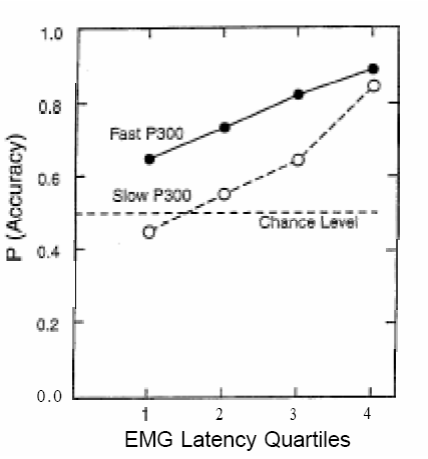
Due Tuesday 1/31/06 in class
COGS 179/279
Homework Problem Set B

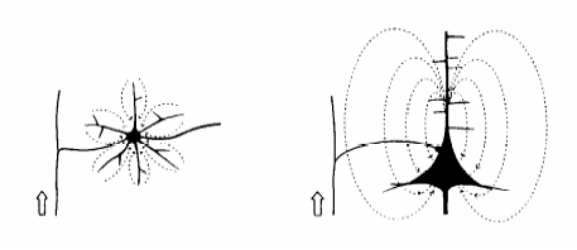
Answer 5 questions (and indicate which ones they are on your answer).

1. The following figure is taken from a study done by Coles et al. (1985: *JEP:HPP*).



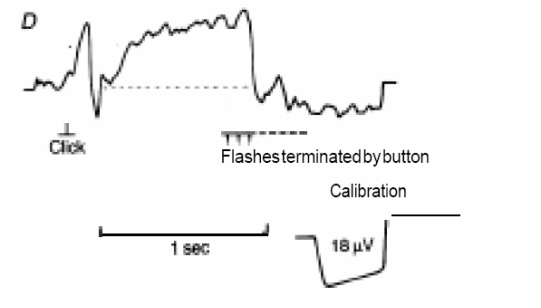
Subjects were asked to identify target letters ('H' or 'S') embedded in background noise by squeezing the appropriate dynamometer in either their left or their right hand. Response times were divided into quartiles (with 1 being the fastest and 4 being the slowest), indicated on the X-axis. The probability that responses in each quartile were correct is plotted on the y-axis. Responses in each quartile were divided into two groups (Fast P300 and Slow P300) based on a median split. (a) Describe the relationship between response times and the accuracy of those responses. (b) Describe how accuracy scores differ in the Fast P300 and the Slow P300 trials. (c) In Kutas, et al. (1977) they used both speed instructions and accuracy instructions. Which quartile here most resembles the speed instructions? (d) Which quartile here most resembles the accuracy instructions? (e) Explain how these results do or do not resemble those reported by Kutas et al. (1977).

2. Draw a diagram of the electrical field generated by (a) the stellate cell on the left and (b) the pyramidal cell on the right. (c) Explain why the shape of the dendrites is important for answering (a) and (b).



3. In this experiment, the subject heard a click, saw a flashing light shortly thereafter, and his task was to press a button to terminate the flashing light. (a) Based on what you read in Rugg & Coles' "compendium of ERP components," what is the name of this component demarcated by the dashed line?

(b) What cognitive process or processes has it been associated with? (c) Given this, how would you explain why this component is not observed when the click and the flashes are paired without a response requirement?



