

EFFECf OF BINAURAL MASKING NOISE ON STUTTERING A SPECTOGRAPHIC ANALYSIS

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The present study was aimed at spectrographically analysing the different parameters of speech i.e., fundamental frequency of voice, vocal level, vowel duration and voice onset time of stutterers and non-stutterers in the absence and in the presence of binaural masking noise in reading condition. In addition, the effect of noise on rate of speech and frequency of stuttering were also observed.

Auditory feedback is important for the acquisition, maintenance and control of speech. Several attempts have been made to account for stuttering as caused by some anomaly in auditory feedback (Stromsta 1956, Wolf and Wolf 1959, Mysak 1960, 1966, Tomatis 1963, Gruber 1965, Van Riper 1971).

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Several studies have investigated the effect of auditory masking on stuttering. Most of the authors have reported that stuttering is significantly reduced during auditory masking (Shane 1946, Black 1950, Atkinson 1952, Cherry and Sayen 1956, Maraist and Hulton 1957, Adams and Hutchinson 1974, Adams and Moore 1972, Gerber and Martin 1977 and Yaire 1976).

Atkinson (1952), Black (1950) and Wingate (1970) reported that the fundamental frequency of voice increases under auditory masking.

Under masking subjects tended to speak loudly and at slower speech rates (Hanley and Stier 1949, Adams and Hutchinson 1974, and Adams and Moore 1972).

However, Yaire (1976) found that binaural masking noise caused significant decrement in stuttering associated with increased vocal intensity and faster speaking rate.

Van Riper (1971), reported that masking noise distracts attention from his speech and reduces anxiety and also changes the manner of speaking.

Wingate (1970) after reviewing the literature on the effect of changes of audition on stuttering concluded that attention in the auditory feedback induces certain changes in vocalization.

In recent years, there have been a few attempts in the application of acoustical analysis to study changes in vocalization brought about by auditory masking.

Bryton and Conture (1978), investigated the effects of masking noise and rhythmic stimulation on stutterers. Vocal fundamental frequency, vocal level and vowel duration and their relation to stuttering have been studied. Results showed that stuttering was significantly reduced during noise and rhythmic stimulation. Decrease in stuttering was correlated with increase in vowel duration in both the conditions.

Subjects: Four male stutterers in the age range of 17 to 23 years with approximately same level of intelligence socio-economic background and reading proficiency with no other speech and hearing problems except stuttering served as experimental group. The control group counted of four non-stutterers matched to age, sex, intelligence, socio-economic background reading proficiency. They were free from any speech and hearing problems.

Reading Material: Two passages were constructed with same numbers of syllables occurring in each passage. These passages were meaningful, non-emotional and easy to read. Pre-determined words occurred in both the passages which were later to be analysed.

Procedure: All subjects read two different passages one each, under two conditions (1) in the absence of noise (2) in the presence of 90dB HL while noise delivered to both ears through earphones, using an Arphi Portable Audiometers (caliberated to ISO 1964). The readings were recorded using a professional tape recorder (UHER 653 LOGIC). All the readings were done in a quiet room.

The data recorded was then subjected to analysis. A voice identification—IC 700 series spectrograph was used to measure VOT and vowel duration by obtaining broad band spectrograms. To measure fundamental frequency of voice, Digipitch was used. Vocal intensity level was measured directly using an audiofrequency analyzer. Rate of speech was calculated by counting the number of syllables read per second. The amount of stuttering was calculated by having a trained speech and hearing post-graduate to mark one whenever she heard any repetitions, prolongation and hesitations in the utterance of sounds and syllables.

Results and Discussion

Results were inferred and discussed on the basis of mean difference values only, as the obtained data could not be subjected to any statistical analysis as the population studied was too small.

The results of analysis for stutterers and non-stutterers are shown in Table-1 and Table-2 respectively.

