

---

---

## Selective cortical representation of attended speaker in multi-talker speech perception

Nima Mesgarani<sup>1</sup> & Edward F. Chang<sup>1</sup>



Arne Meyer

Gatsby Unit, Tea talk

05/12/2014

# The big picture

The "cocktail party problem"



- Humans possess the remarkable ability to attend to a single talker among multiple simultaneous talkers
- Essential for communication
- You can do it, too: 🗣️

# The big picture

The "cocktail party problem"



- Humans possess the remarkable ability to attend to a single talker among multiple simultaneous talkers
- Essential for communication
- You can do it, too: 🎧

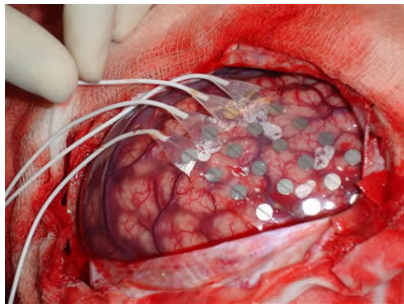
# The big picture

The "cocktail party problem"



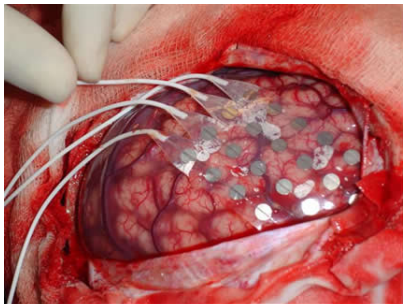
- Humans possess the remarkable ability to attend to a single talker among multiple simultaneous talkers
- Essential for communication
- You can do it, too: 📱
- Very little is known about the underlying mechanisms
- This study: neural correlates of selective attention in human auditory cortex

# Electrocorticography (ECoG)

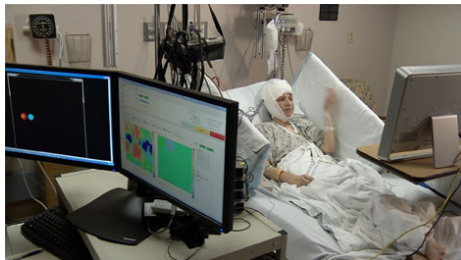


- Electrodes placed directly on the exposed surface of the brain
- Recording of electrical activity from the cerebral cortex
- Usually used to identify regions of the cortex that generate epileptic seizures

# Electrocorticography (ECoG)



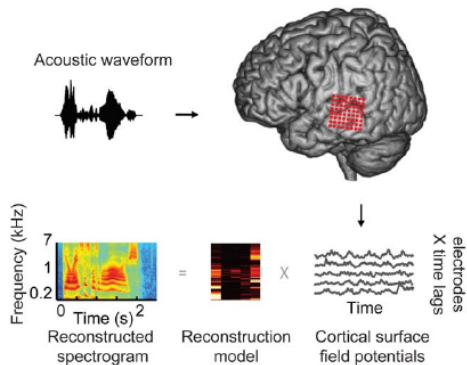
- Electrodes placed directly on the exposed surface of the brain
- Recording of electrical activity from the cerebral cortex
- Usually used to identify regions of the cortex that generate epileptic seizures



<http://www.upenn.edu>

- In very rare cases: experiments in awake humans while recording ECoG responses!

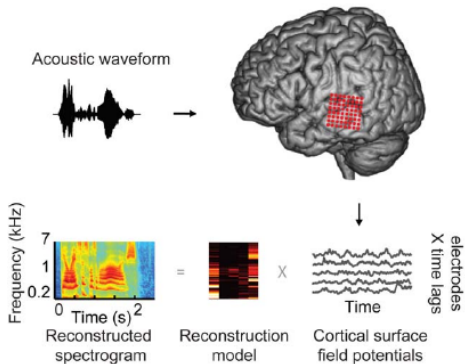
# Reconstruction of stimulus spectrograms



Pasley et al. PLOS Biol 2012

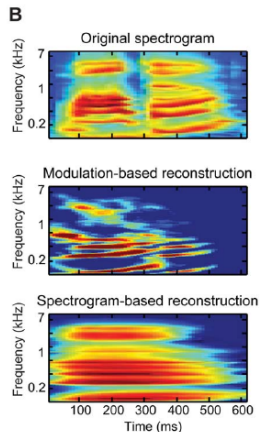
- Posterior superior temporal lobe
- High gamma activity (75 Hz - 150 Hz)
- Fixed linear mapping from response to stimulus spectrogram

