ABSTRACTS

PHONATION AND STUTTERING

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The present study was conducted to investigate the effect of whispering and changes in intensity of voice on the frequency of stuttering and the rate of speech. Nine stutterers read under four experimental conditions. Condition A (reading in whispering), condition B (reading at 60dB SPL), condition C (reading at 70dB SPL) and condition D (reading at 80dB SPL). Results showed that stuttering was significantly reduced with increase in intensity and stutterers became more fluent when they whispered. Rate of speech was significantly reduced in all conditions in which stuttering was significantly reduced. The results are discussed and explained on the basis of enhanced laryngeal feedback.

Stuttering has been explained in many ways and the literature on theories of stuttering run into volumes. But no one theory explains satisfactorily all the aspects of stuttering. The recent investigations concerning the cause and nature of stuttering emphasize on the role of phonatory behaviour in stuttering. Larynn has been held responsible for stuttering to occur.

A number of studies have directly or indirectly indicated phonatory involvement in stuttering (Adams and Hayden 1976, Adams and Reis 1971,1974, Adams *et al,* 1976, Agneilo and Wingate 1971, Agnello, Wingate and Wendell 1974, Brennel, Perkins and Soderberg 1972, Charie Muller 1963, Conture *et al,* 1974, Freeman and Ushijima 1978, Fujita 1966, Manning and Coujal 1976, Schwartz 1974, Stackweather *et al,* 1976, Wingate 1969b, Wyke 1974).

Wingate (1969), after an analysis of various conditions under which stutterers enjoy 'artificial fluency' inferred that 'vocalization' is a crucial element in stuttering.

Wingate (1970) further argued that reduction in stuttering associated with changes in audition is due to changes induced in vocalization. Adams and Moore (1972), and Adams and Hutchinson (1974), observed that as the intensity of masking noise was increased, stutterers became more fluent, increased their vocal intensity and spoke at slower speech rates.

Several authors have reported that stuttering is markedly reduced during whispering (Johnsen and Rosen 1937, Bloodstein 1950, Van Riper 1971, Perkins, Rudas and Bell 1976, Commodore and Cooper, 1978).

Ramig (1980), studied the effect of varying pitch on the frequency of stuttering. He found a significant reduction in stuttering with reduction in reading rate as the stutterers varied their picth above and below their habitual pitch. Reis (1974),

investigated the effect of varying intensity on stuttering. Twenty-eight stutterers read a passage containing all voiced phonemes and a passage containing both voice and voiceless phonemes under three conditions, soft voice, normal voice and aloud voice when 75dB SPL of white noise was presented through earphones. More stuttering was observed in normal voice condition with all voiced phoneme prose. Stuttering was reduced while using soft voice and while using loud voice.

The literature suggests that phonation is an important factor in stuttering and changes in certain aspects of phonation bring about significant changes in the frequency of stuttering. Therefore, in this study it was proposed to investigate the influence of whispering and the influence of varying intensity of voice on stuttering.

Hypothesis: Two hypothesis were proposed for verification.

Hypothesis (1)—There will be no significant difference in the frequency of stuttering during whispering when compared to the frequency of stuttering in the base rate.

Hypothesis (2) —There will be no significant change in the frequency of stuttering as the intensity of voice is increased.

Definition of Stuttering—Repetitions and prolongations of sounds and syllables and hesitations were taken as stuttering responses for all the subjects.

Methodology

Subjects: Nine stutterers (8 males and] female) in the age range of 15 years to 28 years with a mean age of 20-77 years served as subjects for this study. All subjects had Kannada as their mother tongue, they could read Kannada and were free from any other speech problems or hearing problems.

A speech and hearing graduate assisted in recording the number of stuttering blocks and the number of words read under each experimental session for all the subjects.

Apparatus: For the purpose of indicating and controlling the intensity of voice objectively in known steps and to provide visual monitoring of the required intensity level a 'voice-light' was designed and fabricated in the electronic department of the Institute. It covered a range of 50dB SPL to 90dB SPL, variable in lOdB SPL steps.

Reading material—A Kannada text-book containing essays on different topics served as the reading material. The study was conducted in a quiet room *procedure:* In the first step of the experiment base rate of stuttering blocks were established for all the subjects by counting the number of stuttering blocks for every two minutes as they read for 18 minutes.

Then each subject was exposed to four experimental conditions. Condition A (Reading in whispering), Condition B (reading at 60dB SPL), Condition C

(reading at 70dB SPL), and Condition D (reading at 80dB SPL). The assignment of conditions to the subjects were randomized. Each experimental condition was divided into three parts. First six minutes for pre-experimental base rate, in which subjects read in their normal voice, second six minutes for the experimental condition during which the independent variable—intensity changes or whispering was introduced and third six minutes for post-experimental base rate in which the subject read again in his normal voice.

In condition A, each subject was demonstrated for a while and was allowed to practice for a while. Then the experimental session began.

In conditions B, C and D, the intensity dial of the 'voice light' was set at 60 dB SPL, 70dB SPL and 80dB SPL respectively. Each subject was instructed to maintain the loudness at a particular level to cause the light to grow steadily. Each subject was allowed to practice for some time. The voice light was kept in front of the subject to enable him to see the light glowing. The number of stuttering blocks for every two minutes and the total number of words read were recorded for each subject.

Results: The data obtained was then subjected to statistical analysis. Non-parametric statistical tests—Wilcoxon paired sign rank test and Friedman's two-way analysis of variance (Seigel, 1956) was used.

The obtained T values showed no significant difference in the number of stuttering blocks between the first, second and third six minutes of reading using normal voice. Therefore, the base rate of stuttering blocks was stable.

