

AUGUST 11, 2023 - NEUROHACKADEMY 2023

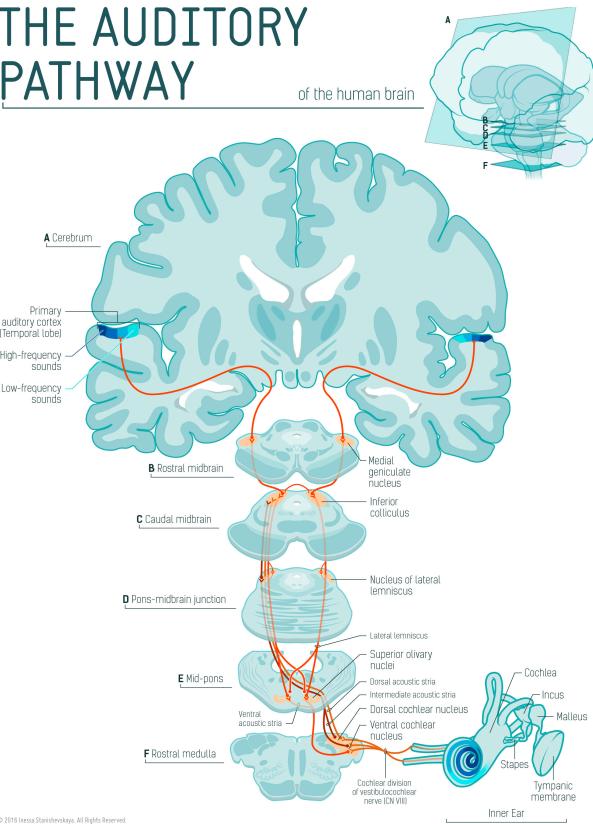
PREPROCESSING IEEG DATA WITH MNE PYTHON

LIBERTY HAMILTON, PHD

Assistant Professor, The University of Texas at Austin
Department of Speech, Language, and Hearing Sciences
Department of Neurology



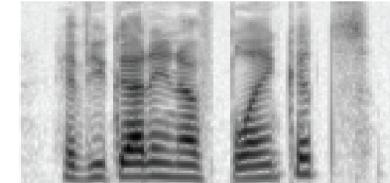
THE AUDITORY PATHWAY



Have you got enough blankets?

hiv|y gar in Af blæn kts

hivygariṇaʌfblænkts



sentence

meaning

word

syllable

phoneme

spectrot temporal
(frequency decomposition)

