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## Perception of Inflected Vowels\*

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The commonly accepted technique for measuring the response of a resonator is to record the amplitude variations of a single pure tone as it is swept through the frequency range. Naturally, if measurements were made at only a few discrete frequencies the response would be less clearly indicated. In a similar manner this may also be true for the perception of the complex resonating characteristics associated with vowels. Specifically, it might appear that the intelligibility scores for vowels would be higher when formant frequency patterns were defined by the sweeping partials associated with an inflected fundamental than when only a few points of this pattern were defined by the fixed partials associated with a periodic fundamental. Indeed, synthesized vowels have been judged more natural when an inflection was used. Moreover, some evidence has been reported which indicates that an inflection does make a significant difference in the recognition of certain vowels.

The purpose of this investigation was to test the hypothesis that there is no significant difference between the intelligibility scores for inflected and for non-inflected spoken vowels.

To test this hypothesis 20 male and 20 female subjects read ten words (composed of different vowels in a "h--d" context) until each word could be spoken with (a) a rising, (b) a falling, and (c) no inflection. A high fidelity system was used to tape record these 1,200 stimuli and to play them back in a random sequence to observers listening through a pair of earphones. In all, 17 observers, each having demonstrated prescribed phonetic transcription ability, listened independently to each stimuli until confident of the

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phoneme identification. Then they recorded their judgment using the symbols of the International Phonetic Alphabet. The data were collated, and an analysis of variance was computed for the main effects and interactions of vowels, sex, and inflection.

The only main effect found significant at the one percent level of confidence was that for vowels. Neither the effects of inflection nor of sex were found significant at this level, and hence they were attributed to chance variations. A closer inspection of the data in terms of intelligibility scores for each vowel-inflection condition showed the vowel differences to be similar to those found in previous studies. In addition, the effects of inflection for certain vowels appeared large but inconsistent in direction. Thus, the null hypothesis that inflection has no significant effect upon vowel intelligibility could not be rejected.

Because so little is known about the identification of such complex stimuli, further generalizations must be quite speculative. It is possible that inflection is unrelated to the recognition of vowels; it is also possible that the quasi-periodic nature of laryngeal vibration defines the resonance characteristics as well as inflection. More research is needed before these phenomena can be clearly understood. In particular, the investigator plans to extend this research using synthesized vowels as stimuli. Thus, the difficulties of measuring and controlling the physical parameters of spoken vowels can be avoided.

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#### Discussion

*Weingartner* (Hamburg): The fact that Chinese vowels can be recognized easily even if they make up morphemes by themselves and are inflected in four tones appears as a corroboration of the paper read.