Further the T values showed that stuttering was significantly reduced during the experimental condition of each experimental session when compared with the pre- and post-experimental condition, in all conditions except the condition B. When the number of stuttering blocks in the experimental condition (second six minutes) of the base rate and 4 experimental sessions A, B, C and D were compared, the X_r^2 value was 26.75 on Friedmen's two analysis of variance. This was significant at .001 level (see Table 1 for scores).

TABLE 1

Shows number of stuttering blocks under base rate and each of the 4 experimental conditions A, B, C and D for all the 9 subjects

Subject No.	Base Rate	Condition A	Condition B	Condition C	Condition D
1	SO	19	45	46	27
2	166	78	159	145	165
3	160	108	158	142	160
4	84	23	82	54	60
S	89	24	91	46	38
6	53	25	53	63	44
7	60	30	53	59	43
8	60	25	53	39	22
9	160	. . 54 .	158	140	108
Mean	98.65	42.88	94.66	81.55	74.11

When the scores in condition A was compared with the base rate of stuttering. The T value of O indicated a significant difference at .01 level. Therefore, hypothesis (1) that 'there will be no significant difference in the frequency of stuttering during whispering when compared to the frequency of stuttering in the base rate' was rejected.

On comparing the frequency of stuttering in the experimental conditions (second six minutes) of conditions B_1 C and D, the X_r value was 10.22 which indicated a significant difference at .002 level. As a group stutterers showed a significant reduction in stuttering at .01 level in condition C when compared with condition B. However, subjects 1, 6 and 7 have not showed such a reduction. On comparing scores in condition C with the scores in condition D, all subjects except subjects 2, 3, and 4 showed a reduction in stuttering in condition D. The T value of O indicated a significant reduction in stuttering in condition D at .01 level.

Thus, there was a significant reduction in stuttering from condition B to condition C and from condition C to condition D. From the above results, the hypothesis (2) that 'there will be no significant change in the frequency of stuttering as the intensity of voice is increased' was rejected.

Among all the experimental conditions greatest reduction in stuttering was observed in condition A, even when compared with condition D.

The number of words read per minute during the experimental condition (second six minutes) was significantly reduced in conditions A, C and D when compared with the base rate.

Discussion

From the above results it is evident that changes in phonation have brought about a significant change in stuttering. The reduction was significant only in conditions A, C and D. In condition B, subjects read at intensity 60dB SPL, which is quite near to the loudness of normal conversational voice possibly the change in intensity was not adequate to bring about any significant change in stuttering. The reduction in stuttering was observed only during the second six minutes of each experimental session, during which the independent variables —changes in intensity and whispering was introduced. This is in accordance with Wingates (1969) statement that the influence of the circumstances which bring about a reduction in stuttering in 'typically transitory'. This is because the stutterers are most likely to revert to their usual manner of vocalizing when the influence of these circumstances ceases. Stuttering was significantly reduced as the intensity of voice was raised to 70dB SPL. There was a further decrement in stuttering as the subjects increased their vocal intensity to 80dB SPL. Thus with changes in intensity there was a significant change in the frequency of stuttering. These findings are in accordance with the results of Reis (1974), Adams and Moore (1972) and Adams and Hutchinson (1974).

The relationship between vocal intensity and stuttering has not been explained. Some changes in the internal laryngeal behaviour has been observed with increase in vocal intensity. The observed changes are:

1. Larger area of contact of vocal folds (Atkinson, 1962);
2. Increased sub-glottic air pressure;
3. Vocal cords remain closed for a proportionately longer time during each vibratory cycle (Fransworth 1940);
4. Greater tension of the vocal cords.

The observations indicate a heightened laryngeal activity with increase in intensity consequently the tactile, proprioceptive and kinesthetic feedbacks from the larynx will be enhanced at higher intensities. Therefore, it is possible that the individual may depend more on the proprioceptive, tactual and kinesthetic feedback from the larynx to monitor his speech.

However, the exceptional subjects, who did not show reduction in stuttering with increasing in intensity may be those who lack optimum feedback which would be gained with changing vocal intensity.

In the present study, all subjects showed a marked reduction in stuttering during whispering. Similar findings have been reported by Johnson and Rosen (1937), Bloodstein(1950), Van Riper (1971), Perkins et *al,* (1976) and Commodore and Cooper (1978).

The essential difference between vocalization and whispering lies in the configuration of the glottis during exhalation and the resultant acoustic output (Zemlin 1968, p. 211), Kinsbourne (1981), pointed that the ability to move differentially without activating all of the synelgism in which the movement is embeded depends on inhibiting the unwanted components of the synelgism. Goldstein (1942), remarked 'the movements continued to (their extreme) are simpler than those which must be stopped at a certain point'.

So, it can be inferred that one needs to exercise greater control over phonatory mechanism while whispering than while vocalizing normally (Margriet Boels—Van Dijk, 1972). In whispering there will be a need for better laryngeal feedback than auditory feedback alone for controlling speech. Van Riper (1972), was right when he stated that stutterers have no difficulty when they whisper, because by concentrating their attention on the feel of their musculature, the stutterers would be forced to do—controlling speech primarily by proprioceptive tactile feedback.

In the present study, the reductions in stuttering were accompanied with reduction in speaking rates. It has not been attempted here to account for the changes observed in the rate of speech. More information is needed in this regard.

Conclusions

The following conclusion's were drawn from the present study:

1. Phonation is an important factor influencing stuttering;
2. Increase in- intensity of voice brings about increasing reduction in stuttering;
3. Whispering significantly reduces stuttering;
4. The rate of speech may be a variable related to stuttering.

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