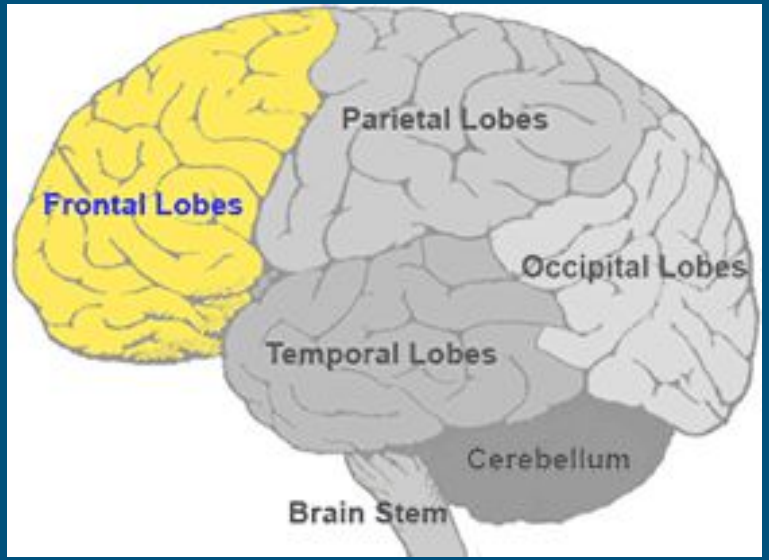
# Frequency Domain and Signal Processing

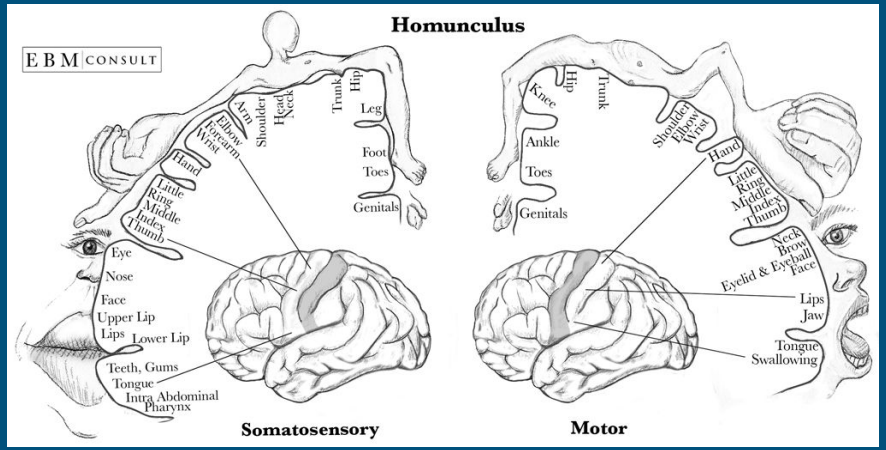
Neurotech@Davis

# Outline

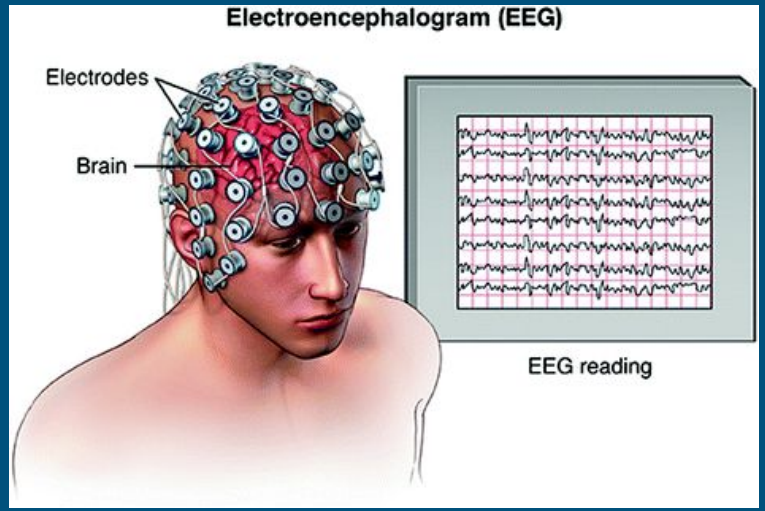
- Recap from last time
- Brain Frequencies
- Fast Fourier Transformations
- PSD Plots
- Filtering
- Interactive Coding

