WIRED 2024

MNE-Python Tutorial

March 13, 2024
9:30am – 12:30pm
Paris, France

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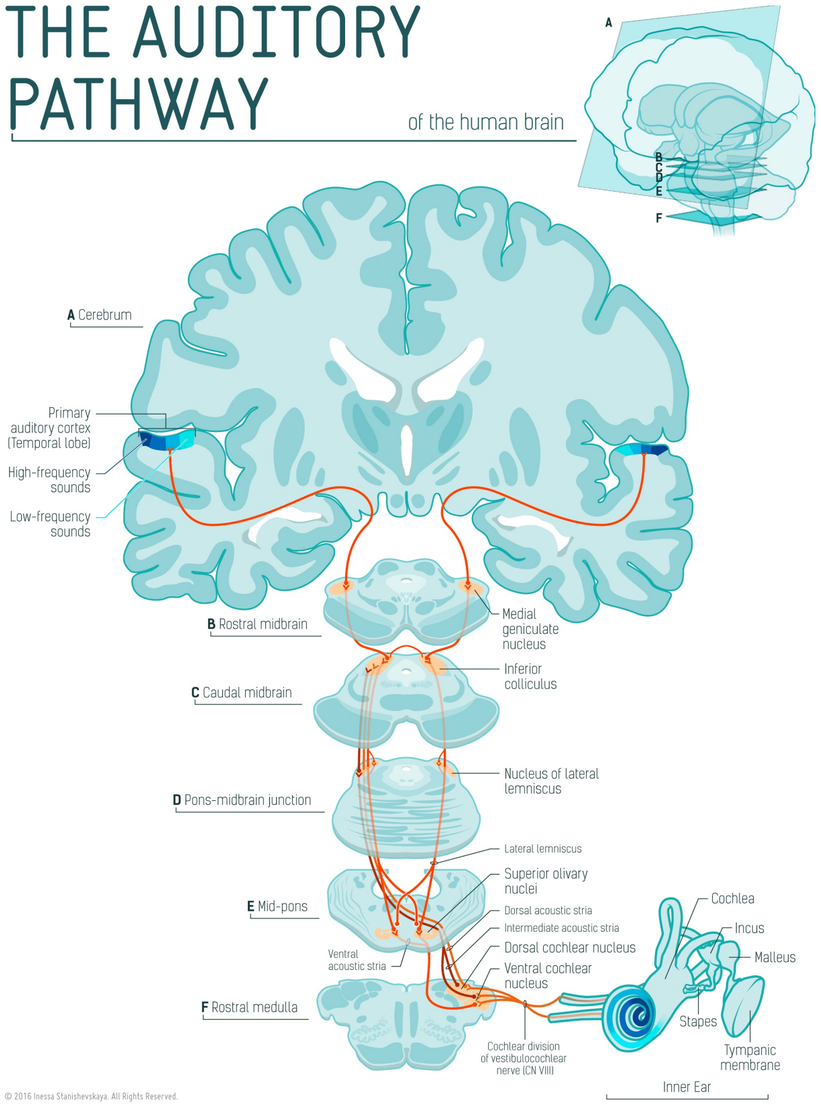


Have you got enough blankets?

