PHONATION AND STUTTERING

A Dissertation
Presented to
University of Mysore

In partial Fulfillment
of the Requirements for the Degree
Master of Science in Speech and Hearing

May 1982

CERTIFICATE

This is to certify that the dissertation entitled "Phonation and Stuttering" is the bona fide work done in part fulfilment for the degree of Master of Science (Speech and Hearing) of the student with Register Number 1

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CERTIFICATE

This is to certify that this dissertation entitled "Phonation and Stuttering" has been prepared under my supervision and guidance.

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DECLARATION

This dissertation entitled "Phonation and Stuttering" is the result of my own study undertaken under the guidance of Mr. G.Purushothama, Lecturer in Speech Pathology, All India Institute of Speech and Hearing, and has not been submitted earlier at any University or Institution for any other Diploma or Degree.

Register Number—1

Mysore

ACKNOWLEDGEMENTS

The investigator wishes to acknowledge her gratefulness to her guide Mr. G.Purushothama, Lecturer in Speech Pathology, All India Institute of Speech and Hearing, Mysore, for his flexible and excellent guidance and supervision throughout the study. She also thanks Dr. N.Rathna, Director and Prof.Saraswathl Menon, Head of the Dept., of Speech Pathology, All India Institute of Speech and Hearing, for having allowed her to conduct this study.

She expresses her sincere thanks to Mr. S.S. Murthy, Lecturer in Electronics, AIISH, for designing and fabricating the "Voice Light", without which, this study would not have been possible.

She also thanks Mr. N.P.Nataraja, Lecturer in Speech Pathology, for extending all the facilities in conducting this study.

She wishes to extend her warm thanks to her friends in general and class-mate(s) in particular, without whom this study could not have been carried out.

She is extremely grateful to all the subjects who participated in this Study.

Last but not the least, sincere thanks are due to Mr. M.H. Sanjeeva Murthy

CONTENTS

LIST OF TABLES

LIST OF GRAPHS

CHAPTER I

INTRODUCTION

> "Stuttering has been called a riddle. . . . stuttering is more than a riddle. It is at least a complicated, multidimensioned, jig saw puzzle, with many pieces still missing". (Van Riper 1971)

Stuttering has infact received more attention than any other speech disorder and increasing number of investigations are being made to find the cause of stuttering, to explain the nature of stuttering and to develop suitable therapy techniques for stutterers.

The complexity of its manifestations and inconclusive findings of the research and mystery surrounding its etiology have made stuttering an unsolved riddle.

Stuttering has been explained in several ways, as a learnt behaviour (Weschner 1947, Sheehan 1958, Brutten and Shoemaker 1967, Johnson 1967), as a form of neurosis (Coriat 1943, Fletcher 1943, Barbara 1954, Glauber 1958), as resulting from an organic deficit (Travis 1931, West 1958, Eisenson 1958). However, there is no common agreement as to the cause and nature of stuttering.

In recent years, laryngeal behaviour in stutterers has attracted the attention of many investigators and several attempts have been made and are being made to investigate various aspects of phonatory behaviour in stutterers.

As early as 1800, some of the old authors began to speak of malfunctioning of larynx in stuttering (Arnott 1829, Serre d'Alais 1829, Avicenna 1837).

In fact altering the manner of vocalization was one of the earliest treatments recommended for stutterers. There are also well known documentations that stutterers became fluent when speaking loudly.

Schwartz (1974) considered abnormal laryngeal behaviour to be the 'core of the stuttering block'.

Wingate (1969 b) after an analysis of various conditions under which stutterers enjoy artificial fluency inferred that 'vocalization' is a crucial element in the complex of stuttering. He argued that in any condition which improves fluency, the stutterer is induced in one way or the other to do something with his voice that he does not ordinarily do.

Wingate (1970) stated the reduction in stuttering which is associated with modification of auditory function, whether this modification is induced through deafness, naturally reduced hearing acuity, auditory masking or delayed side tone would seem to result adventitiously from the fact that alterations in auditory feed back induce certain changes in vocalization. This view has been supported by Adams and Moore (1972) and Adams and Hutchinson (1974). Both the studies showed that as the intensity of masking noise was increased, stutterers became more fluent, increased their vocal intensity and tended to speak at slower rates.

A number of studies have shown that stutterers have difficulty in initiating and terminating phonation. (Agnello and Wingate 1972, Hillman and Gilbert 1974, Adams and Hayden 1974, Agnello, Wingate and Wendell 1974, Starkweather et al 1976, Basu 1979).

Many studies have demonstrated abnormal laryngeal activities in stutterers during the moment of stuttering (Cherrie Muller 1963, Fujita 1966, Conture et al 1974, Freeman and Ushijima 1974, 1975, 1978).

Several authors have reported that stuttering is markedly reduced and stutterers become more fluent when whisper. (Johnsen and Rosen 1937, Bloodstein 1950, Van Riper 1971). But Rathna and Nataraja (1972) reported a stutterer who stuttered even during whispering and silent reading.

Perkins, Rudas and Bell (1976) have shown that stutterers have difficulty in coordinating phonation with articulation. They reported that stuttering was considerably reduced while whispering and practically eliminated while articulating silently. Similar results were obtained by 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 pitch 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 voiced and voiceless phonemes under 3 conditions, soft voice, normal voice and aloud voice when 75 dB SL 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 aloud voice.

The available literature suggests that phonation is an important factor in stuttering. It will be useful and interesting if different aspects of phonation are studied better.

Therefore, in this study it was proposed to investigate the influence of whispering and the influence of varying intensity of voice on stuttering.

Statement of the problem

The problem was to find the change in the frequency of stuttering response with whispering and with varying intensity of voice.

Purpose of the study

The purpose of the study was to test the following hypotheses:

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.

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.

CHAPTER II

REVIEW OF LITERATURE

"Stuttering is primarily a puzzle, the pieces of which lie scattered on the tables of speech pathology, psychiatry, neurophysiology, genetics and many other disciplines. At each of these tables workers have painstakingly managed to assemble a part of the puzzle, shouting "Eureka", while ignoring the pieces of their own or other tables which fail to fit" (Van Riper 1971).

The literature on theories of stuttering runs into volumes. But we are yet to find a theory that explains everything about stuttering.

Dalton and Hard Castle (1977) summarizes the various theories of stuttering under the headings "Organic" including some of the possible physical or constitutional factors, "Psychogenic" where personality traits and particularly neurotic features are given most importance, "Learned behaviour" in which anticipation, conflict and reinforcement are seen as the key factors and "evaluational" where the diagnosis of the parents play a major role.

Berry and Eisenson (1956) have grouped the etiologies of stuttering under the headings of biochemical, neurological, psychological and genetic factors.