# Reconstruction of stimulus spectrograms



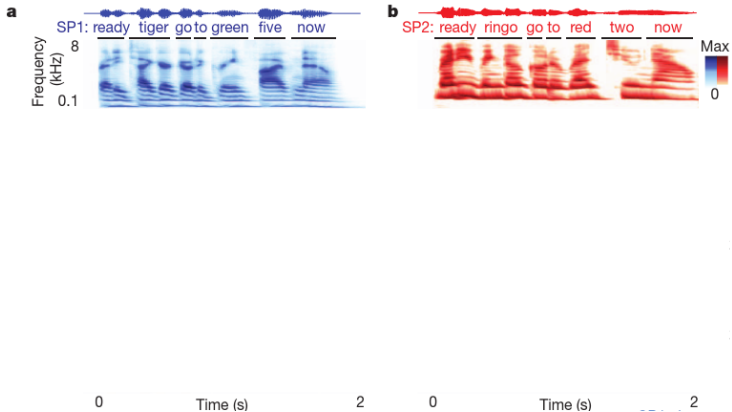
Pasley et al. PLOS Biol 2012

- Posterior superior temporal lobe
- High gamma activity (75 Hz - 150 Hz)
- Fixed linear mapping from response to stimulus spectrogram



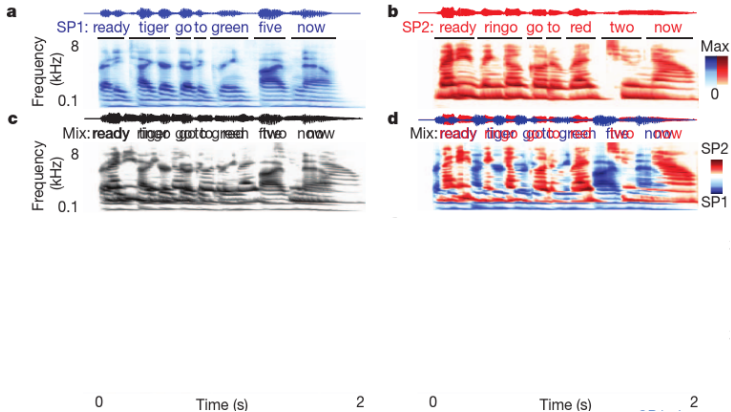


# Experimental design



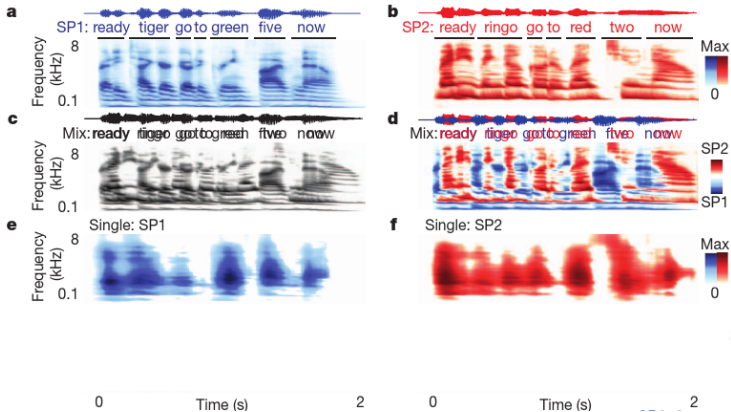
- Mixture of female and male speakers
- Call sign (SP1: tiger/SP2: ringo) shown on screen during each trial
- Subjects were instructed to report the color and number spoken by the corresponding talker

# Experimental design



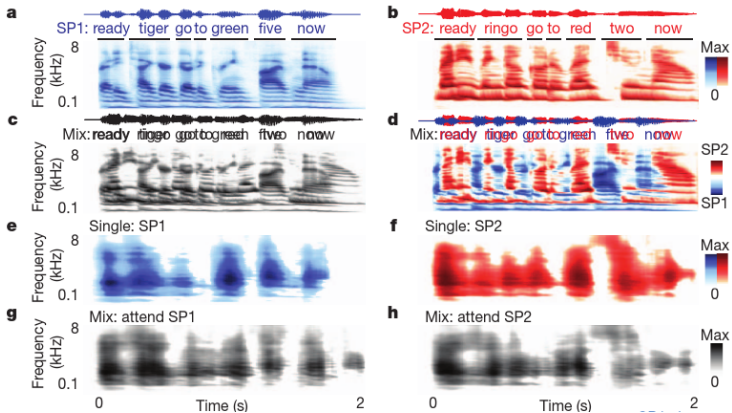
- Mixture of female and male speakers
- Call sign (SP1: tiger/SP2: ringo) shown on screen during each trial
- Subjects were instructed to report the color and number spoken by the corresponding talker