acoustic vibration

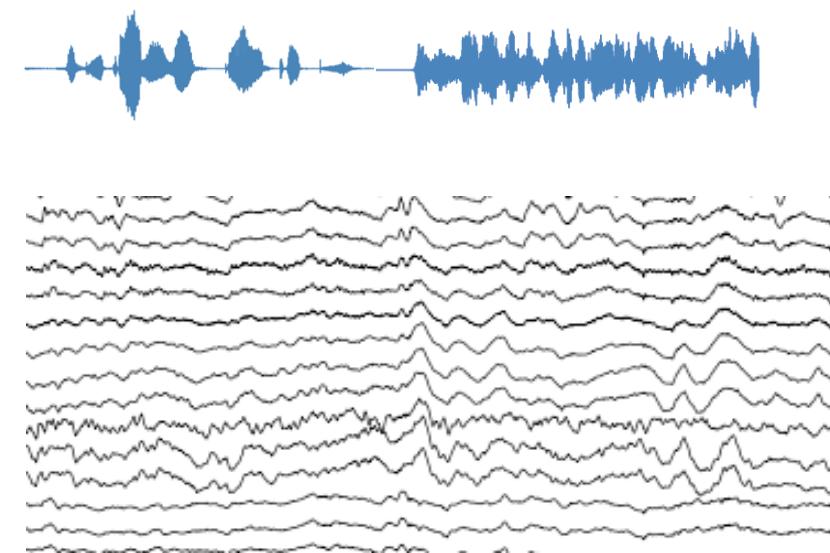




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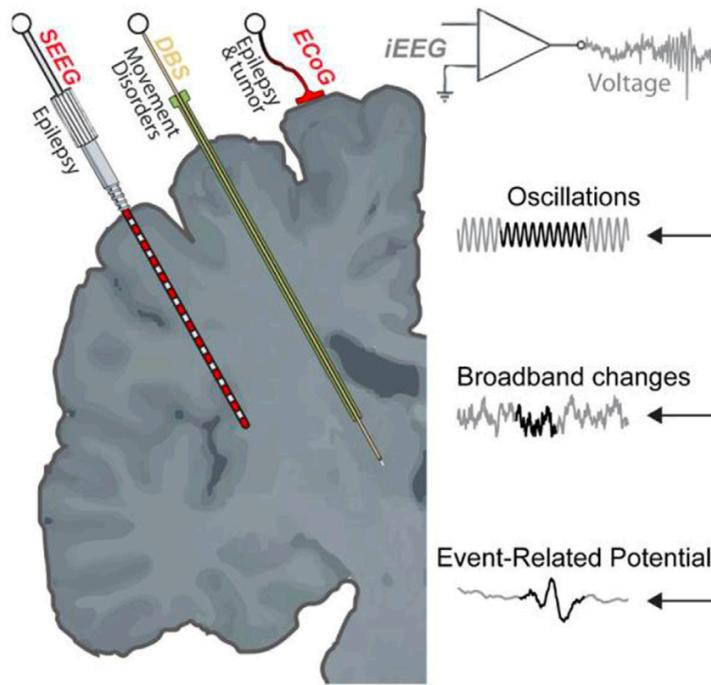
Miller Nature Human Behavior 2019



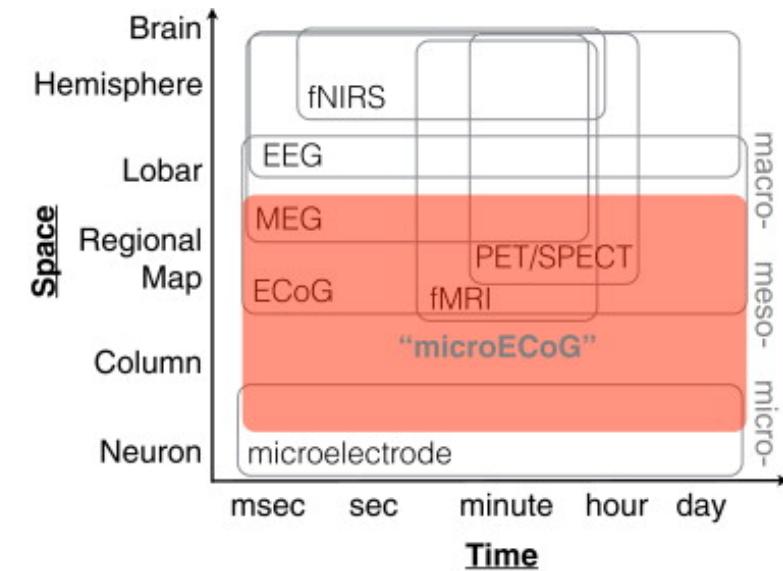
Intracranial recordings + cognitive tasks for research



How do signals differ?