Ainsworth (1971) has classified theories of stuttering into two types. Under the first type he grouped those theories looking for an "active agent" within the child which causes stuttering. It may be constitutional or psychodynamic in nature. Constitutionally the cause may lie in the generalized cortical activity affecting the speech areas (West 1958, Eisenson 1958), may involve relatively complex auditory feed-back circuits (Mysak 1960) or more precisely an auditory feed-back disturbance (Stromsta 1959). Psychodynamically the speech interruption may be triggered by a primary anxiety (Travis 1972). On the contrary there are theories that seek an active agent outside the child - in the listener, in the immediate environment or in the culture itself (Johnson, Brown, Curtis, Edney and Keaster 1967).

Of late there is a shift from the belief in "the cause" of stuttering to "causes" of stuttering. The disorder has developed not from a single cause, but as the result of a complex Interrelationship between many factors (Andrews and Harris 1964).

The recent investigations concerning the cause and nature of stuttering emphasize on the role of phonatory behaviour in stuttering. Larynx has been held responsible for stuttering to occur.

As early as 1800, some of the authors have attributed stuttering to malfunctioning of larynx. Seere d'Alais (1829) and Arnott (1829) regarded chronic spasm of the glottis as the source of stuttering. Avicenna (1837) related stuttering to brain lesions which in turn were the cause of glottic spasms, which produced the stuttering symptoms.

Kussmaul (1877) defined stuttering as a syllabic dysarthria, produced by a lack of coordination of voice, respiration and articulation due to neurological deficits.

Travis (1931) concluded that rational analysis, clinical investigations and systemic research lend support to the fact that many disfluencies judged as stuttering stem from problems of smooth coordination of phonation with articulation and respiration.

Perkins, Rudas, Johnson and Bell (1976) studied the effect of systematically simplifying the complexity of phonatory, respiratory adjustments. 30 stutterers read under three conditions, voiced, whispered and articulation without phonation. They reported that stuttering was considerably reduced when whispering and was practically eliminated when articulating silently. Rate of speech was significantly reduced during whispering and while articulating silently. They considered the simplification of phonatory and respiratory adjustments during these two conditions to facilitate rhythemical flow of speech.

Adams (1974) offered a physiologic and aerodynamic analysis of stuttering and fluency. He proposed that fluency is dependent at least in part upon the correct timing and the prompt imitation and maintenance of airflow and glottal vibration. These effects result from harmonious integration of subglottic pressure, glottal resistance and supraglottic pressure. Any activities which cause the disintegration of these variables prevent the timing, starting and maintenance of airflow and concomitant vocalization. He feels that these variables might be the motor determinants of stuttering.

Schwartz (1974) attempted to explain the "core of the stuttering block". He believed that the disorder is essentially an inappropriate vigorous contraction of the posterior crico-arytenoid muscle (PCA) in response to the subglottal air pressures required for speech. He describes Airway Dialation Reflex (ADR) as a life preserving response in infants to open a 'kinked' airway. The ADR is triggered by an increase in air pressure below the glottis. Abduction of vocal cords is a part of this reflex. ADR has to be inhibited if sufficient subglottic pressure should be created for speech. This inhibition is controlled by supra medullary centers. Under conditions of stress, the effectiveness of normal supremedullary inhibitary control of the PCA is reduced, and ADR occurs in response to the air pressure build up for speech. Thus the opened vocal cords do not phonate. The stutterer forces abduction creating a "laryngospasm" which also prevents phonation. This is the core of the stuttering block.

Based on his theory, Schwartz (1976) recommended "airflow therapy" for the treatment of stuttering. In this technique the stutterer is required to produce a long audible sigh, he is asked to say a one syllable word when half way through the sigh. The number of one syllable words spoken on one breath is then increased. He reasoned that the passive airflow kept the vocal cords open and relaxed prior to speech and thus the brain was deprived of feedback signals necessary to trigger the conditioned reflex of stuttering. He has reported 89% success with this technique.

Lee (1976) applied Schwartz's airflow technique to treat 75 stutterers. He concluded from his experience that this was a valuable contribution to the field of stuttering and therefore, it must be given due recognition.

Wyke (1971, 1974) said that stuttering of laryngeal origin may be a form of phonatory ataxia arising either because of disordered voluntary phonatory timing of the vocal fold musculature or from an incordinated reflex modulation of the activity of this musculature during actual utterance.

Bloodstein (1950) collected literature on 115 different conditions which were reportedly associated with reduction in stuttering. He then presented these items in the form of a questionnaire to 204 stutterers, who indicated the extent to which their stuttering was reduced in each condition. In only 21 of these 115 conditions substantial majority of them reported markedly reduced stuttering or no stuttering at all. Interestingly over half of these were conditions associated with changes in speech pattern like singing, choral reading, speaking in accompaniment to several kinds of imposed patterns, imitation of another person's manner of speaking and imitation of dialects.

Wingate (1969, b) after a critical review of conditions under which stutterers enjoy fluency concluded, that in all these circumstances which improves fluency, the stutterer is induced in one way or the other to do something with his voice that he does not ordinarily do. He further added that the effect of these circumstances is typically transient. Because it is very likely that the stutterers revert to their usual manner of vocalizing when the influence of these circumstances ceases. He drew a general inference from his analysis that vocalization is a crucial element in the complex of stuttering.

Wingate (1970) argued that the beneficial effects of masking are basically related to the changes in vocalization. Subsequent investigations have supported this explanation.

Adams and Moore (1972) studied the effects of auditory masking on the Palmar Sweat anxiety, the frequency of stuttering reading time and vocal intensity in stutterers significantly less stuttering and more vocal intensity were noted under masking as compared to control condition.

Adams and Hutcheson (1974) found that as the intensity of masking was increased from 10 dB SL, 50 dB SL to 90 dB SL, the vocal intensity also significantly increased, and stuttering frequency decreased and reading time became shorter.

However Gerber and Martin (1977) did not support this view. They designed a study to assess the effects of increased vocal level on stuttering in the presence and absence of noise and to assess the effects of noise on stuttering with and without concomitant increase in vocal level. Eight adult stutterers spoker in quiet with normal vocal level, quiet with increased vocal level (12 dB above normal level), in noise with normal level and in noise with increased vocal level (12 dB above normal level). All subjects showed reduction in stt-ttering when compared with quiet conditions. However, there was no difference in stuttering when stutterers spoke with normal when compared with increased vocal level. The reduction in stuttering was related to decrease in auditory feedback. Largest decrease in stuttering occured in noise with normal level condition.

Proprioceptive and kinesthetic feedback have been reported to be important in stuttering.

