

Synthesis of Speech of the Hearing Impaired

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It is beyond doubt that deafness is one of the most serious problems faced by individuals who are affected by it. It is probably one of the most recognised problems. One of the major and often seen effects of hearing loss is a deficit in oral communication skills. According to Conrad (1979), the magnitude of the problem illustrated by recent studies suggests that about 75% of the prelingually deaf children with hearing loss of 90 dB or more are classified to be "barely intelligible" or "worse".

This low achievement of the hearing impaired has led to several investigations of the receptive and productive variables of speech.

Attempts have been made by Lang (1975), Osberger and Levitt (1979), Maassen and Povel (1984,1985), Oster (1985) and Sheela (1988) to study the direct effect of segmental and suprasegmental error corrections on speech of hearing impaired using modern computer processing techniques. Three congenitally deaf children in the range of 9 to 12 years were selected for the study. All these children had severe to profound bilateral sensorineural hearing loss with no other problem. All could read simple bisyllabic words in Kannada.

Eight simple bisyllabic Kannada words with VCV combinations were selected from the test developed by Babu, Rathna, and Bettagiri (1972).

The speech samples of all the three children were recorded as they read the words. Recordings were also obtained of a matched group (for age and sex) of three normal hearing children reading the same set of words.

I Step

The samples were analysed using a PC-XT computer and values for the following parameters obtained.

1. Initial and final vowel duration
2. Duration of pause (if any) and
3. Total word duration

Then the data was subjected to statistical analysis in order to determine the mean, standard deviation and significance of difference.

The following Conclusion were drawn from the results

1. On the average the hearing impaired group had significantly longer durations for vowels (both initial and final) than that of normal hearing group.
2. Normal hearing children did not show any intersyllabic pauses (intra word) whereas two out of three children in the hearing impaired group inserted intersyllabic pauses.
3. The total duration of the words uttered by the hearing impaired children were significantly longer than that of normal hearing group. In all instances, the hearing impaired children exhibited greater variability than normal children.

II Step

Vowel duration and Pauses (if any) were modified using synthesis programs towards normal values of the respective counter parts of the control groups.

The measures corrected were both in isolation and in combination with each other. Thus,

1. Correction of pause alone.
2. Correction of vowel duration alone by 100%.
3. Correction of vowel duration by 100% and elimination of pause (if any)
4. Correction of vowel duration by 75% and elimination of pause (if any)
5. Correction of vowel duration by 50% and elimination of pause (if any)
6. Correction of vowel duration by 25% and elimination of pause (if any)

III Step

A total of 176 samples (47 uncorrected + 119 corrected and 10 from both groups for reliability check) were presented randomly using a tape recorder to the three judges for intelligibility rating and word identification under both open and close set conditions. The number of words identified correctly were converted into percentage scores. The judges had to rate the intelligibility on a three point interval scale, ranging from "1" (unintelligible) to "3" (highly intelligible).

The intra and inter judge correlation were high. The results indicated that correlation of correction of vowel duration by 75, 50 and 25 percent elimination of pause had positive effect on intelligibility, while all the other types of corrections had detrimental effect on intelligibility. The correction of vowel duration by 75, 50 and 25 percent with elimination of pause showed an average improvement in intelligibility by 2.05%.

The word which was correctly identified by most of the judges for most of the time was /u:ta/ followed by /emme/, /a:ne/, /o:le/, /e:lu/, /ili/, /ondu/ and /ele/.

The performance of rating improved in the closed set as compared with the open set responses.

The synthesis of speech of the hearing impaired showed that the intelligibility

- a. Improved when vowel duration (both initial and final) were altered by 75, 50 and 25 percent with elimination of pauses (if any).
- b. Decreased
 - i. When pause alone was altered.
 - ii. When duration alone was altered.
 - iii. When duration was altered by 100% with elimination of pause (if any).

Thus it was observed correction of some of the suprasegmental aspects of speech caused only a small increase in the intelligibility. It was also seen that correction of a part of vowel duration with elimination of pause had beneficial effects on the speech intelligibility.

On the basis of the present study and on those which were carried out by Osberger and Levitt (1979), Maassen and Povel (1984), Oster (1985) and Sheel (1988), it can be concluded that improvement in intelligibility can be expected if one succeeds in training the hearing impaired children for better control over the suprasegmental aspects of speech.

This implies that correction of segmental errors along with suprasegmental errors bring about more improvement in the intelligibility.

Recommendations :

1. Similar studies can be carried out for segmental corrections.
2. Similar studies can be carried out for both segmental and suprasegmental corrections in various speech material.
3. Similar studies can be carried out using sentences as speech materials.
4. A study to establish the relative impact on intelligibility of different types of speech errors and to develop an individualised program for speech improvement would be interesting.