TABLE 1

Mean values of different variables studied in the absence and in the presence of binaural masking noise for stutterers

Variables	Absence of masking noise	Presence of masking noise
No. of stuttering blocks	21.25	17.75
Fundamental frequency	123.12 Hz	141.87 Hz
Vocal intensity	93.12 dB	106.00 dB
Vowel duration— (a)	0.13 sec	0.16 secs
(i)	0.13 sec	0.15 secs
(u)	0.10 sec	0.11 secs
(e)	0.09 sec	0.13 secs
Voice onset time (k)	0.022 sec	0.022 secs
(p)	0.020 sec	0.020 secs
(o)	0.017 sec	0.020 secs
Reading rate	3.01	3.10

TABLE 2

Mean values of different variables studied in the absence and in the presence of binaural masking noise in non-stutterers

Variables	Absence of masking noise	Presence of masking noise
No. of stuttering blocks	Nil	Nil
Fundamental frequency	127.25 Hz	139.37 Hz
Vocal intensity	92.51 dB	97.5 dB
Vowel duration— (a)	0.17	0.17
(i)	0.12	0.14
(u)	0.07	0.11
(e)	0.12	0.16
Voice onset time (k)	0.023	0.025
(p)	0.020	0.017
(o)	0.017	0.022
Reading rate	6.27	6.32

The mean values of stuttering blocks in the presence and in the absence of masking noise show that the stuttering is reduced during binaural masking noise condition in stutterers. This is in agreement with the previous investigators (Shane 1946, Cherry and Sayers 1956, Marairt and Hurlton 1957, Stromsta, 1957, Sulton and Chau 1961, Adams and Moore 1972, Adams and Hutchinson, 1974, Guber and Martin 1978, Yaire 1976 and Bryton and Conture 1978). Non-stutterers showed no stuttering blocks under binaural masking condition.

There was no observable difference in the mean syllabic output rate per Second in the absence and in the presence of binaural masking noise in both the control and experimental groups. However, two non-stutterers and two stutterers have shown a decrease in the rate of speech under masking condition. Whereas two non-stutterers and two stutterers showed an increase in the rate of speech with masking. That means the individual response to binaural masking noise, in terms of rate of speech may vary.

- Both stutterers and non-stutterers showed an increase in vocal intensity under binaural masking noise. Similar findings were reported by Hanley and Steev (1949), Adams and Moore (1972), Adams and Hutchinson (1974) and Yairi (1976).- But Guber and Martin (1977) argued that the beneficial effect of auditory masking cannot be related to increase in vocal intensity. However, stutterers showed a greater increase in vocal intensity than non-stutterers.

Subjects in both groups showed an increase in the fundamental frequency of voice, in the presence of binaural masking noise. Similar observations were made, by Black (1950) and Atkinson (1952). Again stutterers showed a greater increase in fundamental frequency of voice when compared to non-stutterers. The increase in, case, of stutterers was about 18Hz and in case of non-stutterers. 12HZ.

There was a marked increase in the duration of vowel (a, i, u, and e) in the presence of masking noise when compared to vowels in the absence of masking: noise for both stutterers and non-stutterers. This is in accordance with the findings at Bryton and Conture (1978).

It is interesting to note from the present study that there was no significant difference in the voice onset time of stutterers and non-stutterers. This is contrary to findings of several investigators. (Adams and Reis 1971, Babul Basu 1977, etc.), who found that stutterers exhibit a longer "VOT and normals. There was no change in VOT values under auditory masking for both the groups. Lisker and Abramson (1964), have reported that reading acts as a variable, in the measurement of VOT. In the present study also sample used was reading.

From the results of the present study it is evident that stuttering significantly-reduced during auditory masking. This reduction is accompanied by increase in vowel durations, vocal intensity and fundamental frequency of voice. No significant change was observed in VOT measurements under binaural masking noise. The influence of masking noise on rate of speech was variable. Similar findings were observed in the case of non-stutterers also.

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