Devaraj (1978) compared a stutterer and a normal subject under four different conditions. Before anesthetization, immediately after anesthetization, after complete recovery from anesthetic effect. He found a substantial reduction in stuttering under palatal and labial anesthesia in the stutterer, while the same produced stuttering like behaviour in the normal subject.

Gaultheron et al (1972) using microphonic and glottographic recording of utterance of /Sa/ found that in stutterers there was a long silence of about 100 m. sec.

between the noise of fricative and the vowel. They postulated that the excessive tension sustained in the larynx of stutterers prevents gentle undulating vocal cord movements which is observed in normals.

They tried to obtain auto correction with the aid of visual feedback of the laryngeal activity. They reported that stutterers could modify the tension of their larynx so as to obtain the desired patterns on the scope and became fluent.

A number of studies have directly or indirectly indicated phonatory involvement.

Wingate (1969 a) consideres stuttering to be a transition defect and suggests that it is the difficulty in shifting from one sound to another sound which makes the stutterer to stutter.

Adams and Reis (1971, 1974) reported that stutterers stutter significantly less and get adapted faster while reading a passage contained all voiced sounds when compared to a passage containing both voiced and unvoiced sounds. They maintained that fluency is dependent on the correct timing and prompt smooth initiation and maintenance of airflow and glottal vibrations.

Manning and Coufal (1976) found that both stutterers and non stutterers exhibit lower percentage of disfluencies during voiced to voiced transitions, than during voiceless to voiced, voiced to voiceless and voiceless to voiceless phonatory transitions.

Brenner, Perkins and Soderberg (1972) observed that neither silent rehersals with articulatory movements nor whispered rehersal reduced stuttering as much as aloud rehersal. They suspected that the differences were due to complexity of the phonatory process rehersed in each condition.

Moss (1976)prepared four separate lists of sentences of equal length. His subjects read the lists under four different conditions. Silent rehersal, lipped rehersal, whispered rehersal and aloud rehersal. Aloud rehersals resulted in significantly less stuttering than the other three types of rehersals. He suggested that the crucial factor which distinguished the four types of rehersals was "vocalization".

There are many studies which have shown that stutterers are inferior to their non stuttering peers in their ability to start and stop phonation. (Hillman Gilbert 1974, Agnello, Wingate and Wendal 1974, Adams and Hayden 1976, Starkweather, Hirschmann and Tannenbaum 1976, Basu 1979).

Agnello and Wingate (1972) found that even when stutterers spoke fluently, their voice onset times were longer than normal.

Evidence to phonatory involvement in stuttering has also come from physiological studies. Certain abnormal laryngeal activities like arythmic vocal fold vibration (Chevrie Muller 1963), wide separation of the posterior vocal folds (Conture, McCall and Brewer 1974), assymetric tight closure of the larynx (Fujita 1966) and disruption of normal reciprocity between abductor and abductor muscle groups (Freeman and Ushijima 1974, 1975 and 1978) have been observed to occur in the laryngeal mechanisms of stutterers at the time of the stuttering block. All these studies indicate that there is some disruption in the flow of air from the subglottal to the supraglottal region, either because of the failure of the coordinated activity of the laryngeal muscles or because of increased muscular tension.

Hanna, Wifling and McNaill (1975) found in their preliminary observation, that periods of stuttering could be differentiated from normal speech using electromyographic spikes. They reported more than 50% reduction in stuttering in their 17 year old patient when electrodes were placed on either side of the thyroid eminance and feedback was given auditorily.

Webster (1977) developed a therapy program which constitutes a carefully administered systematic approach for constructing the details of articulation and voicing in stutterers. The "gentle onset of voicing" constituted the single most important target of the pnogram. After teaching gentle onset, the voice was coordinated with the new established articulatory targets. Out of 200 patients treated 70% sustained good speech fluency.

Quarrington (1977) interviewed spontaneously recovered stutterers. His stutterers reported that their new speech patterns consisted of one principle, such as 'speaking slowly' or 'talking more clearly' or 'speaking in a deeper and firmer voice'.

More interesting is the finding that stuttering does not occur when vocalization is eliminated as in whispering esophageal speech, while using electrolarynx.

Johnson and Rosen (1937) found that stutterers speak more fluently when they whisper. Blood Stein (1950) reported that stutterers seldom have difficulty when they whisper.

Van Riper (1971) stated that stutterers have no difficulty when giving commands by phentomime to skilled lip readers. Because by concentrating their attention on the feel of their musculature, the stutterers would be forced to what all normal speakers probably do - controlling speech primarily by proprioceptive - tacticle feedback.

He suggested that the marked reduction of stuttering during whispering and its elimination during phantomimed speech could be attributed to the high degree of concious articulation at slower speech rates that permit synchronization of articulation, phonation and respiration. He also proposed the alternative that this puzzling reduction in stuttering could be accounted for on the basis of simplified synergy, i.e., the absence of voice and airflow.

Meckenzie (1955) has found complete elimination of stuttering in the stutterer who had used electrolarynx.

Oswald (1948), Irwing and Webb (1961) reported that laryngectomized stutterers did not stutter after having learned esophageal speech. But of late Tuck (1979) reported a laryngectomized stutterer who exhibited speech disfluencies even while using esophageal voice.

Ratna and Nataraja (1972) reported a stutterer who stuttered severely with secondaries even while whispering and during silent reading.

Commodore and Cooper (1978) studied the effect of communicative stress on the frequency of stuttered syllables in stutterers. Stutterers read 6 different equivalent passages using normal voicing, whispering, and articulation without phonation under stress and non stress condition. Results revealed that stuttering was significantly greater in normal voicing than in whispering, greater in whispering mode than in articulation without phonation mode. No differences were found between the stress and non stress conditions with respect to stuttering.

Recently Gayathri (1980) investigated some aspects of phonatory behaviour in stutterers. She investigated the

1) effect of varying degrees of voicing while reading a passage;

2) the relationship between the frequency of stuttering and onset of phonation in varied contexts, syllables, word lists and passages;

3) the relationship between the frequency of stuttering and the stressed syllable.

She concluded that phonatory behaviour is not normal in stutterers.

Reis (1974) studied the effect of selected vocal characteristics on the frequency of stuttering and the rate of speech. 28 stutterers were presented with 8 prose passages, four of which contained only voiced phonemes, while the other four passages contained both voiced and voiceless phonemes. Subjects read under four conditions. Normal voice, soft voice and loud voice while 75 dB SL of white noise was presented through earphones. Results showed that more stuttering occured in normal voiced condition with all voiced prose.