sentence

meaning

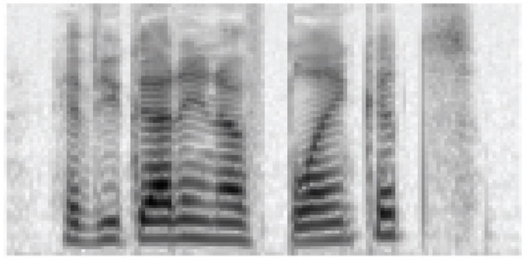
word

hɪv | y | gɑr | ɪn | ʌf | blæŋ | kɬts

syllable

hɪvygɑrɪnʌfblæŋkɬts

phoneme

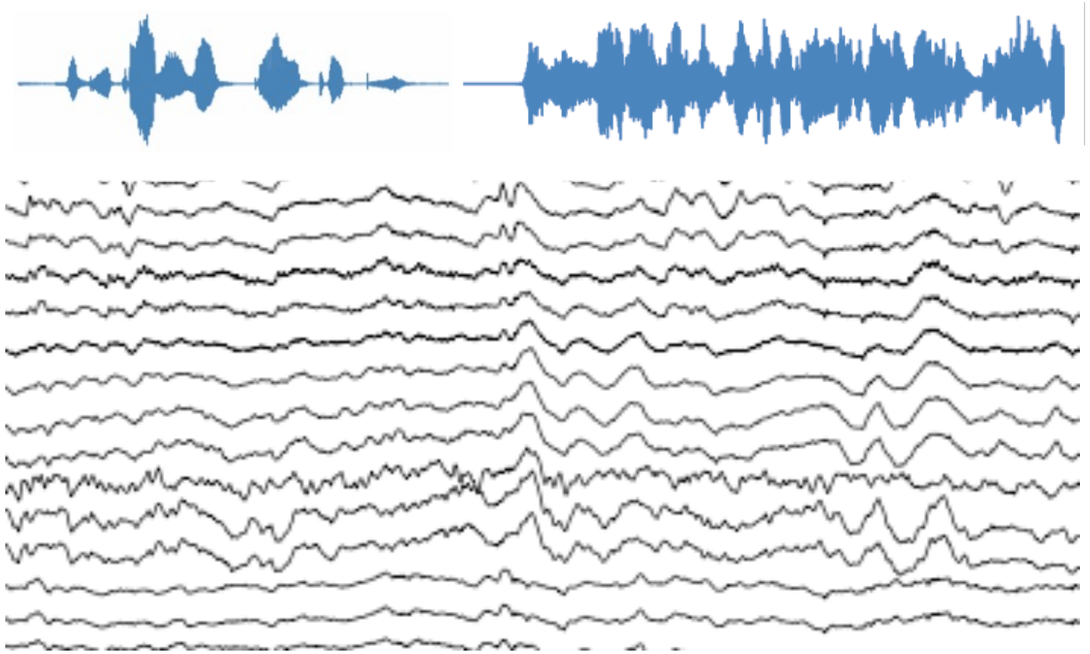


spectrotemporal (frequency decomposition)