4. The data below were taken from an experiment on mental rotation.

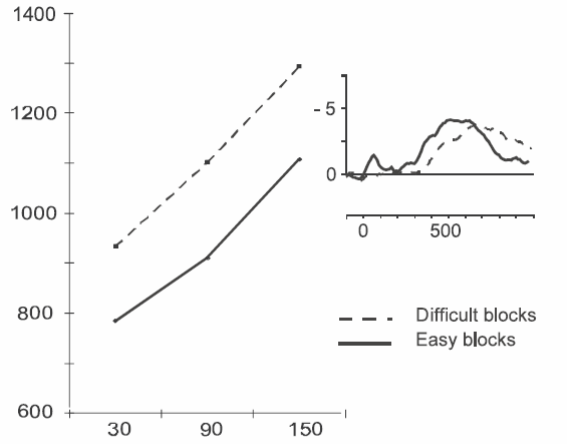
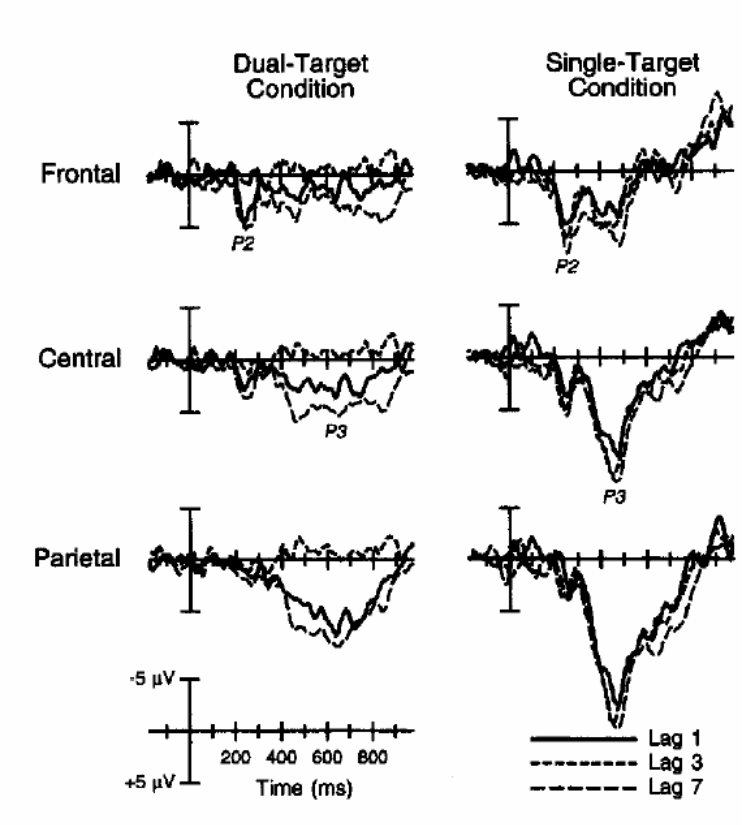


Figure 7. Left: Mean response times as a function of character orientation and discrimination difficulty. Right: Mental-rotation-related amplitude modulation (difference waveforms 150° minus 30°) as a function of discrimination difficulty. Data from Heil and Rolke (2002b).

(a) What aspect(s) of the waveform would you measure to characterize the timing of mental rotation in the easy and the difficult blocks? (b) Is there a good correspondence between the reaction time difference between difficult and easy blocks, and differences in the timing of this ERP component? (c) Assuming that doing this task involves discrimination and mental rotation, how would you characterize the relative timing of these two processes. (d) Justify your answer by pointing to the RT and the ERP data.

5. The data below are taken from a study published by Vogel et al. (1998) in *JEP:HPP*. A stream of 19 characters was presented via rapid serial visual presentation. 17 items were blue letters, 1 was a blue number (T1), and 1 was a red letter (T2). At the termination of the sequence, the subject was asked first to report what number (if any) had been presented, and second to choose between 2 alternatives to indicate which letter appeared in red. One of these letters occurred on 85% of the trials, the other on the remaining 15% of trials. However, the main experimental manipulation was to vary the number of items that intervene between (T1) and (T2) (known as "lag"). (a) What is this experimental paradigm called? (b) Which lag would you expect to be associated with the lowest accuracy rates on T2? (c) The graph below shows the difference waves obtained by subtracting the frequently (85%) occurring targets from the infrequently (15%) occurring targets. What ERP component do you think this was intended to

isolate? (d) Focusing on the ERPs at the central electrode site, describe the effect of lag on the ERPs in the *dual target* condition (where there was both a T1 and a T2) and the effect of lag on the ERPs in the *single target* condition (only T2). (e) How might this pattern of results be explained?