Ramig and Adams (1980) studied the effect of changing the pitches on the reading rate, number of disfluencies and the vowel and pause duration of groups of child and adult stutterers and normal speakers. The subjects were asked to read a passage in three conditions. Habitual condition, higher pitch and lower pitch. Results showed that all 4 subjects groups reduced their frequency of disfluencies from the habitual to both experimental conditions. The reduction in disfluencies were accompanied by significant reductions in fluent reading rate and increase in both vowel and pause duration.

Thus the review of literature shows that phonation is an important factor in stuttering. Abnormal laryngeal behaviour has been held responsible for stuttering. Investigations have revealed that changes in certain aspects of phonation brings about a significant change in stuttering behaviour. Thus it would be interesting and useful to investigate how changes in certain aspects of phonation, particularly intensity affects the stuttering behaviour in stutterers.

CHAPTER III

METHODOLOGY

This study was aimed at investigating the effects of changes in the intensity of voice on stuttering.

Subjects

7 male stutterers and 1 female stutterer were selected from the clinic of All India Institute of Speech and Hearing. The age range of subjects was from 15 years to 28 years with a mean age of 20.77 years. Subjects were selected based on the following criteria:

1. Kannada was their mother tongue.
2. They could read Kannada.
3. They had normal hearing.
4. They were diagnosed as stutterers.
5. They had no other speech problem.
6. They were of normal intelligence.

The experiment was conducted in a quiet room. The subject was seated comfortably in a chair with the book for reading.

an experienced senior post-graduate student served as the observer. Sat at a comfortable distance from the subject and recorded the stuttering blocks in all the sessions.

The experimenter gave instructions, recorded the time and signalled to the observer to make fresh maskings of the score once in every two minutes.

Collection of data

The first step in the study was to find the base rate of stuttering blocks for each subject. Subject was asked to read an essay for 18 minutes. Two readings were obtained for each subject on consecutive days. The observer noted down the stuttering responses for every two minutes of reading separately and also the total number of words read during the session. The stuttering responses were found to be consistent during 18 minutes of reading. After establishing the base rate, each subject was exposed to 4 experimental conditions.

Condition A - Reading in whispered voice

Condition B - Reading at 60 dB SPL intensity

Condition C - Reading at 70 dB SPL intensity

Condition D - Reading at 80 dB SPL intensity

To control the influence of order effects, the conditions A, B, C and D were presented randomly. Table 1 shows the

Reading material

A Kannada text book containing essays on different topics served as the reading material. The essays were meaningful and non-emotional.

Apparatus

For the purposes of indicating and controlling the intensity of voice objectively in known steps and to provide visual monitering of the required intensity, a 'voice light' was designed and fabricated in the Electronics Department of the Institute. The voice light has the following specifications

1. It covered the intensity range from 60 dB SPL to 90 dB SPL variable in 10 dB SPL steps.

2. The red light would glow only when an input equal to the intensity level set on the intensity dial is fed to the microphone.

3. The changes in the input intensity was monitered on the VU meter dial.

It was possible for the subject to recognize whether the light is on or not as he read the passage.

A stop watch was used to record the durations of the experiments.

An experienced senior post-graduate student served as the observer. Sat at a comfortable distance from the subject and recorded the stuttering blocks in all the sessions.

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To control the influence of order effects, the conditions A, B, C and D were presented randomly. Table 1 shows the

Table 1: Assignment of order of conditions A, B, C and D to the 9 subjects

Subject No.	Order of assignment of conditions			
1	A	B	C	D
2	D	C	B	A
3	B	A	D	C
4	C	B	D	A
5	A	D	C	B
6	B	C	A	D
7	D		B	C
8	B	C	D	A
9	C	D	A	B

Condition A - Reading in whispered voice
Condition B - Reading at 60 dB SPL intensity
Condition C - Reading at 70 dB SPL intensity
Condition D - Reading at 80 dB SPL intensity

order of presentations of the conditions to the subjects.

Maximum of two experimental sessions were conducted in a day for each subject. Sufficient interval was allowed between the two experimental sessions. Collection of data was completed over a period of 4 days for each subject.

In each experimental session, the subject read for 18 minutes of which first 6 minutes was for pre-experimental base rate, second 6 minutes for experimental condition and the third 6 minutes for post-experimental base rate.

Condition A (Reading in whispered voice)

In this session, the subject was asked to read the passage in whispering, without vocalizing. The subject was given demonstration and was allowed to practice. Then the experimental session began.

The subject was instructed as follows:

"When I say ready, start reading and continue reading until I signal to you. As soon as I give the signal start reading in whispering and continue reading until I signal to you again, as soon as I signal again, start reading in your voice, and continue bo read till I say stop". Please ask me if you have any doubts".

As the subject read, the observer noted the number of stuttering response for every two minutes separately. He also recorded the total number of words read during the experimental session. This was used calculating the rate of speech.

Condition B (Reading at 60 dB SPL intensity)

Here the subject was asked to read at a level of loudness sufficient to cause the light to glow, and to keep the light glowing without making it go off. The subject was seated in front of the voice light making it possible for him to recognize whether the light is on or not as he reads the passage. The distance between the microphone and the subject's mouth was maintained at a constant level. The intensity dial was set at 60 dB SPL.

The subject was given demonstration and allowed to practice. Then the experimental session began.

The subject was instructed as follows:

"When I say ready, start reading, and continue reading until I signal to you, as soon as I signal to you. Start reading at a loudness level to keep the light glowing, and do not allow the light to go off in between, continue reading like this till I signal to you again. As soon as I give you the signal once again start reading in your usual voice, and continue to read till I say stop. Ask me if you have any doubts".

The subject was reminded whenever he/she failed to maintain the same loudness.

As the subject read, the observer noted the number of stuttering response for every two minutes and also recorded the number of words read during the experimental condition.

Condition C (Reading at 70 dB SPL intensity)

Procedure and instructions were same as for Condition B. But the intensity dial of voice light was set at 70 dB SPL.

Condition D (Reading at 80 dB SPL intensity)

Procedure and instructions were same as for condition B and condition C. The intensity dial of voice light was set at 80 dB SPL.

Analysis of data

The data obtained was then analyzed statistically using non-paramatric statistics. The "Wilcoxon matched-pairs signed rank test and "The Friedman Two-way Analysis of Variance" were used for analysis.

CHAPTER IV

RESULTS AND DISCUSSION

The number of stuttering blocks for every six minutes of reading were calculated for each subject for the initial two consecutive readings to establish the base rate. The scores were tabulated as shown in Table 2. Then the number of stuttering blocks in the first, second and third six minutes of reading were compared to see if there was any significant difference. The T values obtained showed that there was no significant difference. The base rate of stuttering blocks was found to be stable for all the subjects. The scores of base rate are presented graphically (Graph 1).

