

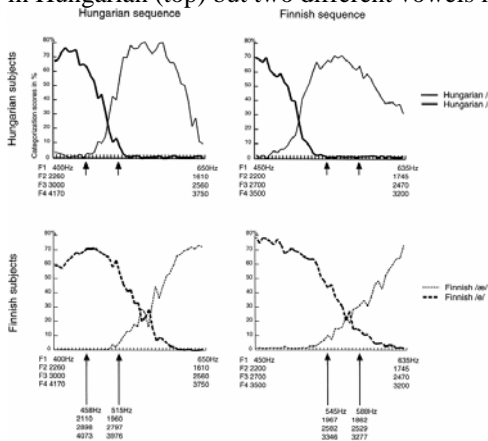
Due Tuesday 2/7/06 in class
 COGS 179/279
Homework Problem Set C

(1) In the article “Hearing lips and seeing voices” McGurk and McDonald describe a phenomenon now known as the McGurk effect (also known as the McGurk-McDonald effect). (a) Which Response Category in Table 1 of this article is relevant for the effect? (b) What is their explanation of why the fused response occurs? (c) What is their explanation of why the combination response occurs? (d) Why do you think performance in this study differed in the children and in the adults? (e) What pattern of results would you expect from senior citizens on this task, and why?

(2) Describe the model Sams et al. (1991) give for the McGurk-type effect they observed. It may help to sketch a picture (but you don’t have to!).

(3) Sams et al. (1991: 144) write “the present difference waveform cannot be the magnetic counterpart of the well known P300 deflection, elicited by various infrequent changes in a stimulus sequence.” (a) Explain why this is relevant for the argument they make in the paper. (b) On that same page they write, “Our control condition with light stimuli suggests that the observed difference waveform cannot be explained by different degrees of attention allocated to the frequent and infrequent stimulus.” If the latter were the case, what would expect to see in the MEG-ERPs to the Red vs. the Green stimuli? (c) On p. 143 they write, “Visual articulation presented alone, without the auditory input, elicited no response over the left temporal area in the two subjects studied.” Given their larger agenda in this article, why is this an important finding?

(4) This diagram shows how Finnish and Hungarian subjects classified two different vowel sounds as a function of what vowels were in their respective languages. The acoustic stimuli on the left side of the graph sound like two different vowels in Hungarian (top), but the same vowel in Finnish (bottom). The acoustic stimuli on the right side sound like the same vowel in Hungarian (top) but two different vowels in Finnish (bottom).



Based on the week 3 and week 4 articles, what predictions would you make about the amplitude of the MMN component elicited by an oddball paradigm that used the two acoustic stimuli on the left in (a) Hungarian subjects? (b) Finnish subjects? What predictions would you make about the amplitude of the MMN component elicited by an oddball paradigm that used the two acoustic stimuli on the right in (c) Hungarian subjects? and (d) Finnish subjects?

(5) (a) If the polarity of the MMN is negative at an electrode over the front of the head (Fz) and positive over the left mastoid electrode, what does that suggest about the location of the neural generator for this effect? (b) Where in the brain do most electrophysiologists think the source or sources of the MMN is/are?

(6) In their study of the McGurk effect, Colin et al. (2002) found that the scalp distribution of the MMN evoked by two tones was slightly different from the MMN evoked by the two acoustically similar but perceptually different audiovisual stimuli (i.e. the McGurk stimuli). (a) What do you think this difference implies? (b) Does this finding support the auditory theory of speech perception, the motor theory of speech perception or neither? (c) Justify your answer to (b).

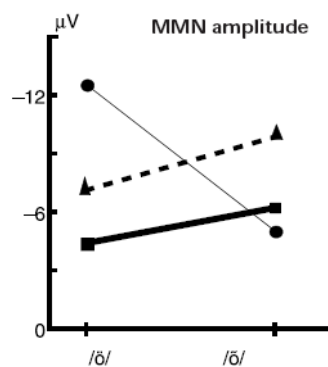
(7) Stekelenburg et al. (2004) report finding an MMN to the ventriloquist illusion that is very similar to that elicited by sounds coming from locations separated by 20 degrees. (a) What is the ventriloquist illusion? (b) What is the functional significance of the MMN component? (c) How do they interpret their findings? (d) Given that they used 16 electrodes, what

is an alternative explanation of their failure to find a difference in the scalp distribution of the two MMNs they observed? (e) How would this affect the interpretation of their findings?

(8) In their study of auditory change detection, Opitz et al. (2002) found that while their hypothesized temporal lobe generators of the MMN were more activated in the large than medium deviant condition, frontal lobe generators were more activated in the medium than the large deviant condition. They write (p. 172) “In the present experiment standard tones and large deviants were separated by an octave (100% change in all three partials) and, thus, despite their physical differences belong to the same pitch class. It could thus be assumed that the medium changes were perceived as more deviant than the large change...” (a) How could you test whether this was the case? [Hint: may not involve ERPs.] (b) How did the methodology used by Opitz and colleagues differ from that described in some of the other MMN papers we have read, and why might it account for the elicitation of a P300 component in this experiment?

(9) Acoustically, the phoneme on the left is easier to discriminate than the one on the right, as reflected in the slightly larger MMN amplitude for the latter in the Estonians. (a) Is the pattern in the 6-month-old Finns or the 12-month-old Finns more similar to the Finnish adults we read about in a similar study? (c) What do you think explains the Finnish data below?

Fig. 3. The MMN peak amplitude (at Cz) as a function of the deviant stimulus. Results are shown for three groups: six-month-old (squares, thick solid line) and one-year-old (circles, thin solid line) Finnish infants and one-year-old Estonian (triangles, dotted line) infants. These are arranged in the order of increasing F2 difference from the standard stimulus. —■, 6-month-old Finns; —●, one-year-old Finns; --▲, one-year-old Estonians.



(10) (a) What is categorical perception? (b) Why was it once thought that only humans show categorical perception of speech sounds? (c) Describe some evidence that suggests non-human species show categorical perception of speech sounds.

279 Question

(11) How does the functional significance of the MMN component in the ERPs compare to that of the P3a (frontal, orienting response) and P3b (centroparietal “classic” P3) as discussed by Ranganath, et al. in the Nature Neuroscience paper we read 2 weeks ago? Could our knowledge of the MMN be integrated with their general proposal about how the brain represents context and novelty? (No “right” answer here – I’m just interested in what you think.)