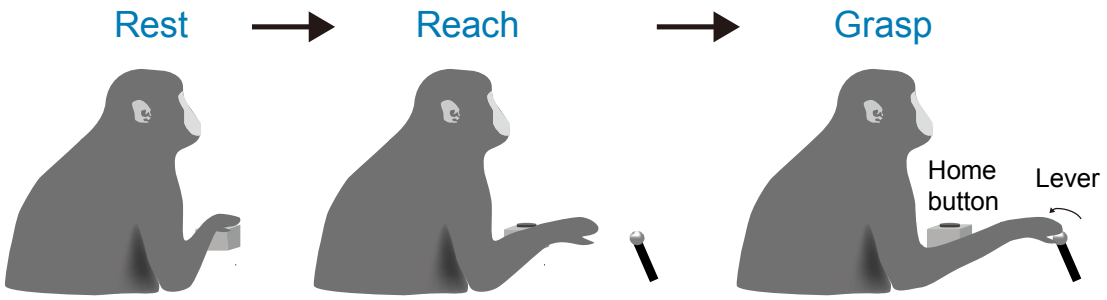
Assignment #3. LFP, ECoG, & EEG Data Analysis

- The report needs to be submitted in an electronic format (word document, pdf, etc.) via email (zenas.c.chao@gmail.com)
- Put your name in the filename.
- You need to submit your report before Dec 13. Late assignment will not be accepted.
- You are encouraged to discuss with your classmates, but you need to write the report yourself. Plagiarism will be severely punished!
- You need to attach your codes in the report. Remember to use "%" to comment your programs.
- Use function "saveas" to create figures.

EXERCISE 3.1

Download the ECoG data ("ECoG_data.mat" from the class website). The dataset was recorded from 32 channels in a monkey during a reaching-and-grasping task. The data contains three variables:

- **ECoG**: data points X channels
- **times**: timings (in second) of the data points
- **Movement_onset**: The reaching onsets (in second). There are 133 trials