Tables 3, 4, 5 and 6 show the number of stuttering blocks during the pre-experimental (first 6 minutes), experimental (second 6 minutes) and post-experimental (third 6 minutes) condition for each subject under the four experimental sessior A, B, C and D respectively. The data is also shown in graphic forms in graphs 2, 3, 4 and 5 respectively.

The number of stuttering blocks in the pre-experimental, experimental and post-experimental periods in each experiment session were compared with each other to see if there was an

Table 2: The base rate of stuttering blocks for all the 9 subjects

Subject No.	First 6 minutes	Second 6 minutes	Third 6 minutes
1	53 17, 18, 18	50 17, 17, 16	53 16, 19, 18
2	169 56, 57, 56	166 55, 54, 57	173 58, 58, 57
3	162 54, 54, 54	160 56, 57, 57	164 54, 55, 55
4	79 26, 28, 25	84 27, 29, 28	82 26, 27, 29
5	93 32, 31, 30	89 30, 30, 29	92 30, 30, 32
6	52 16, 18, 18	53 18, 19, 16	55 18, 19, 18
7	64 21, 21, 22	60 20, 20, 20	63 21, 21, 21
8	63 20, 21, 22	60 18, 22, 20	63 20, 20, 23
9	162 55, 54, 53	160 53, 54, 53	166 56, 54, 56

The upper score in each row indicates the total number of stuttering blocks in 6 minutes, the lower scores indicate the number of stuttering blocks in each of 2 minitues separately.

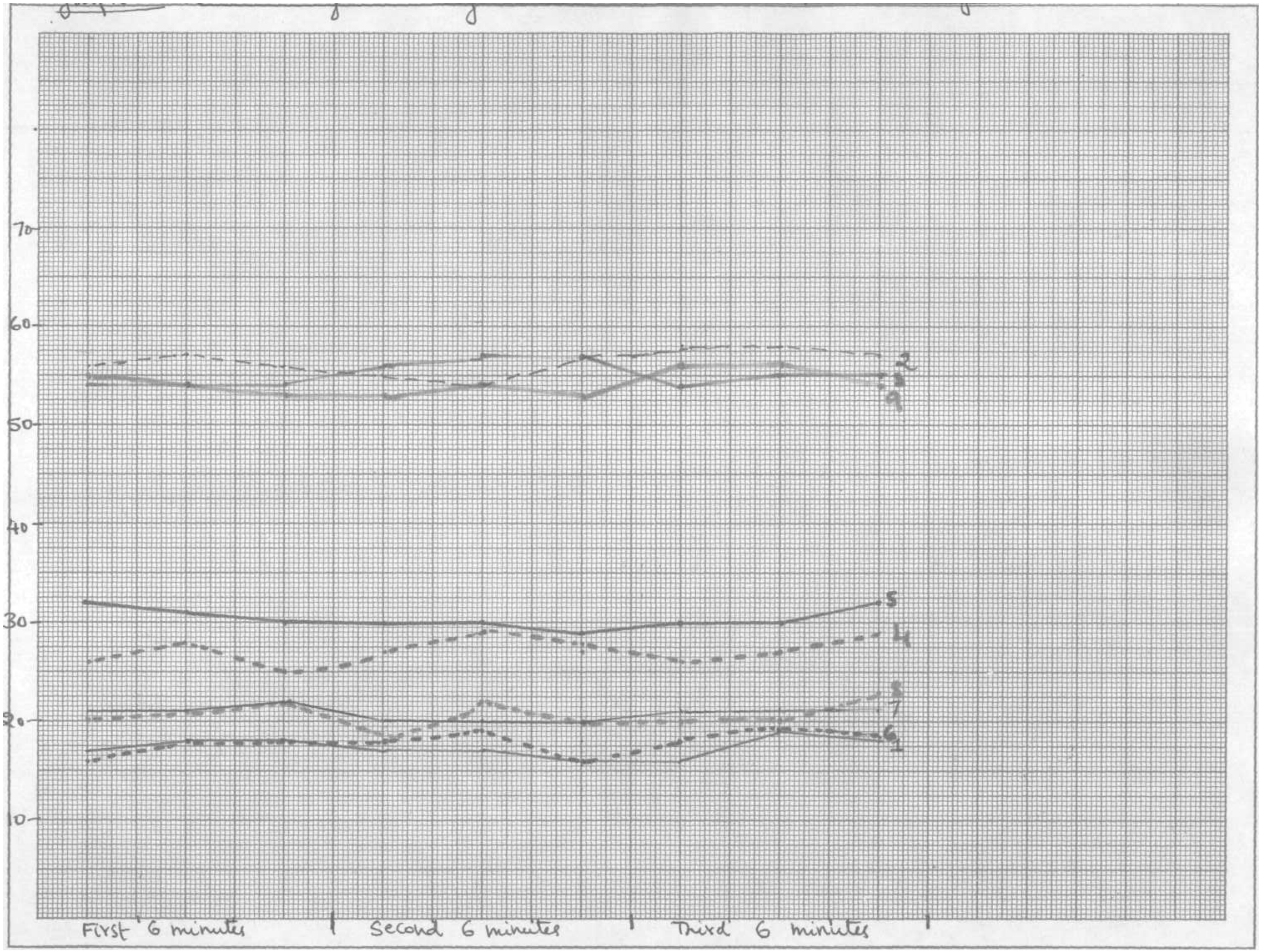

70
60
50
40
30
20
10
2
3
9
5
4
8
7
6
1
First 6 minutes
Second 6 minutes
Third 6 minutes

Table 3: Number of stuttering blocks during condition A for all the 9 subjects

Subject No.	Pre-experimental condition	experimental condition	Post experimental condition
1	56 18, 18, 20	19 6, 6, 7	52 16, 17, 19
2	190 62. 63, 65	78 28, 26, 24	195 66, 64, 65
3	168 58, 55, 55	108 35, 38, 35	162 54, 52, 56
4	61 20, 22, 19	23 11, 6 , 6	63 21, 21, 21
5	80 24. 28, 28	24 9, 8, 7	75 24, 27, 24
6	45 14, 14, 17	25 7, 8, 10	40 16, 12, 12
7	54 16, 18, 20	30 12, 9, 9	50 13, 14, 13
8	58 18, 20, 20	25 8, 9, 8	57 17, 20, 20
9	150 48, 52, 50	54 19, 17, 18	146 49, 49, 48

The upper score in each row indicates the total number of stuttering blocks in 6 minutes, the lower scores indicate the number of stuttering blocks in each of 2 minutes separately.

