

## Problem Set F

(f is for final)

*Due in class Thursday 3/9/06*

**1.** In a discussion of ERP studies where pictures elicit N400 effects, Van Petten and Rheinfelder (1995:487) write “Barret and Rugg presented famous faces which had been sorted into occupational categories (e.g. politicians, actors, etc.) and assigned the task of deciding whether sequentially presented faces belonged to the same category. Faces preceded by a face in a different category elicited a larger late negative wave than those paired with faces from the same category. This result can be accommodated within a language-specific view of the N400 by postulating that subjects performed the task by semantically recoding the faces into verbal labels. Other experiments combining pictures and words are amenable to a similar explanation.” Describe an ERP study discussed in lecture or the readings that revealed a picture N400 not subject to this sort of explanation, and tell why it is hard to explain via verbal recoding.

**2. (a)** What theoretical suggestion motivates the search for ERP components specific to OC versus CC words? **(b)** What ERP component was originally thought to reflect processing of OC but not CC words? **(c)** What ERP component was originally thought to reflect processing of CC but not OC words (but isn't now)? **(d)** Describe the experimental evidence that has led ERP researchers to rethink the functional significance of the component you answered for (c).

**3. (a)** Describe an ERP experiment discussed in lecture or the readings that compared brain activity associated with the semantic processing of pictures versus words. **(b)** Tell what aspect of the findings in this experiment is most informative for the question of whether people exploit a common versus multiple semantic system(s). **(c)** Explain why the findings in the study you described support either unitary or dual coding (common versus multiple semantics).

**4.** In the article we read by Muentz and colleagues, it says “The N400 and the LPN found with both types of words could be tentatively interpreted as reflecting some aspects of lexical processing, while the N400-700 effect might reflect the activity of the syntactic processor. In order to test this hypothesis, experiments have to be done contrasting closed class words of different functions (e.g. determiners, conjunctions, prepositions), that are matched for length and frequency.”

Assuming you have matched a set of determiners, a set of conjunctions, and a set of prepositions for length and frequency, what does Muentz's hypothesis predict for the relative amplitude of the

**(a)** N400: determiners vs. conjunctions vs. prepositions?

**(b)** LPN: determiners vs. conjunctions vs. prepositions?

**(c)** N400-700: determiners vs. conjunctions vs. prepositions?

**5.** Van Petten & colleagues (1999) raise 3 alternative hypotheses about the relative timing of word recognition and semantic integration in auditory sentence processing.

(i) Semantic processing of words begins after the uniqueness point has been reached.

(ii) Although the meaning of all the words in the cohort are active early, integrating word meaning with contextual meaning doesn't begin until after uniqueness point has been reached.

(iii) Semantic processing at both word and sentence levels begins early.

In their study, they recorded ERPs as subjects listened to sentences such as “It was a pleasant surprise to find that the car repair bill was only seventeen” that ended either as expected (dollars), with an unexpected word from the cohort (dolphin), or with a rhyming word (scholars). **(a)** Describe the relative amplitude ( $>$ ,  $<$ ,  $=$ ) of the N400 component elicited by these three sorts of sentence final words. **(b)** Describe the relative timing ( $>$ ,  $<$ ,  $=$ ) of the N400 component elicited by these three sorts of sentence final words. **(c)** Describe the onset of the N400 elicited by these three sorts of sentence final words with respect to their uniqueness points. **(d)** Explain how these data argue for or against position (i) above. **(e)** Explain how these data argue for or against position (ii) above. **(f)** Explain how these data argue for or against position (iii) above.

6. **(a)** What is the main difference between the N400 elicited by words vs. pictures?
- (b)** What does this finding imply about the existence of a common semantic system?
- (c)** How does the scalp distribution of the N300 compare to that of the picture N400?
- (d)** What is the main evidence that N300 and N400 are different components?
- (e)** What has been proposed about the functional significance of the N300 vs. the N400?

7. Van Petten & Kutas (1991) found that closed class (but not open class) words elicited an N400-700 component. In congruent sentences, this component was larger for words that occurred late in the sentence than for words that occurred early. In random word strings (that began with a capital letter and ended with a period), the N400-700 was the same size for words appearing early and late in the “sentence”. **(a)** What other ERP component did they relate the N400-700 to? **(b)** Explain how their data support this claim.

8. The following data is taken from a study done by Besson and colleagues (1998) in which they compared the impact of expected versus unexpected words and expected versus unexpected notes in opera music (which has both linguistic and musical content). What do these data imply about the neural resources that underlie the processing of semantic and harmonic integration? (Be sure to justify your answer.)

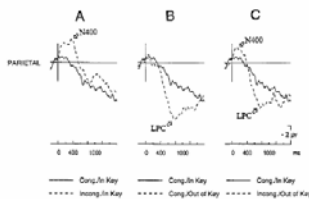


Fig. 8. ERPs results averaged across 16 professional musicians and recorded from the parietal electrode (Pz). Terminal congruous words sung in key are compared to (A) semantically incongruous words sung in key, (B) semantically congruous words sung out of key and (C) semantically incongruous words sung out of key. The vertical lines mark the onset of the final word of the excerpts. A large N400 component develops during the 50–600 ms that follow the presentation of semantically incongruous words (A). In marked contrast, an LPC develops during the 400–1200 ms that follow the presentation of words sung out of key (B). Most importantly, both an N400 and an LPC develop in response to the double incongruity (C; from Besson et al., 1998).

**279/179** Extra Credit

**(a)** Can the following two positions on the functional significance of the N280/LPN be reconciled? **(b)** If so, explain how. If not, explain why one position is better than the other.

- Munte: N280/LPN elicited by both OC & CC words
  - Latency/frequency relationship more robust in sentences that engage normal reading patterns
  - May reflect suppression of eye movements typically made but forbidden in artificial RSVP used in lab
- ter Keurs: Early distinction (N280/LPN) between OC and CC items evident in control groups but not aphasics
  - Contributes to syntactic processing difficulties

**(c)** Can the following two positions on the functional significance of the N400-700 be reconciled? **(d)** If so, explain how. If not, explain why one position is better than the other.

- Munte: N400-700 unique to CC words
  - In fact, unique to very high frequency CC words (which tended to be determiners)
  - Observed in both lists and sentences
  - May reflect syntactic processing
- ter Keurs: N400-700 much reduced in aphasics relative to controls (and right-lateralized in aphasics versus left lateralized in healthy & RH lesion controls)
  - Presence of even small effect suggests eventually aphasics recognize word class distinction, consistent with suggestion that language processing is delayed in aphasics
  - Because CC words aren't meaningful to aphasics, N400-700 could reflect CNV-like anticipation of next word in hopes it will be meaningful to them...