6. The data below come from an experiment using ERPs in coordination with the PRP paradigm.

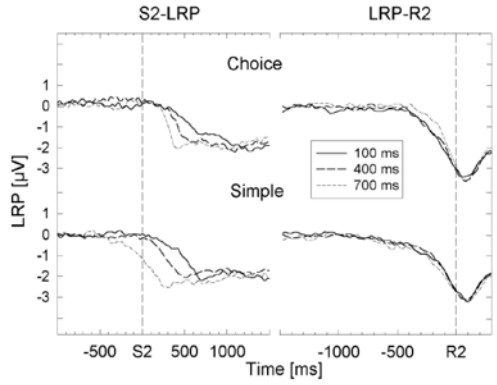
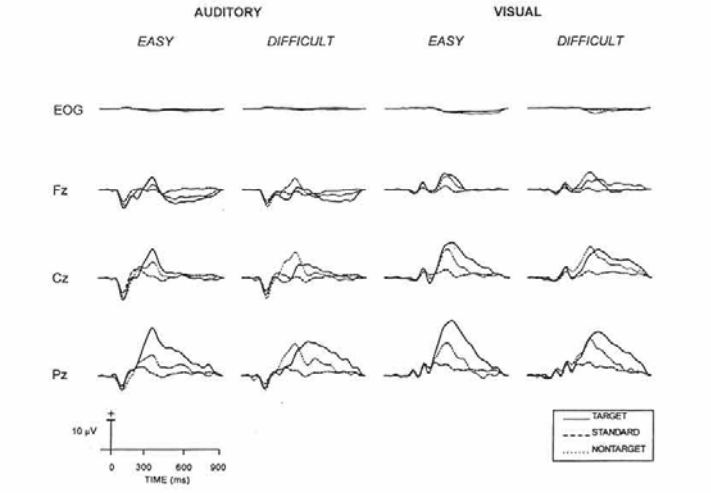


Figure 3. Stimulus- and response-synchronized lateralized readiness potentials (LRPs) in the S_2–R_2 cycle for two-choice and simple response tasks, superimposed for the stimulus onset asynchronies (SOAs) 100, 400, and 700 msec.

(a) Describe the PRP paradigm and typical results on reaction times for RT2 at a short SOA such as 100 and a long SOA such as 700. (b) Based on what Coles & Rugg write about the Lateralized Readiness Potential (LRP) in their "compendium of ERP components", what stage of information processing is the LRP particularly sensitive to? (c) How do these results compare to Luck's findings using the P3 as a

dependent variable? (d) Based on what you know about the experiment that produced the data above (which is not enough to say for sure), do these results (in conjunction with Luck's) support Pashler's theory of attentional limitations? (e) Explain why or why not.

7.
The data below were taken from Comerchero & Polich (1998:CBR) in an experiment that had 3 sorts of stimuli, frequently occurring standards 80%, infrequently (10%) occurring task-relevant targets, and infrequently (10%) occurring task-irrelevant nontargets. (a) In the Auditory Difficult column, do ERPs to the Target and Nontarget stimuli show a qualitative or a quantitative difference? (b) Describe that difference. (c) In the Visual Easy condition, do the Target and Nontarget stimuli show a qualitative or a quantitative difference? (d) Describe that difference. (e) How might you interpret the difference between the effects you described in (a) versus (c)?



8. The following figure shows ERPs to Novel (top) and Known (bottom) stimuli in a memory experiment. The thin line (the one that is clearly more positive at about 200 ms in the Low Pass filtered ERPs) shows the ERP before Woody filtering, and the thick line shows the ERP after Woody filtering. (a) What problem is Woody filtering intended to correct? (b) Briefly describe the way that Woody filtering proceeds? (c) Given the impact of Woody filtering on the amplitude of the positivity peaking at 500 ms, what would you conclude about the signals elicited by Novel and Known stimuli?