Acoustic Analysis of the Speech in Normal Adults *

GOPAL, N. K.

Speech is a neuromuscular activity. Tn other words, the output of this activity is the acoustic signals, which are used for communication—as speech. The acoustic characteristics of speech have been found to vary with age. These acoustic characteristics on various aspects of speech production indicate the accuracy of control changes with the age.

"Today we are able to measure the acoustic or audible aspects of voice with sophisticated equipment. The voice prim analyzer, sonograph, airflow meter, pressure recorder and computerized model of the vocal tract enable investigators to confirm earlier empirical findings and unearth new aspects of vowel sound characteriza+ion. The physiological aspects of sound production such as breathing patterns, vocal attack, vocal fold vibration, and some resonance qualities can be revealed by acoustic means."

The acoustic analysis to study the changes in speech as a function of age in adults has been found to be useful as such studies reflect :

1. The adjustment of phonatory apparatus.
2. The shaping of the vocal tract.
3. The timing and coordination of articulation and neuromuscular changes of speech mechanism. This information, is of importance in identification, diagnosis and treatment o various speech, and voice disorders

The acoustic analysis has been considered to be useful in knowing more aboui disorders in adults and thus in the treatment of disorders.

The present investigation was therefore undertaken to study certain acoustic parameters of speech, recommended by Hirano (1981). namely :

1. Fundamental frequency.
2. Frequency range,
3 Intensity range,
4 Rise time,
5. Fall time,
6. Intensities at harmonics,
7. Vowel duration.

These parameters were studied in a sample of one hundred adults, both males and females, ranging in age from sixteen years to sixtyfive years, who were normals in terms of their speech, language and hearing.

Data on the repetition of three Kannada sentences "idu pa:pu". "iduko:ti" and ""idu kempu banna" were recorded. Each adult was given three trials. Average of these samples of the nine trials was used for analysis.

• Master's Dissertation, University of Mysore,

The speech samples were fed to the pitch Analyzer (PM-100) to obtain speaking fundamental frequency, frequency range, in speech, intensity range in speech, rise time and fall time of speech.

To measure the vowel duration and the harmonics, the word "idu" was fed to the high resolution signal analyser. The duration of the vowel [i] and the harmonic occurring in it were measured, for all one hundred adults.

The data thus obtained was subjected to statistical analysis, in order to determine the mean, standard deviation and significance of difference between the sexes and different age groups.

Conclusions

After statistical treatment, the following conclusions have been drawn :

I. ***Speaking Fundamental Frequency***

(a) There is a gradual increase in S.F.F. with increase in age in males. The changes in S.F.F. are more at old ages, *i.e.,* above 55 years. It increases from 139-7 Hz at 16-25 years, to 149-76 Hz at 55-65 years.

(b) There is a graudal increase in S.F.F. with increase in age till 55 years in females. From 56 years, the S.F.F. lowers in females. It increases from 224-5 Hz at 16-25 years to 258-7 Hz at 46-55 years and decrease to 234-73 Hz at 56-65 years.

(c) There is a significant difference between males and females in S.F.F. Males use lower S.F.F. than females.

2. ***Frequency Range in Speech***

(a) Males show an increasing trend in the range of fundamental frequency with the increase in age upto age of 45 years. From 46-55 years males show decreasing trend in the frequency range of speech with increase in age.

(b) Females also exhibited an increasing trend in the range of fundamental frequency used in speech as a function of age.

(c) Females use greater range of fundamental frequency in speech than males.

3. ***Intensity Range***

(a) There is a gradual but insignificant decrease in range of intensities in speech in males.

(b) Female subjects show inconsistent intensity range in speech.

(c) Difference in the range of intensities between two sexes is not significant.

4. ***Rise Time of Speech***

(a) There is a gradual increase in rise time as a function of age in males is seen.

(b) In case of females, rise time decreases as age increases till 36-45 years, then increases upto 65 years.

(c) There is no significant diff rence between males and females in rise time.

5. *Fall Time of Speech*

(a) In males fall time increases gradually a s a function of age.

(b) In case of females fall time decreases till the age of 55 years. After which it starts increasing.

(c) There is no difference between males and females with respect to fall time till 45 years of age. From 46-65 years, males show longer fall time than females.

6. *Vowel Duration*

(a) Males show inconsistent variability with respect to vowel duration with increase in age.

(b) In case of females there is a gradual increase in vowel duration from 16-65 years of age.

(c) Females show longer duration of vowel than males.

7. *Harmonics*

(a) The energy level above 1000 Hz is less than energy level below 1000 Hz in both males and females.

(b) The α-parameter shows no signi-licant difference till the age of 55 years in both males and females- The age groups 56-65 years show significant difference when compared to 16-25 years. The age group 56-65 years show lower α-parameter than the age group 16-25 years in both males and females.

(c) There is no significant difference in the a-parameter between males and females in the age range of 16-55 years. But from 56-65 years, males show higher a-parameter than males.

Recommendations

(1) Study may be earned with larger sample in each age group.

(2) The analysis could be extended to other acoustic parameters.

(3) The same parameters can be studied with clinical adult population to explore clinical utility of this infor-mation.