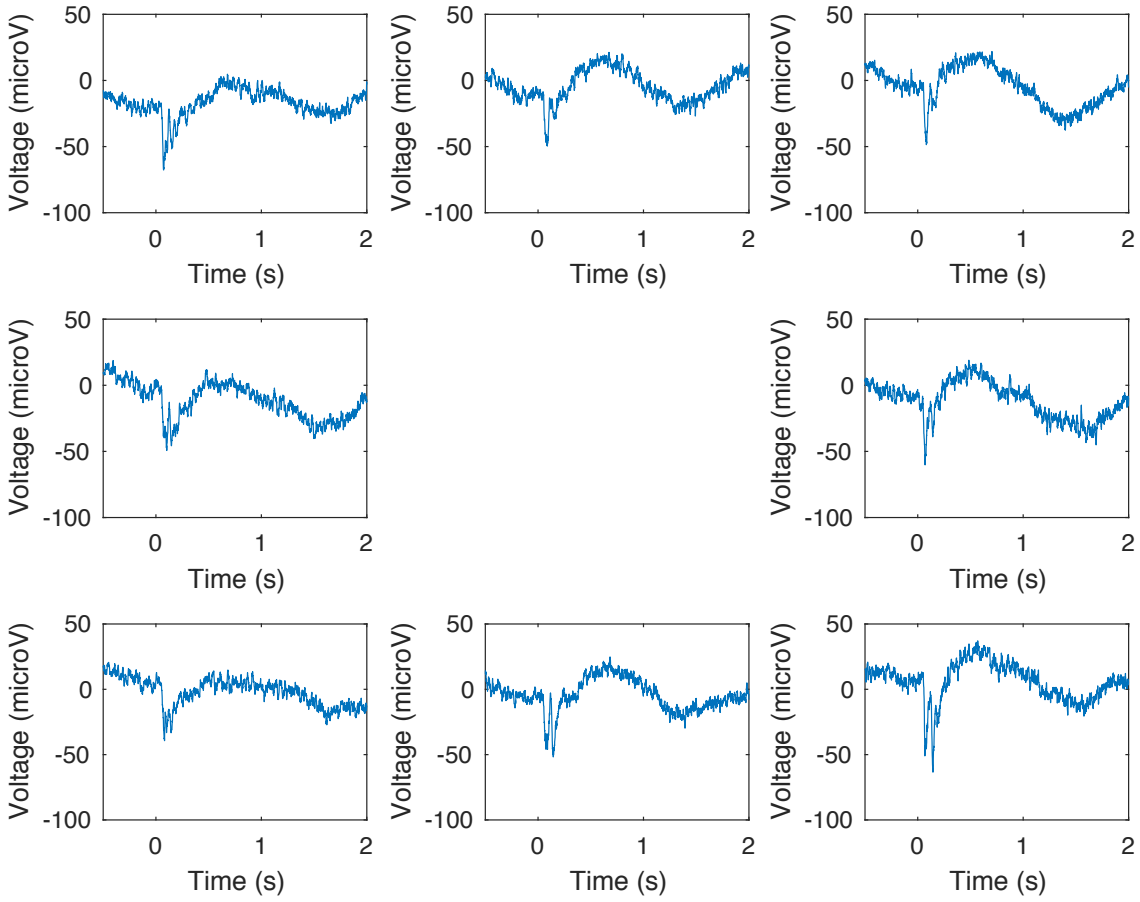


1) What is the sampling rate of the data (in Hz)?
2) Plot the averaged ERP from channel 18. Include signals from 2 seconds before the movement onset to 2 second after the movement onset. HINT: use the trick from Part 5.
3) Plot the averaged TFR from channel 18. Include 2 seconds before the movement onset to 2 second after the movement onset. Use the code in Part 11 with the following parameters:

```
params.Fs=          ;  %Sampling rate in Hz (from question (1))
params.tapers=[2 3];  %Taper parameters
params.fpass=[5 120]; %Look at 5-120 Hz band
movingwin=[0.3 0.03]; %Window to compute spectrum
```

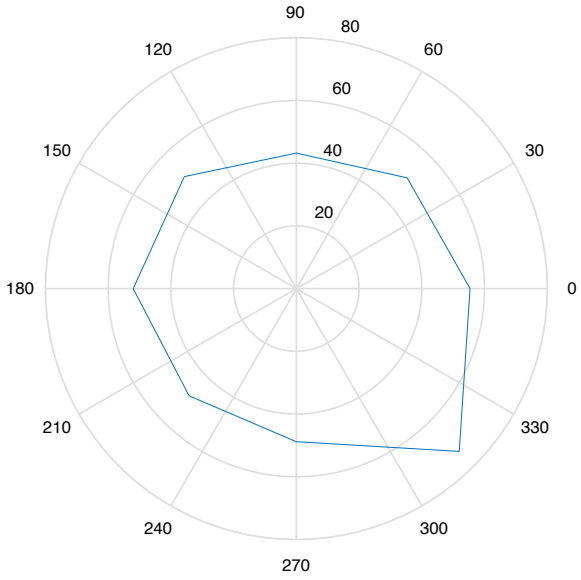
4) Based on the TFR plot, what happens to the low frequency power (<20Hz) around the movement onset? Write down your observations.

EXERCISE 3.2 (continued from exercise Part 7)
From exercise Part 7, ERPs from different movement directions are shown below:



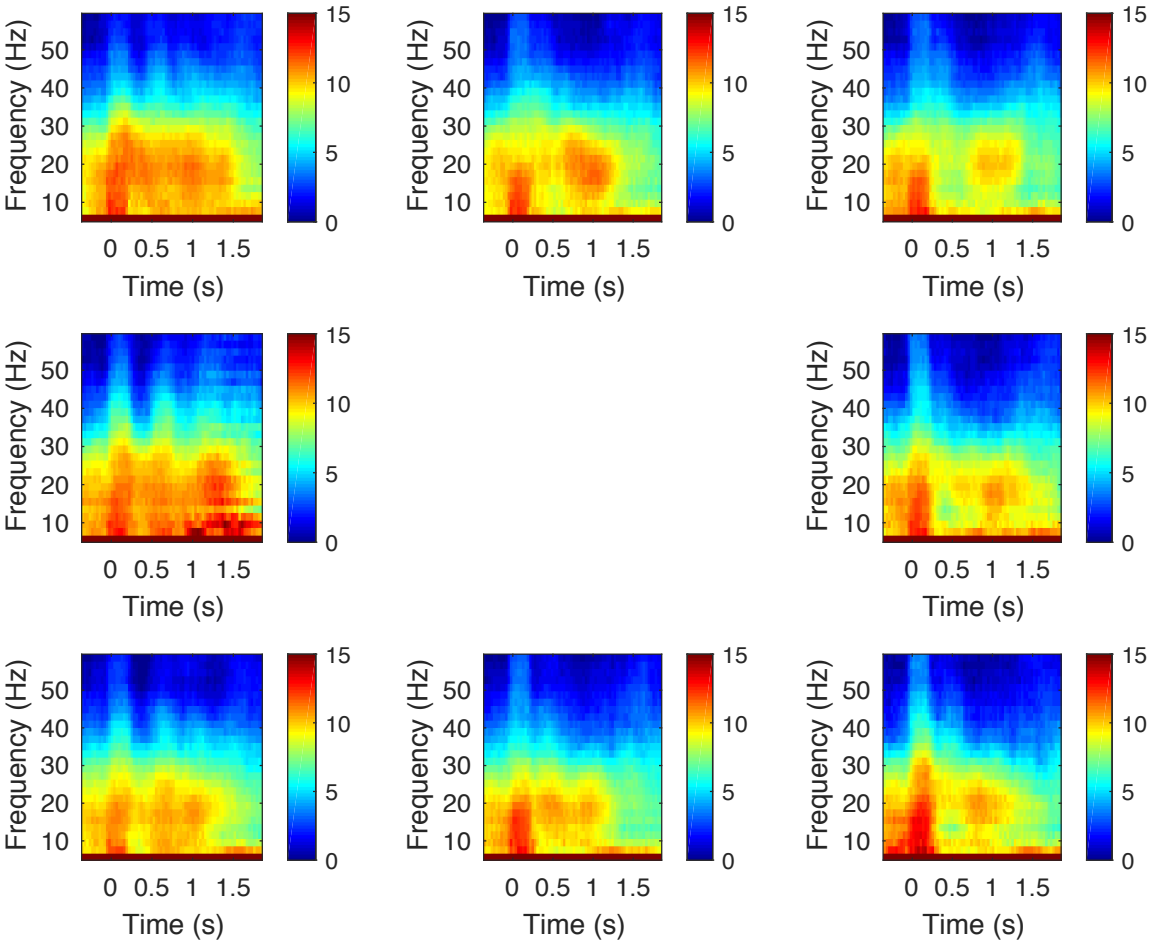
1) Design a measurement (for example, the minimum ERP value between 0 and 500ms), and show how this measurement changes according to the movement direction. To answer this, you need to plot the tuning curve: the measured value (y-axis) vs. movement directions (x-axis).
2) Plot the measure values vs. the movement angles (see example below). HINT: use the "polar" function.

Variable "direction"	1	2	3	4	5	6	7	8
Movement angle	0	45	90	135	180	225	270	315



3) Do you see “direction tuning” in your measurement? Describe your finding.

[BONUS] EXERCISE 3.3 (continued from exercise Part 11)
From exercise Part 11, TFRs from different movement directions are shown below:



1) Design a measurement (e.g. the average power between 0 and 500ms and between 10 & 20Hz), and show how this measurement changes according to the movement direction by plotting the tuning curve (as in EXERCISE 3.2).
2) Plot the measure values vs. the movement angles (as in EXERCISE 3.2).
3) Do you see "direction tuning" in your measurement? Describe your finding.