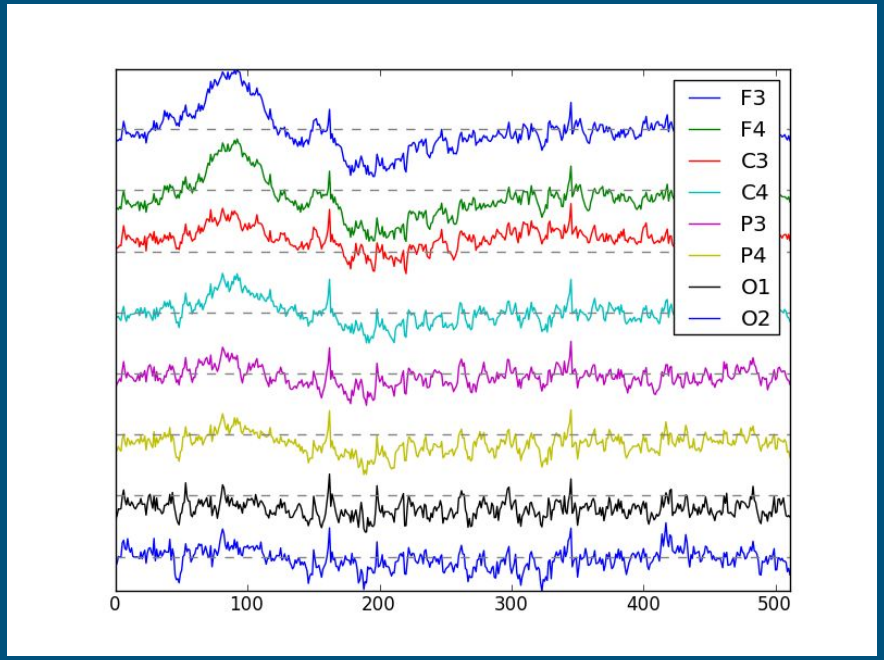
# Recap - Neuroscience



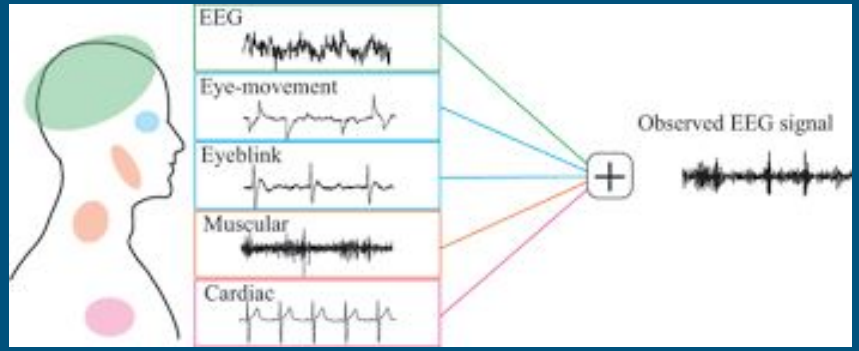



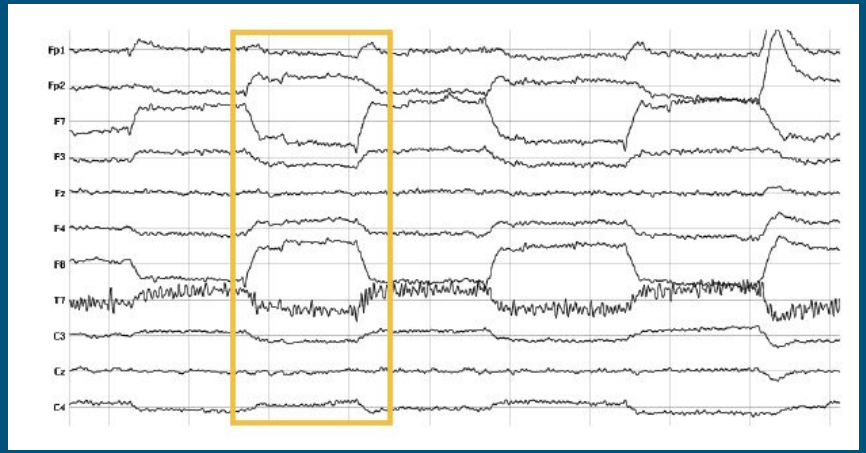
# Recap - EEG


Electroencephalogram (EEG)
Electrodes
Brain
EEG reading


F3
F4
C3
C4
P3
P4
O1
O2
0
100
200
300
400
500

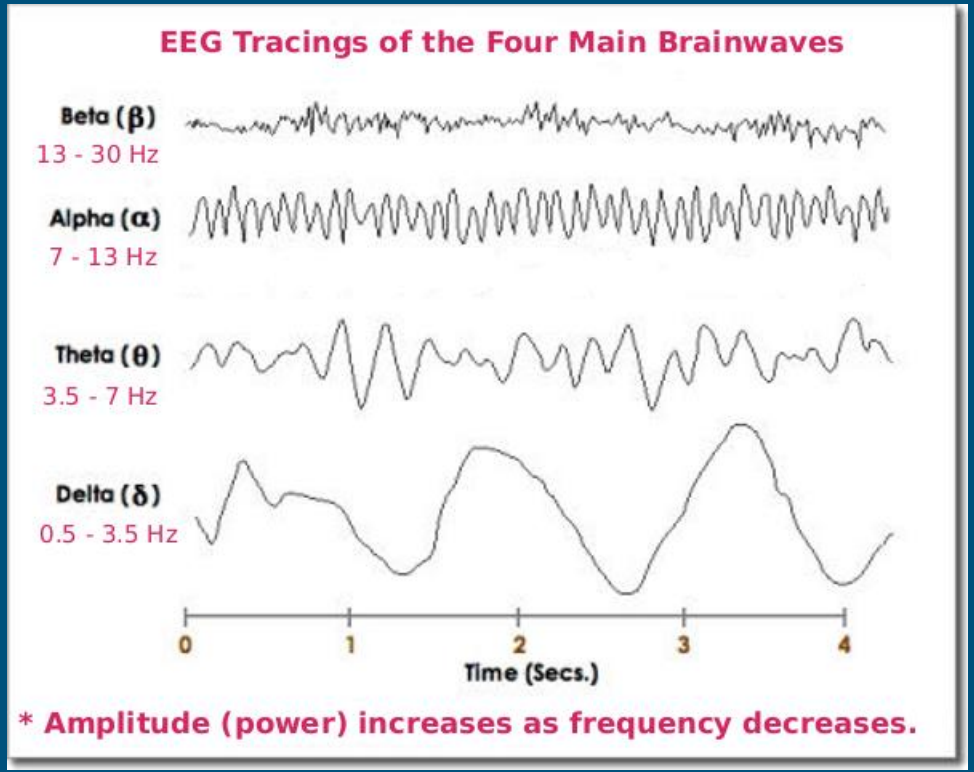
# Recap - Artifacts



# Brain Frequencies

- Beta Waves
  - Awake, thinking, excitements
- Alpha
  - Passive, mentally relaxed, inattentive
- Theta
  - Creativity, meditation
- Delta
  - sleep