acoustic vibration

INTRACRANIAL RECORDINGS IN THE HOSPITAL

Miller Nature Human Behavior 2019



Intracranial recordings + cognitive tasks for research

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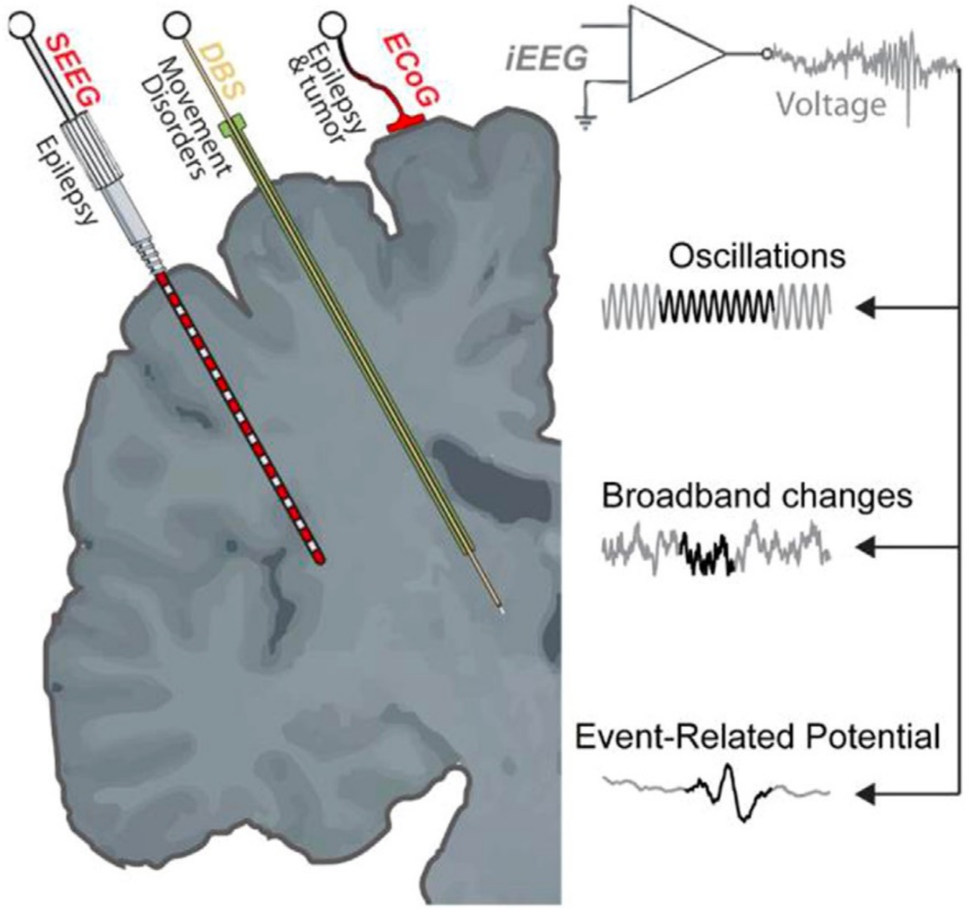
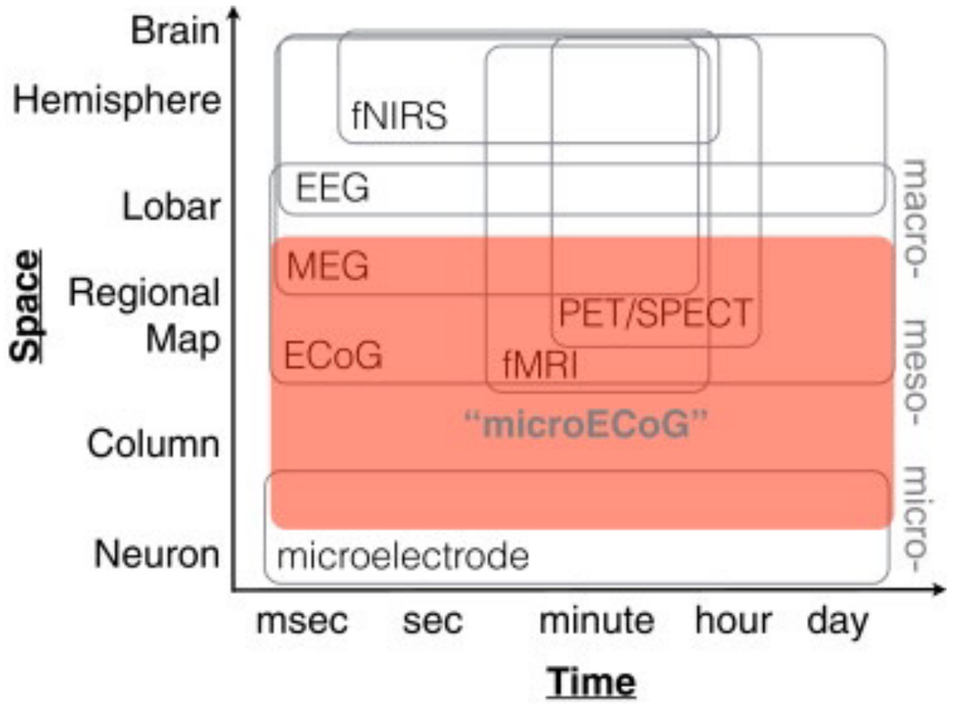
HOW DO SIGNALS DIFFER?