# Experimental design



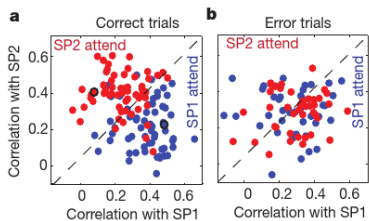
- Mixture of female and male speakers
- Call sign (SP1: tiger/SP2: ringo) shown on screen during each trial
- Subjects were instructed to report the color and number spoken by the corresponding talker

# Experimental design

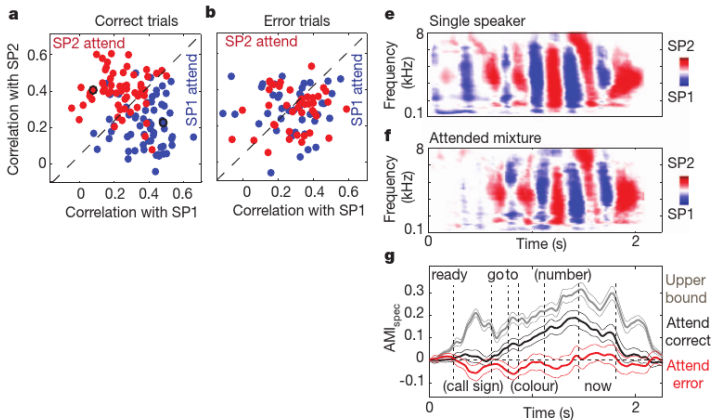


- Mixture of female and male speakers
- Call sign (SP1: tiger/SP2: ringo) shown on screen during each trial
- Subjects were instructed to report the color and number spoken by the corresponding talker

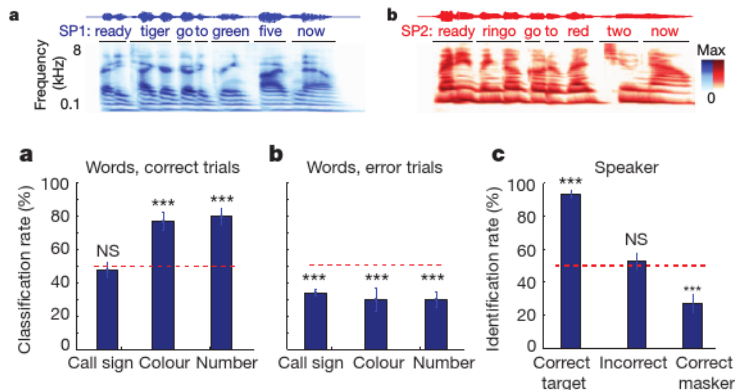
# Quantifying attentional modulation of neural responses



# Quantifying attentional modulation of neural responses



# Results: classification



- Classification of single words using reconstructed spectrograms
- Linear classifier (binary)

## Some useful things to remember ...

- Human ECoG data + crude analysis  $\leq$   
Nature paper
- The same is true for Science (Mesgarani and Chang 2014)

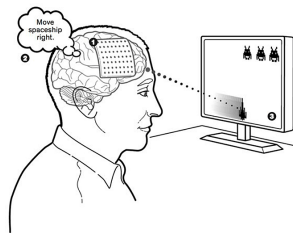


## Some useful things to remember ...

- Human ECoG data + crude analysis  $\leq$   
Nature paper
- The same is true for Science (Mesgarani and Chang 2014)
- Neural correlates of selective attention in humans
- Non-primary auditory cortex (involved in high-level auditory processing)
- Rapid attentional modulation of responses

# Some useful things to remember ...

- Human ECoG data + crude analysis  $\leq$  Nature paper
- The same is true for Science (Mesgarani and Chang 2014)
- Neural correlates of selective attention in humans
- Non-primary auditory cortex (involved in high-level auditory processing)
- Rapid attentional modulation of responses



<http://www.nytimes.com>