Graph 2: Number of Stuttering blocks during condition A for all the 9 Subjects

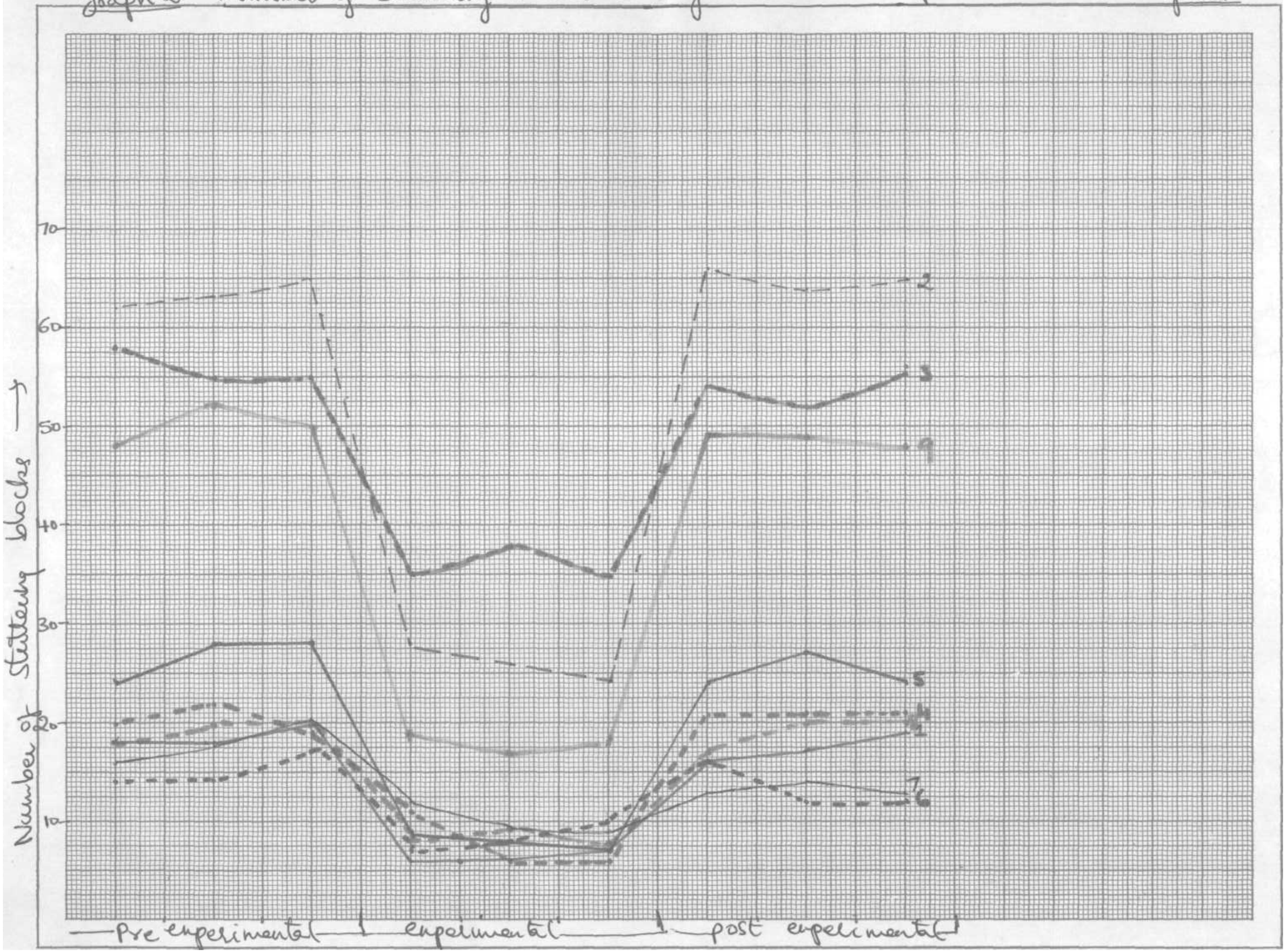


Table 4: Number of stuttering blocks during condition B for all the 9 subjects

Subject No.	Pre-experimental	Experimental	Post-experimental
1	56 20, 18, 18	45 14, 15, 13	53 18, 19, 16
2	164 52, 56, 56	159 52, 52, 55	169 58, 54, 57
3	168 55, 55, 58	158 50, 53, 55	162 54, 52, 56
4	79 28, 26, 25	82 27, 28, 27	83 27, 29, 27
5	89 30, 31, 28	91 29, 32, 30	85 28, 30, 27
6	52 17, 16, 19	53 17, 19, 17	59 19, 22, 18
7	55 20, 18, 17	53 17,19, 17	59 19, 22, 18
8	51 16, 18, 17	53 16, 18, 19	50 16, 18, 16
9	165 55, 55, 55	158 49, 56, 53	169 55, 56, 58

The upper score in each row indicates the total number of stuttering blocks in 6 minutes, the lower scores indicate the number of stuttering blocks in each of 2 minutes separately.

