Problem Set E
Due Tuesday 2/21/05 in class

1. Below we can see data recorded from intracranial electrodes in an experiment in which the patient read words, some of which were preceded by semantically related words. For example, the prime might be DOCTOR and the next word (target) might be NURSE.

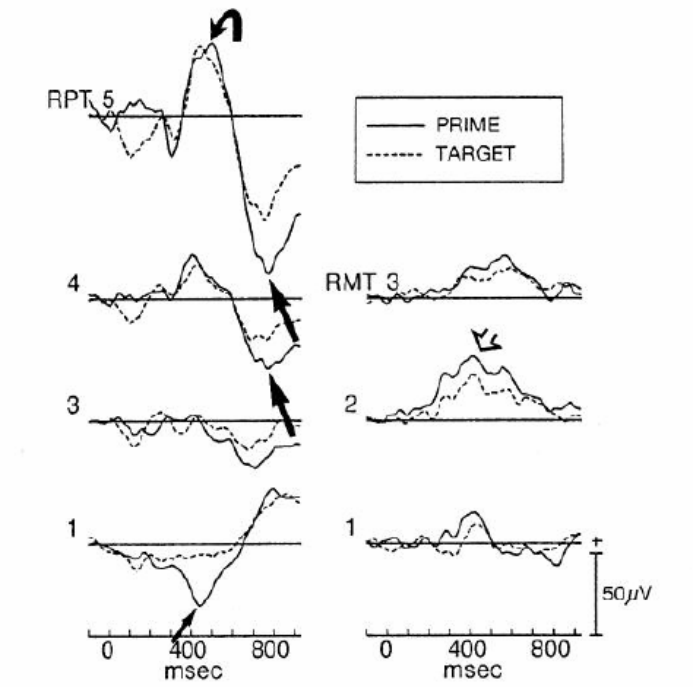

Figure 8. ERPs elicited by PRIMES and TARGETS (semantic priming task) at four electrodes of the right PT probe and three electrode sites of the underlying left subdural strip RMT. The MRIs show the location of the right PT electrodes (*top*), and the locations of the subdural-strip electrodes relative to RPT 1 (*bottom*). The AMTL N400 recorded from RPT 1 in the amygdala is marked by the *small solid black arrow*. The hippocampal P300, recorded at electrodes RPT 4 and 5 within the hippocampus, is marked by *large black arrows*. The *curved black arrow* marks the positive potential that preceded the hippocampal P300 at RPT 5. The positive ERP recorded from the subdural electrode RMT 2 medial to the collateral sulcus is marked by an *open arrow*.

a) Describe the factors (discussed in lecture) that neuroscientists consider when localizing the source of activity recorded with intracranial electrodes.
b) Given the AMTL-N400 observed at electrode RPT 1 (on the left) and the activity at RMT 2 (and the anatomical information described in the caption), where do you think the locus of the AMTL-N400 is?
c) Given the positive activity evident at RPT 5 at 400 ms after word onset (before the hippocampal P300), does it seem likely or unlikely that the hippocampus participates in the generation of the AMTL-N400? [note: this is a tiny bit trickier than it might seem]
d) Explain why or why not.
e) Given what is known about the scalp-recorded N400, what experimental manipulation would you try if you were recording from these sites?
f) What pattern of activity would you expect to see at RPT 1?
g) Explain your answer in f).

h) What other electrode/s would be of potential interest?
i) Why?

2. In an fMRI study Kuperberg and colleagues asked people to read sentences that were either normal, contained pragmatic anomalies (violations of world knowledge), or syntactic anomalies. The following chart describes the activation patterns for various comparisons.

Table 5. Pairwise Comparisons: Modulation of Activity within the Left Temporal–Frontal Cortex and Bilateral Parietal Cortex to Normal, Pragmatically Anomalous, and Syntactically Anomalous Sentences

(A) Region	*Brodmann's Area*	*Prag. > Synt.*	*Prag. > Norm.*	*Norm. > Synt.*
L inferior frontal gyrus	44/45	×	×	×
L fronto-orbital gyrus	47	×	×	×
L middle frontal gyrus	9/46	×	×	
L superior temporal gyrus (posterior)	22	×		
L superior temporal sulcus (posterior)	22	×	×	×
L anterior occipital sulcus	21/37	×		×
L superior temporal gyrus (anterior)	22	×		
L superior temporal sulcus (anterior)	22	×		
L temporal pole	38	×		
L fusiform gyrus	20	×		

a) Which comparison is most relevant for identifying the neural generators of the N400 component?
b) Do the brain areas found by Kuperberg and colleagues correspond to N400 generators as determined by MEG researchers?
c) Do the brain areas found by Kuperberg and colleagues correspond to N400 generators as determined by intracranial EEG recordings (e.g. by Nobre)?
d) What are some reasons that might explain discrepancies between scalp-recorded EEG and fMRI activations?
e) Van Petten & Luka (2006) give a general description of how to determine the impact of inferior frontal gyrus activity on the amplitude of the scalp-recorded N400. Describe the design of a particular experiment that might shed light on this issue.
f) Briefly explain the logic of your design.

279/179ExtraCredit: Briefly discuss the implications of the involvement of IFG in the generation of the N400 for the cognitive and language processes indexed by this ERP component. Be sure to consider the putative role of IFG in other cognitive and/or language processes.