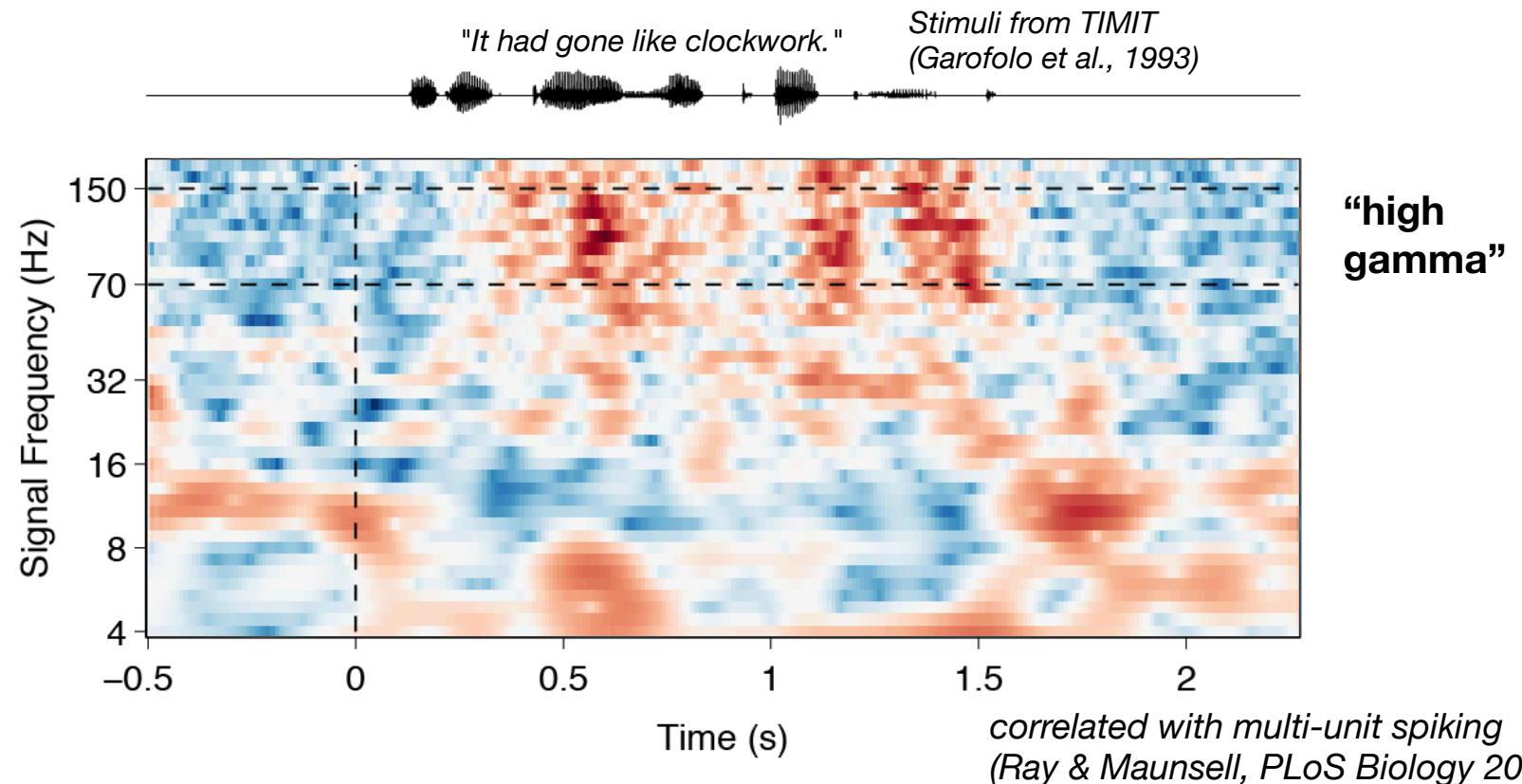
Mercier et al. *NeuroImage* 2022



Chang et al. *Neuron* 2015



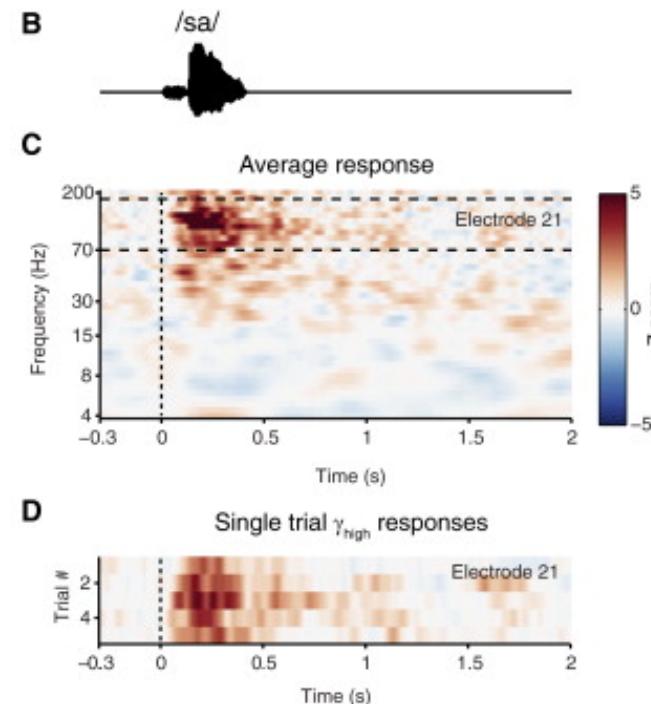
High gamma as an index of local neural activity





Advantages of intracranial recordings (iEEG)

- Can measure changes at fast timescales
 - Phonological information: /b/ vs. /p/
- You know where your signals are coming from
- Very high SNR, requires fewer trials than EEG/MEG



Chang et al. Neuron 2015



Disadvantages of intracranial recordings (iEEG)

- Coverage depends on clinical need, not your research question
- Invasive, must be done in patient populations
 - Epilepsy / tumor
- Relatively time-limited experiments / less controlled environment



Considerations when preprocessing iEEG data

