Perception of Dichotically Presented Steady-State Vowels as a Function of Interaural Delay*

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When stop-vowel syllables are presented dichotically with a temporal delay between syllables at the two ears, the lagging stop is recalled more accurately on the average then the one which leads (Studdert-Kennedy et al., 1970; Lowe et al., 1970). Porter et al. (1969) have reported finding a slight lead advantage rather than a lag advantage when the competing stimuli were steady-state vowels rather than stop consonants. They interpret the difference between stops and vowels as evidence that the lag effect in recall of dichotic stimuli is associated with special speech decoding processes. They attribute the absence of the effect for vowels to the vowels' being treated perceptually like nonspeech stimuli.

There is considerable evidence that steady-state vowels can be perceived either in a speech mode or nonspeech mode. For example, Spellacy and Blumstein (in press) claim that dichotically presented vowels will give either a left-ear advantage like nonspeech stimuli or a right-ear advantage like stop consonants depending on whether the test context induces subjects to listen for speech or nonspeech stimuli.

If the lag effect is associated with perception in the speech mode, then it should be possible to obtain a lag effect for isolated steady-state vowels under conditions which induce the subjects to perceive the vowels as speech. I have data which indicate that this is so. Figure 1 compares two groups of subjects. The ten naive subjects were people who had never taken a dichotic test. The ten experienced subjects had previously taken at least one dichotic test in which they identified vowels in stop-consonant vowel syllables. The stimuli in the present test were three synthetic steady-state vowels [e], [a], [ɔ] present in pairs at opposite ears with delays of 10, 30, 50, 70, or 90 msec between onsets of stimuli at the two ears. The subjects' task was to identify both vowels on each trial and to indicate which vowel sounded clearer by recording the clearer stimulus in the first column of the answer sheet. The graphs show the pattern of first responses for the two groups. Negative time values refer to lagging stimuli.

The naive subjects showed a slight lead advantage and a slight right-ear effect, neither effect significant. The experienced subjects showed both a right-ear advantage and a lag advantage. The two groups differ

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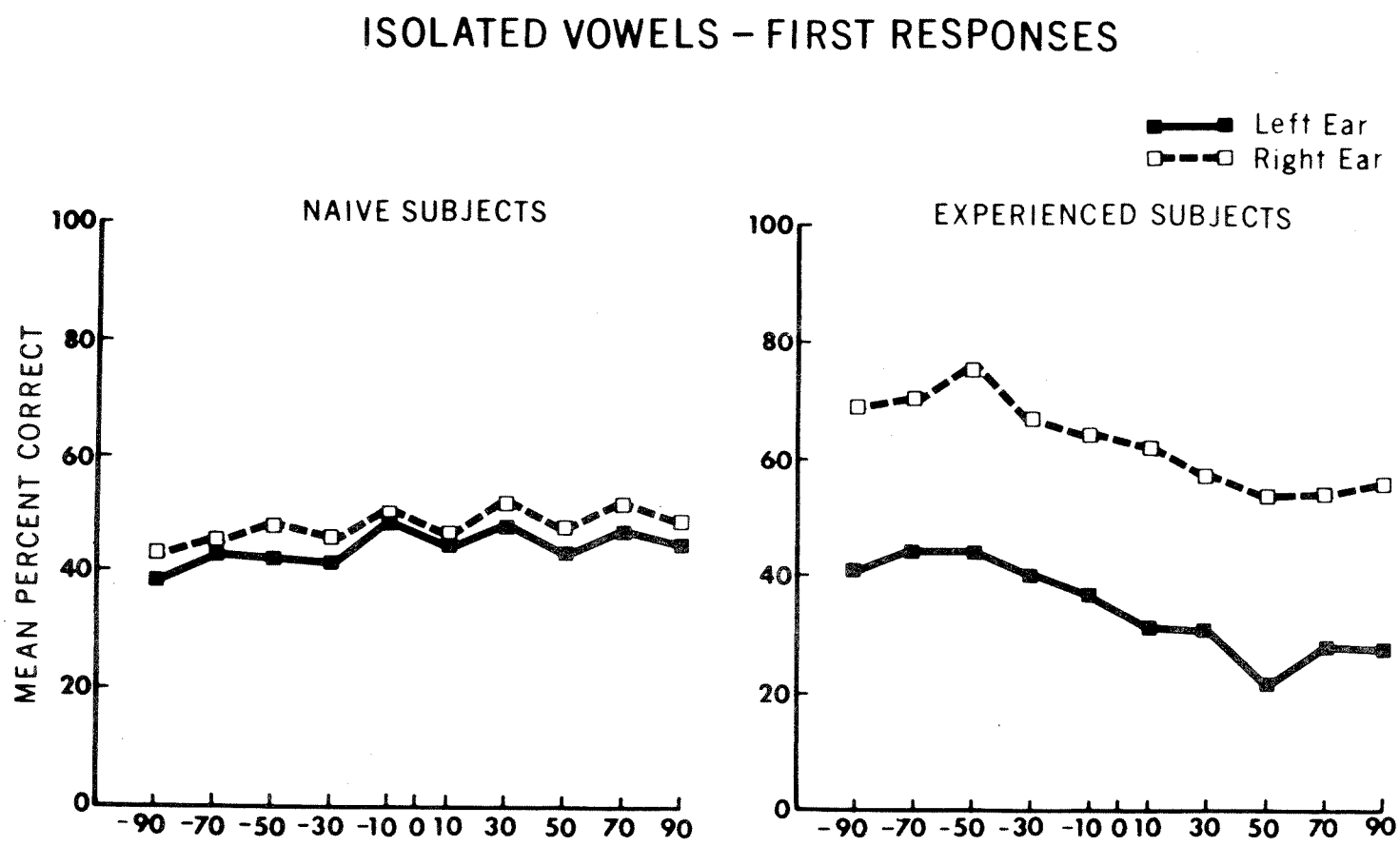
ISOLATED VOWELS – FIRST RESPONSES
Left Ear
Right Ear
NAIVE SUBJECTS
EXPERIENCED SUBJECTS
MEAN PERCENT CORRECT
100
80
60
40
20
0
-90 -70 -50 -30 -10 0 10 30 50 70 90
LEAD TIME IN MSEC

