PURSUE

Preparing Undergraduates for Research in STEM Using Electrophysiology

Waveform Plots & Scalp Maps
# In-Class Lab
Worksheet

Student's Name:

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Due Date: 11/26 via Blackboard

Overview

- Complete this lab worksheet alongside the lab guide.
- Answer the guided questions. Use any assigned readings and lecture notes to supplement your answers to these questions. Put your answers in the gray area between the brackets so that your answers are highlighted in gray. ▮
- If you create any plots of the data, paste screen shots of those plots into this worksheet.
- Each question will be evaluated on a 3-point scale: 0=no answer, 1=missing key concepts, 2=adequate response, 3= fully explained response. A fully explained response requires the answer to this question plus your rationale (from readings, lecture, and your evaluation process).

Part 1: Plotting Waveforms Questions

1. Paste the N400_GAdif_n10_CzCPzPz.jpg into your worksheet.
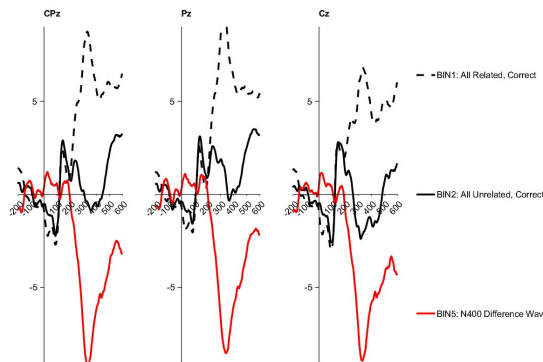
2. Consider the custom settings. What settings do you need to consider adjusting when plotting your data to demonstrate the condition differences more clearly?
   I would adjust the x-axis settings so the plot continues for longer. Right now, the plot seems cramped and more difficult to read. I might also make the y-axis longer because it cuts off the difference wave for CPz.

3. Paste the N400_GAdif_n10_topographic.jpg into your worksheet.
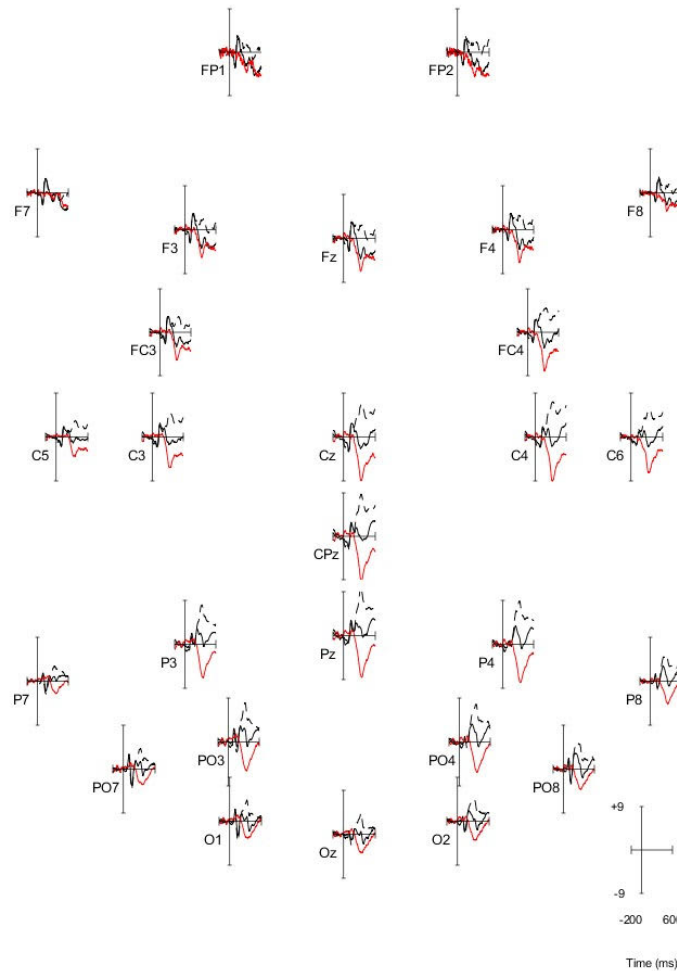
4. Compare the "Classic ERP" plot with the topographic plot. If you wanted to convey to your reader the distribution of the N400 response, what are the pros and cons of each layout?

A pro of the topographic plot is its spatial distribution, so viewers can see where in the brain the N400 has the greatest effect. The con of this is that it could be more difficult to read, since many more electrodes are included and they're not distributed in a traditional way.

A pro of the classic plot is that its distributed in a more common way, meaning it could be easier to interpret which electrodes are most significant and then single those electrodes out. It was easier to interpret the N400 effect with only 3 electrodes.