Graph 3: Number of stuttering blocks in condition B for all the 9 subjects

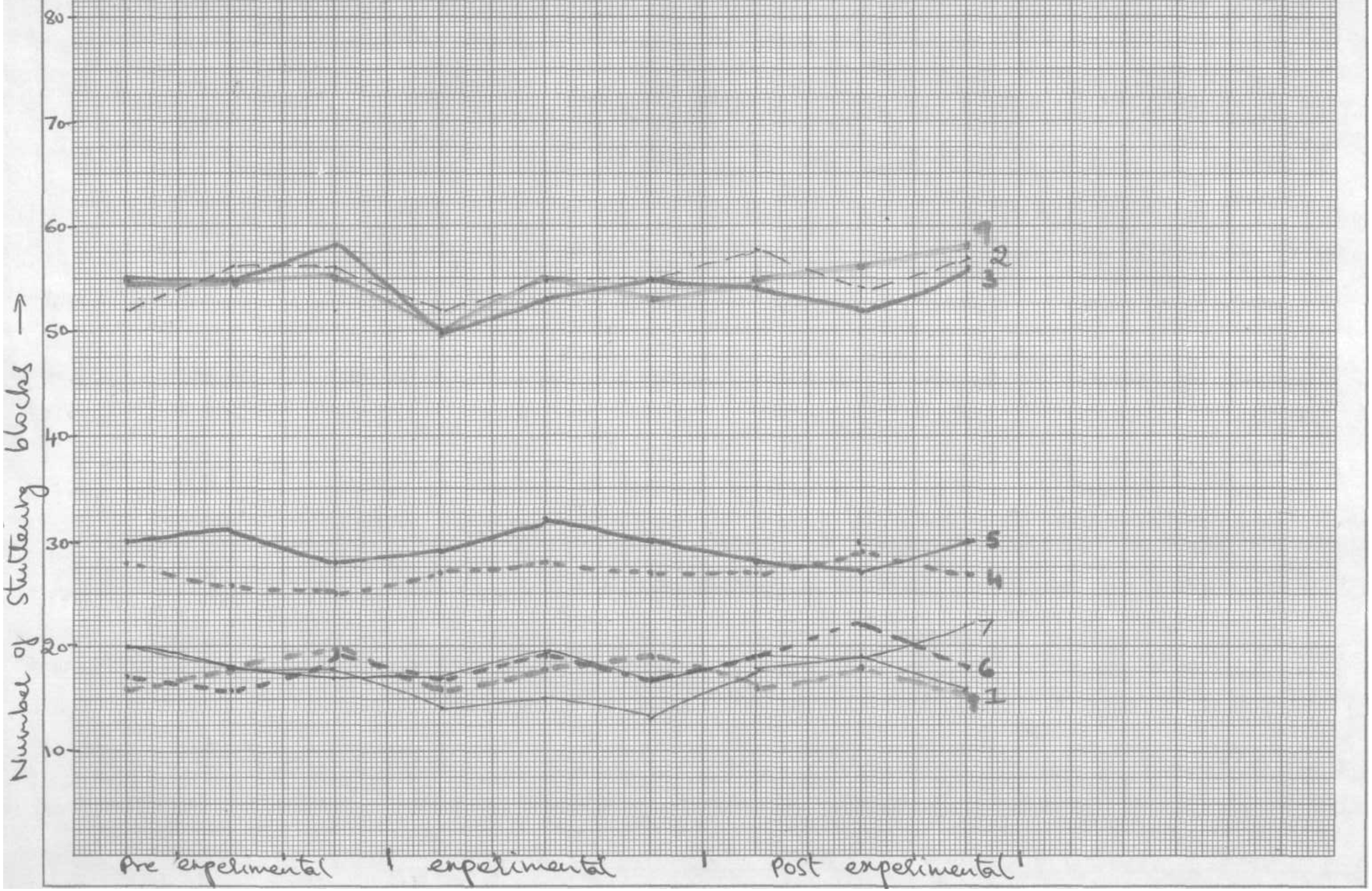


Table 5: Number of stuttering blocks during condition C for all the 9 subjects

Subject No.	Pre-experimental	Experimental	Post-experimental
1	58 20, 19, 19	46 14, 17, 15	54 18, 19, 17
2	140 47, 47, 46	145 48, 48, 49	150 51, 49, 50
3	153 49, 48, 46	142 47, 47, 48	149 52, 49, 48
4	70 22, 26, 22	64 19, 23, 22	70 25, 25, 20
5	70 23, 25, 22	46 15, 15, 16	68 20, 23, 25
6	72 21, 25, 26	63 22, 20, 21	70 22, 23, 25
7	63 19, 23, 21	59 19, 20, 20	67 22, 23, 22
8	54 17, 18, 19	39 12, 15, 12	58 18, 20, 20
9	160 52, 54, 54	140 49, 46, 45	165 55, 54, 56

The upper score in each row indicates the total number of stuttering blocks in 6 minutes, the lower scores indicate the number of stuttering blocks in each of 2 minutes separately.