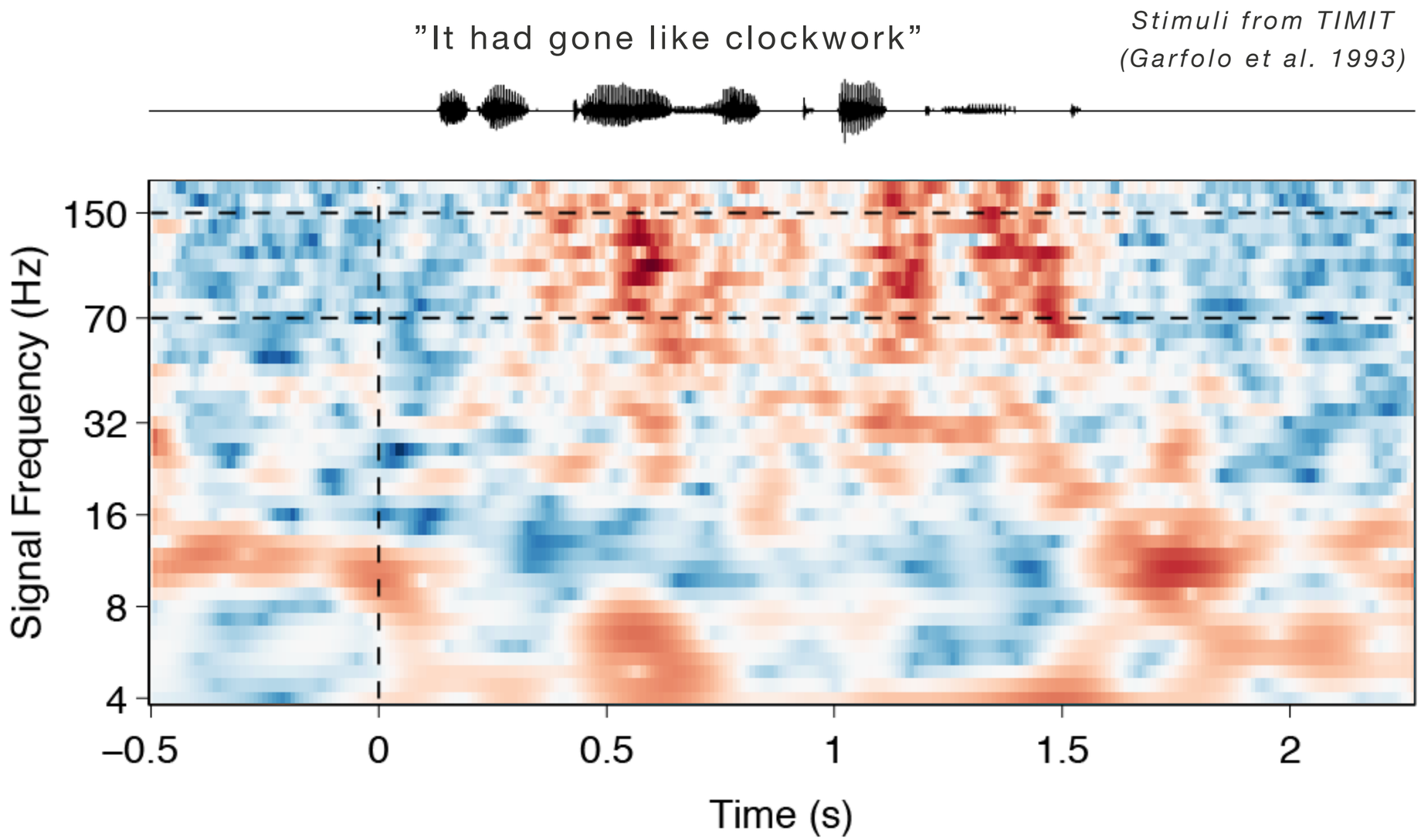


Mercier et al. NeuroImage 2022



Chang et al. Neuron 2015

HIGH GAMMA AS AN INDEX OF NEURAL ACTIVITY

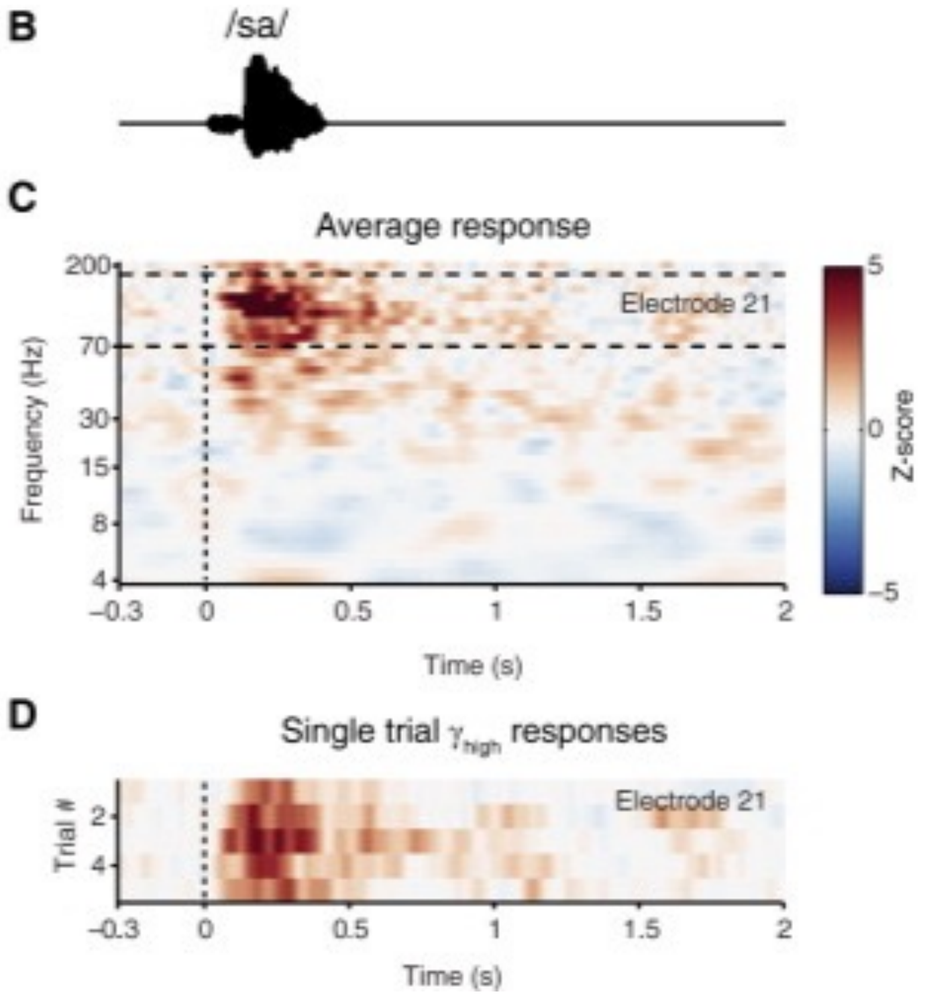


“high gamma”

correlated with multi-unit spiking
(Ray & Maunsell, PLoS Biology 2011)

ADVANTAGES OF INTRACRANIAL RECORDINGS

- 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



DISADVANTAGES OF INTRACRANIAL RECORDINGS

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

CONSIDERATIONS WHEN PREPROCESSING iEEG DATA

- Environment is not as controlled as a typical recording environment (sound proof booth)
  - 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 information

DIFFERENT TYPES OF iEEG ARTIFACTS

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

SEIZURE ACTIVITY (LEFT)

iEEG TUTORIAL

- We will load iEEG data with BIDS metadata
- Plot power spectrum
- Plot raw data and look for bad channels and artifacts
- Convert to high-gamma analytic amplitude
- Plot evoked data