing and a better understanding of the sequence in which those cortical areas are activated.

We hope this will allow for more targeted resections and preservation of language and speech areas

Subdural Electrodes



Electrode-Gyrus Registration



Methods

13 patients fitted with subdural electrodes for invasive surgical work-up for medically intractable seizures

3 language tasks were conducted:

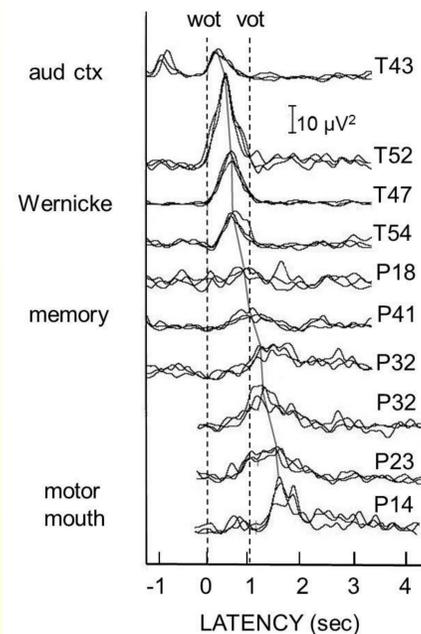
- Boston Naming task: repeat words presented as either spoken word, visual text, or pictures.
- Noun-Verb task: patient hears noun and responds with an associated verb.
- Long-term memory task: patient presented with list of words and instructed to remember them.

ECoG recordings were collected and analyzed on NeuroScan by looking at gamma activations as shown.

- The onset, peak, and offset of each gamma activation in the different gyri were measured

Gamma Activations

Cued Recognition



Results

Activity in response to the tone was recorded in the primary auditory cortex.

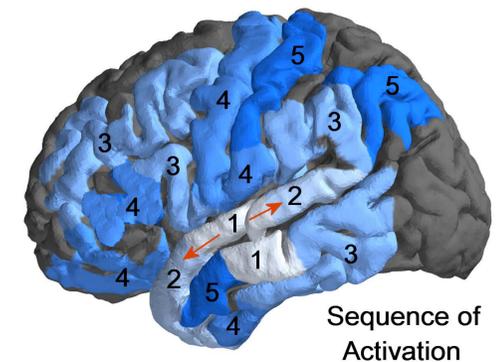
Activity in response to word was widespread and occurred in 5 groups

- 1) Primary auditory cortex region of central STG and central MTG
- 2) Activity then spreads through STG and temporal pole
- 3) Widely distributed activity in the frontal, temporal, and parietal lobes.
- 4) Frontal lobe and inferior temporal lobe
- 5) Cluster of activity in frontal, parietal and middle temporal lobes.

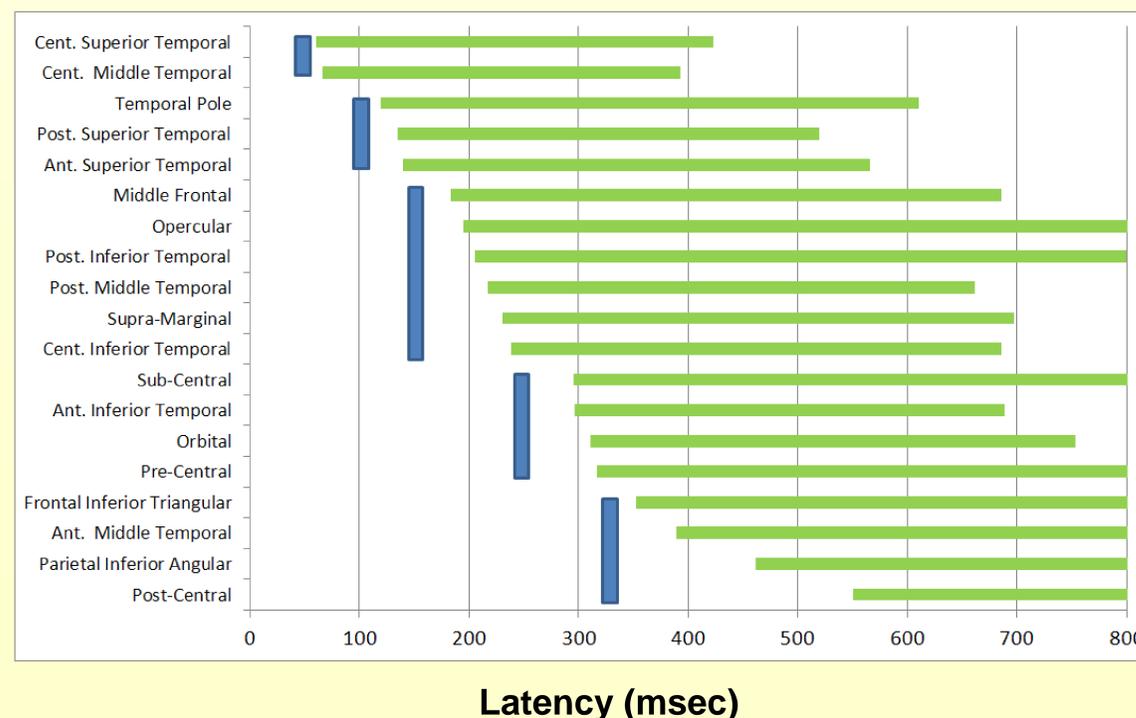
Conclusion

Processing occurred in five successive networks, numbered as such in the image below:

- 1) Acoustic network
- 2) Phonetic Network
- 3) Semantic/Lexical network
- 4) Response preparation/execution
- 5) Self-monitoring network



A Cascade of Activation



Background

Speech is thought to be processed by multiple networks in the brain in a parallel and serial fashion. [3]

- The exact networks and the sequence of their activation is poorly understood
- One consequence is cognitive deficits in speech and language following epilepsy surgery [2]

Electrocorticography (ECoG) uses subdural electrodes to provide time-sensitive data

- The widely used fMRI in contrast has relatively poor temporal resolution, so ECoG allows for a more accurate analysis of the sequence of processing. [1]

References

1. Brain (2008), 2013-27.
2. Epilepsia (2007), 26-9
3. Nat Rev Neurosci (2007), 393-402.

Acknowledgements

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