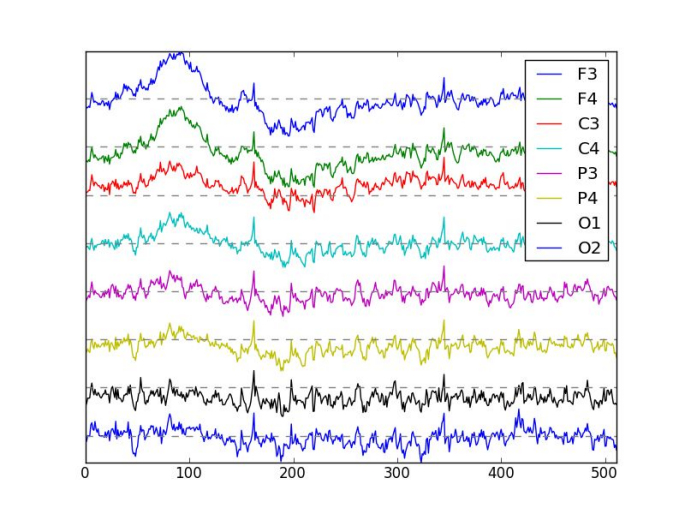


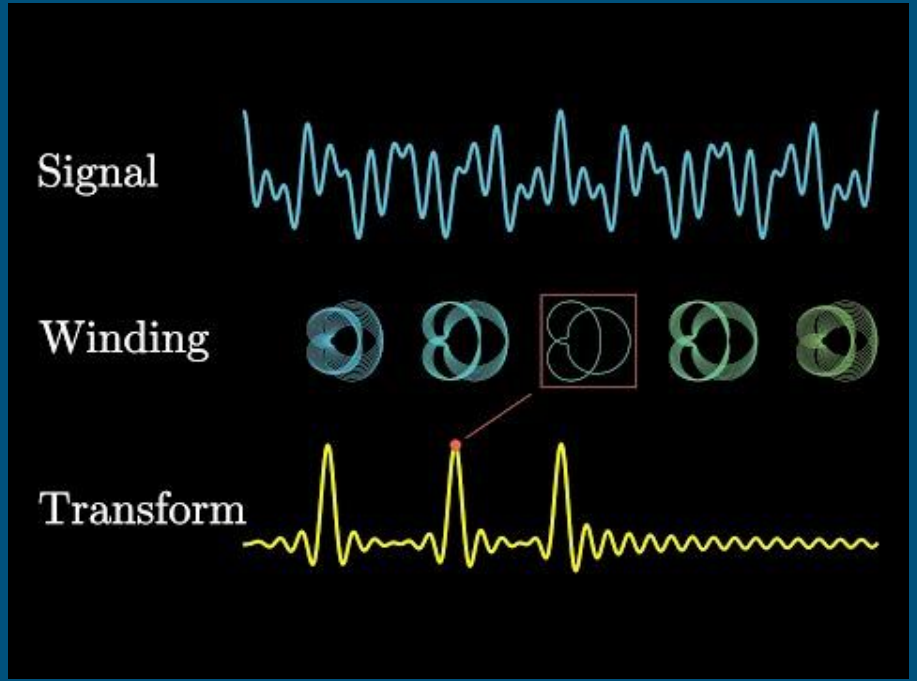

Author: Kushaal Rao

# Time Domain to Frequency Domain

Neurotech@Davis

- How  do we get from time domain to the frequency domain?