Fig. 1

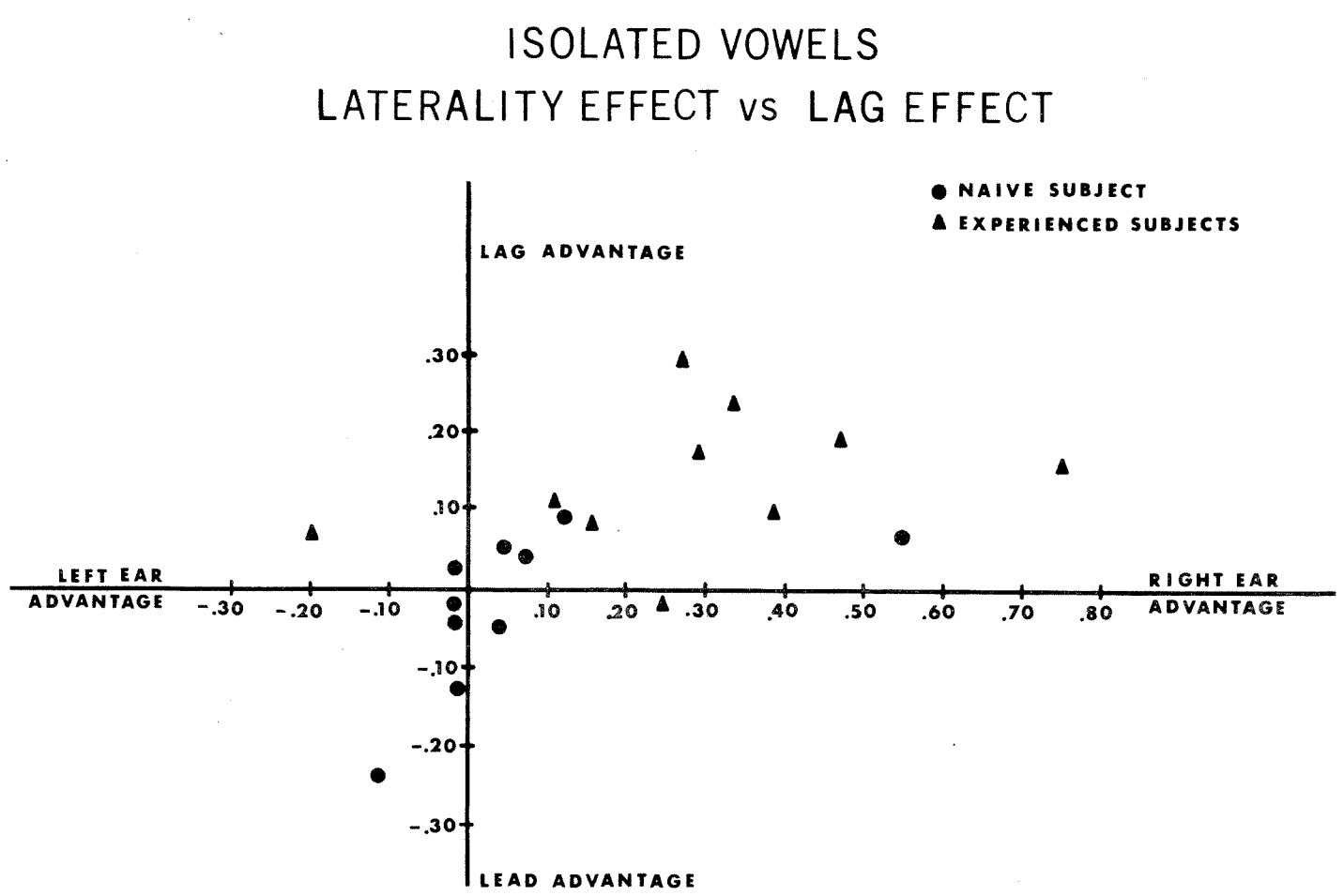
ISOLATED VOWELS
LATERALITY EFFECT vs LAG EFFECT
NAIVE SUBJECT
EXPERIENCED SUBJECTS
LAG ADVANTAGE
LEAD ADVANTAGE
LEFT EAR ADVANTAGE
RIGHT EAR ADVANTAGE
.30
.20
.10
-.10
-.20
-.30
-.30
-.20
-.10
.10
.20
.30
.40
.50
.60
.70
.80

Fig. 2

significantly from each other. Apparently previous experience in dichotic tests involving vowels in CV syllables can shift listeners into a speech mode for isolated vowels, and this shift affects their time preference as well as their ear preference.

Indices of the magnitude of the lag effect and ear effect were computed for each subject based on first responses. A scatter plot of the ear effect vs. the lag effect is shown in Figure 2. Each naive subject is represented by a dot, each experienced subject by a triangle. An association between the right-ear effect and the lag effect was found not only when the two groups are compared with each other but also when individuals are compared within each group. The Spearman rank correlation coefficient between the right-ear effect and lag effect was +.71 for the ten naive subjects, which is significant with $p < .025$ on a one-tailed test. For the experienced subjects the correlation between the two effects is positive but not significant (.50).

For competing stop consonants most subjects show both a right-ear advantage and a lag advantage. I have not found any systematic relationship between the magnitude of the lag effect and right-ear effect for dichotically presented stops. The failure to find a positive correlation for stops suggests that the lag effect and right-ear effect in dichotic listening involve independent processes. Both effects may nevertheless depend upon the stimuli being perceived as speech. The results I have reported here for isolated vowels can be rationalized by the assumption that vowels can be analyzed by both speech and nonspeech processors. Both effects would occur when the speech mode predominates. Neither the lag effect nor the right-ear effect would be obtained when the nonspeech mode predominates. The significant correlation between the two effects for naive subjects suggests that individual subjects are shifting back and forth between the speech and nonspeech modes within the same test. The lack of lateralization typically reported for dichotic vowels may mean that the vowels are analyzed inconsistently by speech processors in the left hemisphere and nonspeech processors in the right hemisphere.

In summary, the finding of a positive correlation between the lag effect and right-ear effect for steady-state vowels supports the conclusion that the lag effect is a manifestation of processing in the speech mode.

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