- Environment is not as controlled as typical research environment
 - Background sounds!
- Where electrodes are located
- How electrodes are plugged into amplifier is important for (re)referencing
- Sources of electrical noise
- Acquisition sampling rate is important if you want high frequency activity





Different types of iEEG artifact

- Motion artifact
- Epileptiform artifact
- Chewing/jaw artifact
- VNS artifact (vagus nerve stimulator)



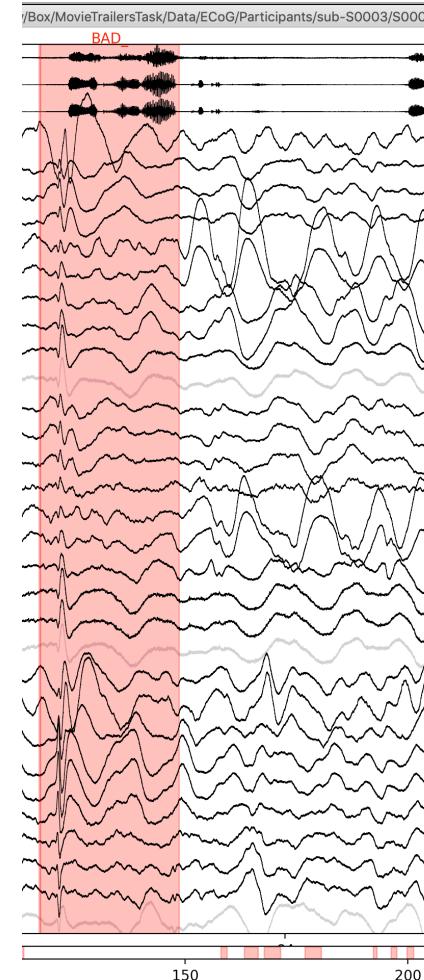
Seizure activity (left)





Spike wave

- An example of an epileptiform artifact - fast spike followed by a slow wave





Tutorial

- We will load iEEG data with and without BIDs metadata
- Plot power spectrum
- Plot raw data and look for bad channels and artifacts
- Convert to high gamma analytic amplitude
- Plot evoked data