Part 2: Plotting Scalp Map Questions
Instantaneous Amplitude Scalp Maps Questions

1. Paste the N400_GAdif_n10_ScalpMap_InstantAmpCustomScale.jpg into your worksheet.
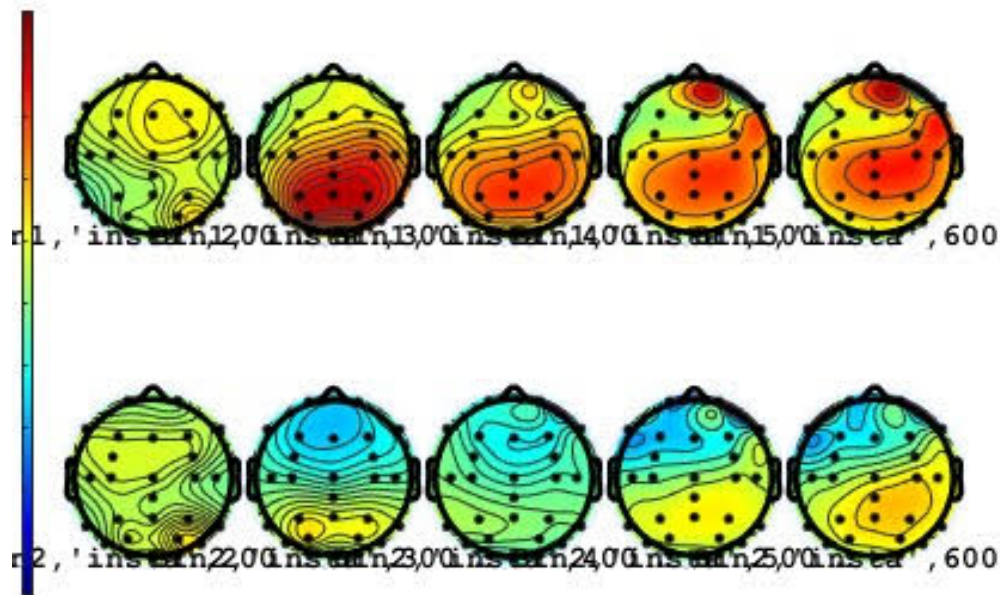
2. What time points display the largest difference between maps for Bins 1 and 2?

   The greatest difference is between 300 and 400 ms.

3. What areas (e.g. central, central parietal, frontal) display the largest activation differences between maps for Bins 1 and 2.

   Central and central parietal areas display the greatest activation differences between bin 1 and bin 2.

Mean Amplitude Scalp Map Questions

1. Paste the N400_GAdif_n10_ScalpMap_MeanAmpCustomScale.jpg into your worksheet.

Bin1,'mean',300-600 ms

Bin2,'mean',300-600 ms
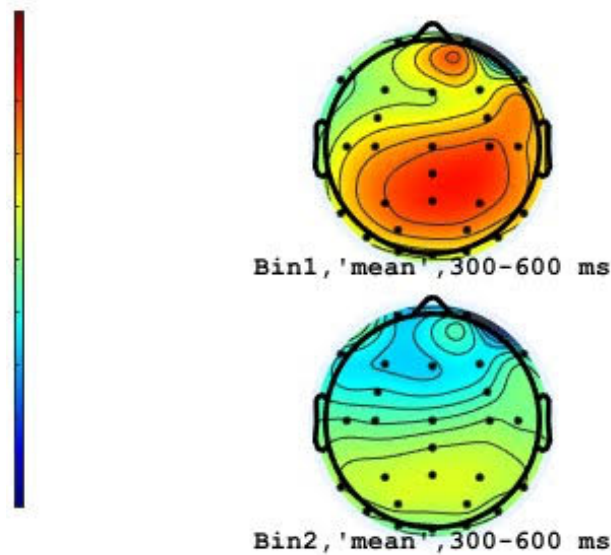
2. Compare the mean amplitude scalp maps for 300-600 ms with the instantaneous amplitude maps between 300-600 ms. What similarities and differences do you see?

The mean amplitude is the average of all 5 instantaneous amplitudes. For Bin 1, the dark red area in the mean amplitude graph is lighter than the second bin and darker than the third and fourth instantaneous amplitude scalp maps. For Bin 2, the yellow area in the mean amplitude graph is lighter than the second, fourth, and fifth instantaneous amplitude scalp maps, but darker than the third.

3. Think about the similarities and differences between the 2 methods of scalp map plotting. Why is one relatively red and one relatively blue?

The mean amplitude scalp map represents the mean amplitude across a certain period of time, whereas the instantaneous scalp map represents the amplitude of selected electrodes at each individual point in time.

Bin 1 is relatively red, which indicates a positive effect for the N400 words that are semantically related. Bin 2 is yellow, which indicates a neutral N400 for words that are semantically unrelated.

4. If you were to give a presentation of your work, what choices would you consider to best display your results regarding the types of plots you would use and how they are displayed?

I would most likely use the classic ERP map and instantaneous amplitude scalp map for a presentation (possibly mean amplitude as well).

The classic ERP map is very straightforward and easy to interpret. You can also select which electrodes you'd like to display, which lends to an easier interpretation of the effect.

The topographical map is useful in how it shows where the electrodes are located on the scalp, and where on the scalp the effect was most prominent. However, it could be difficult to interpret due to the many electrodes included that aren't particularly relevant to the desired effect. I would probably not choose to use the topographical map for a presentation on the N400.

The instantaneous scalp map is useful because the color shows where on the scalp the ERP component had the greatest effect, which makes it very easy to interpret. In addition, it shows how the effect changes over time and when it is most prominent. This makes it a very useful tool for interpretation, but the axes need to be label correctly for people to understand what the colors mean.

The mean amplitude scalp map is useful because it is less data that needs to be interpreted by the reader, which could lend to easier comprehension. It also shows the different colors between the two conditions very clearly. However, it does not show the progression of the effect over time like the instantaneous amplitude scalp map does.