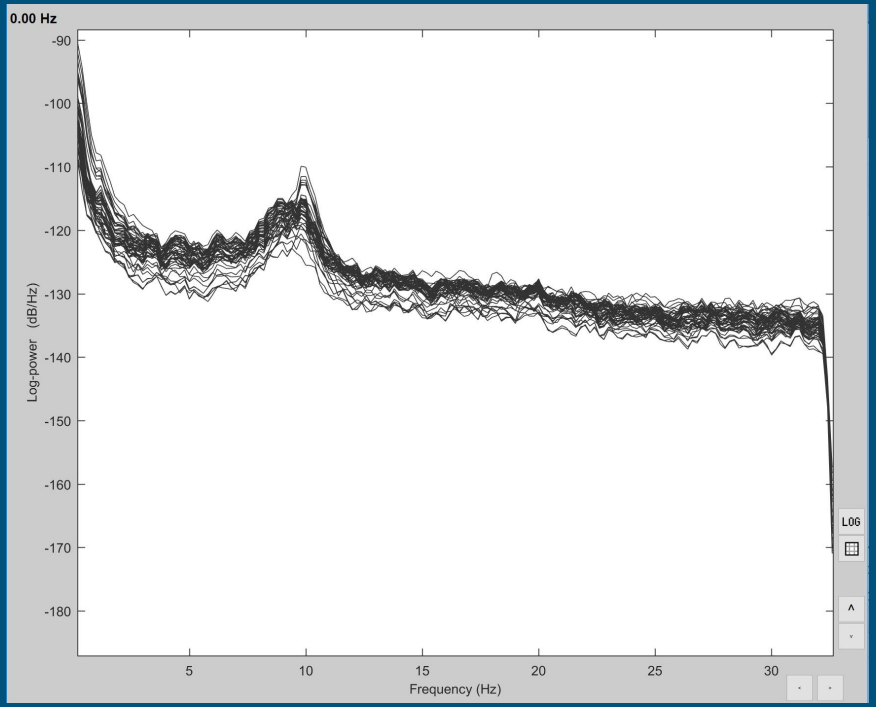


# PSD Plots



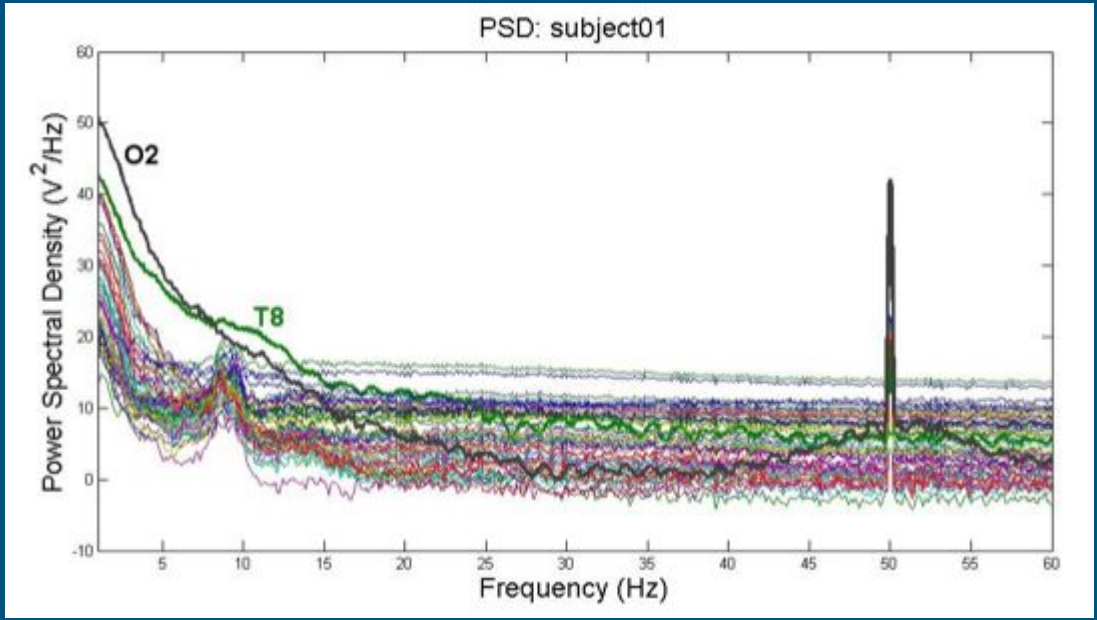
- PSD = Power Spectral Density
- Allows us to analyze magnitude of frequencies within a given timeframe



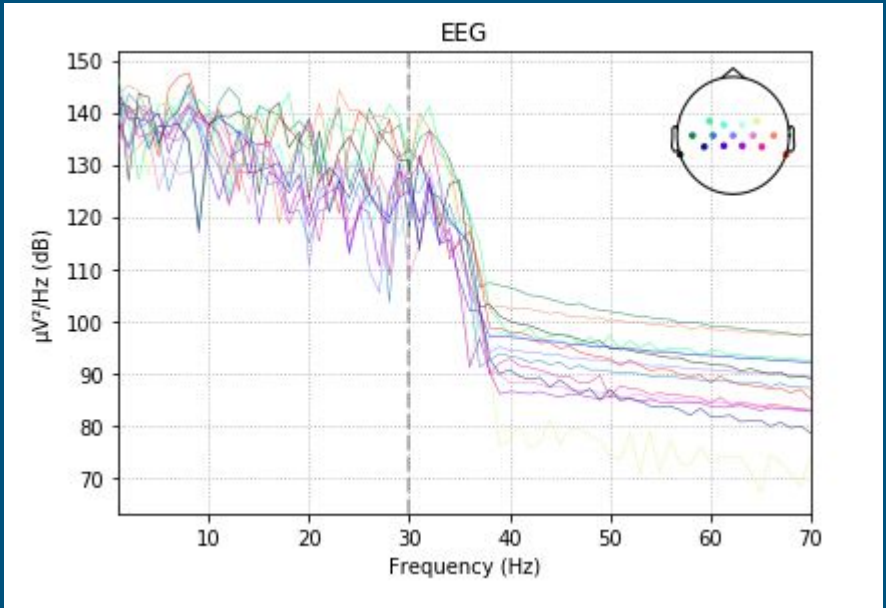
# Filtering

- Allows for removal of selective frequencies
  - Useful when trying to isolate frequencies and choose features
- Low-Pass Filter
  - Frequencies below a certain threshold are kept, anything higher is removed
- High-Pass Filter
  - Frequencies higher than a certain threshold are kept, anything lower is  removed
- Band  Pass Filter
  - Frequencies  between a certain range are kept
- Notch Filter
  - A specific frequency is removed (i.e. 60Hz)

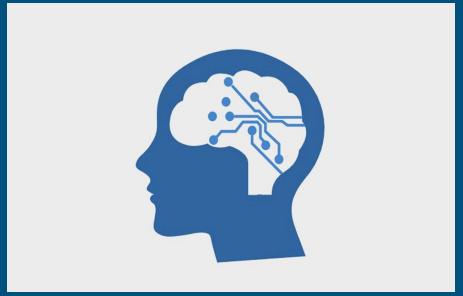
# Which Filter Would We Use?



# What is this filter doing?



# Thank You



http://neurotechdavis.com/

https://www.facebook.com/groups/davisneuro/

davisneurotech@gmail.com