Graph 4: Number of Stuttering blocks in Condition C for all the 9 Subjects

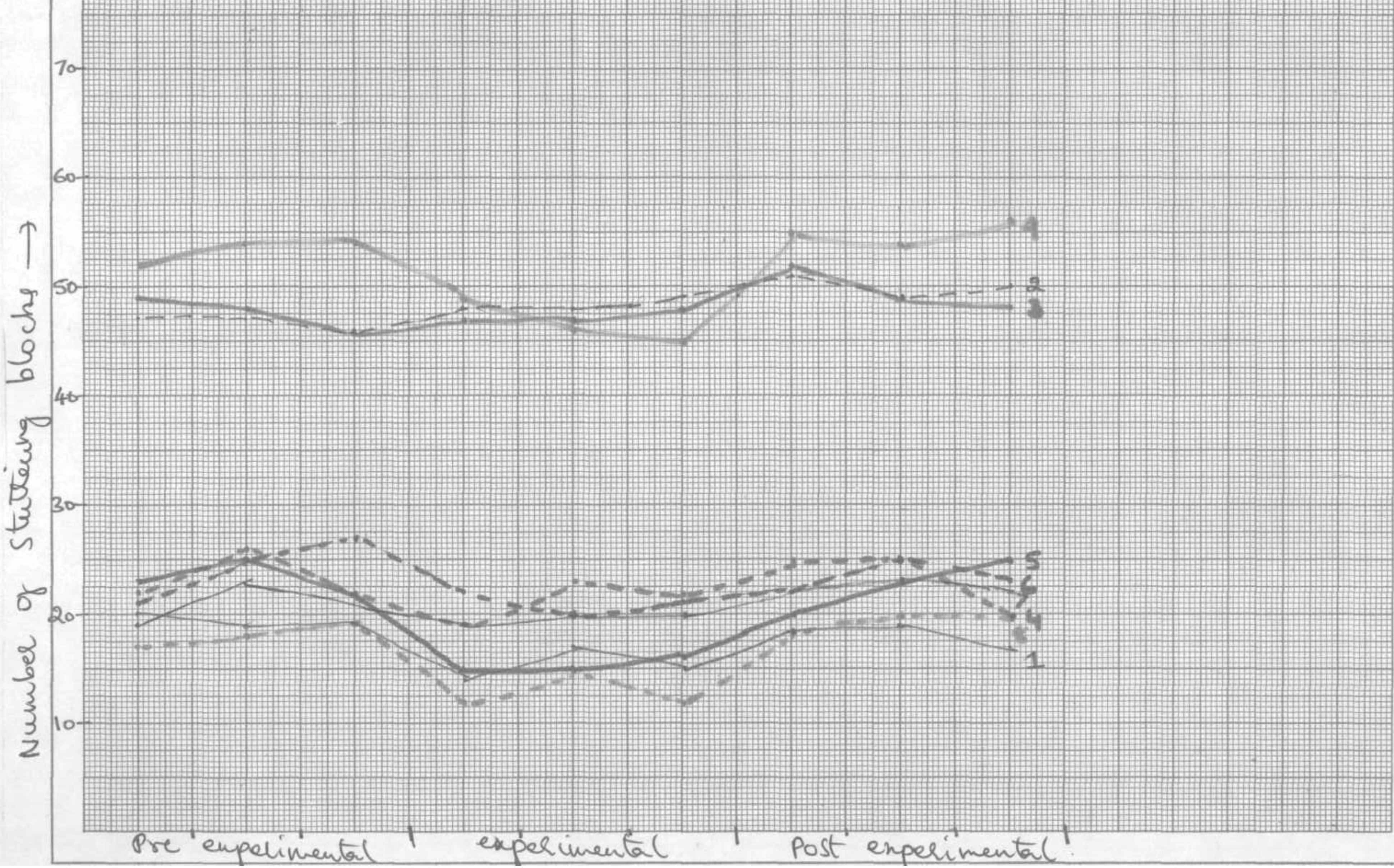
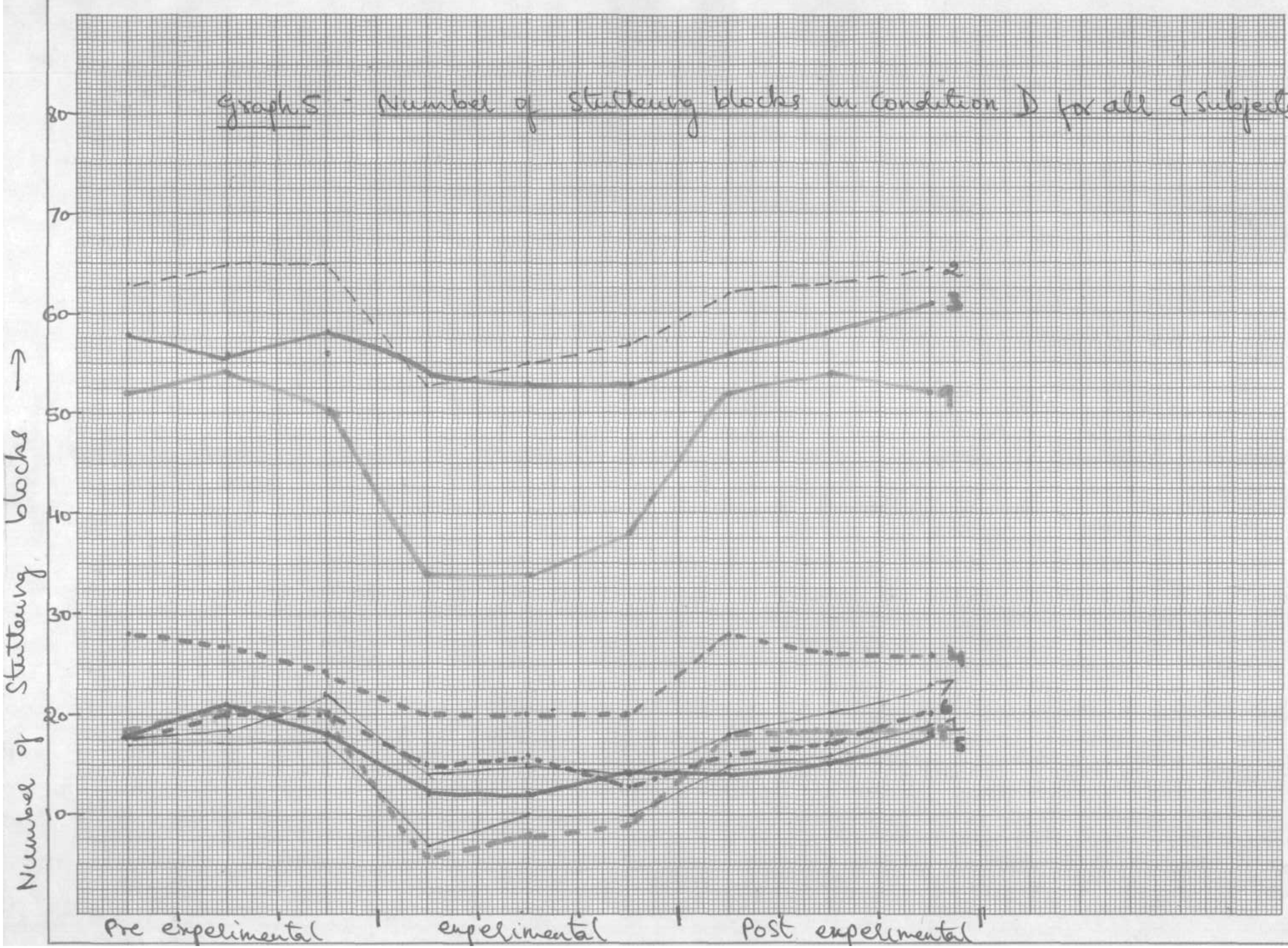


Table 6: Number of stuttering blocks during condition for all 9 subjects

Subject No.	Pre-experimental	Experimental	Post-experimental
1	51 17, 17, 17	27 7, 10, 10	50 15, 16, 19
2	193 63, 65, 65	165 53, 55, 57	189 62, 63, 64
3	172 58, 56, 58	160 54, 53, 53	175 56, 58, 61
4	79 28, 27, 24	60 20, 20, 20	80 28, 26, 26
5	52 18, 21, 18	38 12, 12, 14	47 14, 15, 18
6	58 18, 20, 20	44 15, 16, 13	53 16, 17, 20
7	58 18, 18, 22	43 14, 15, 14	61 18, 20, 23
8	56 18, 18, 20	22 6, 7, 9	54 18, 18, 18
9	156 52, 54, 50	106 34, 34, 38	158 52, 54, 52

The upper score in each row indicates the total number of stuttering blocks in 6 minutes, the lower scores indicate the number of stuttering blacks in each of 2 minutes separately.

Graph 5 - Number of Stuttering blocks in Condition D for all 9 Subjects



significant change in stuttering whenever the independent variables - intensity and whispering - was introduced. For this purpose Wilcoxon paired sign rank test was used. Table 7 shows the T values for each comparison and their significance for conditions A, B, C and D. Results show that stuttering is significantly reduced in the experimental condition when compared with pre and post-experimental conditions for the conditions A, C and D. However, in condition B, even though there was a reduction in stuttering in experimental condition, when compared with pre and post-experimental conditions, the difference was not significant.

Further, it was tested to see if there was any significant change in the frequency of stuttering across the five conditions. Base rate, condition A, condition B, condition C and condition D. For this purpose, the number of stuttering blocks in the experimental condition (second 6 minutes) for each of the above conditions for all the subjects were tabulated as shown in Table 8. The mean values of stuttering blocks across the 5 conditions are presented in graph 6. Then the scores were compared. The X^2 value of 26.75 on Friedman's two way analysis of variance showed a significant difference at .001 level. There was an over all reduction in stuttering as the phonatory pattern was varied.

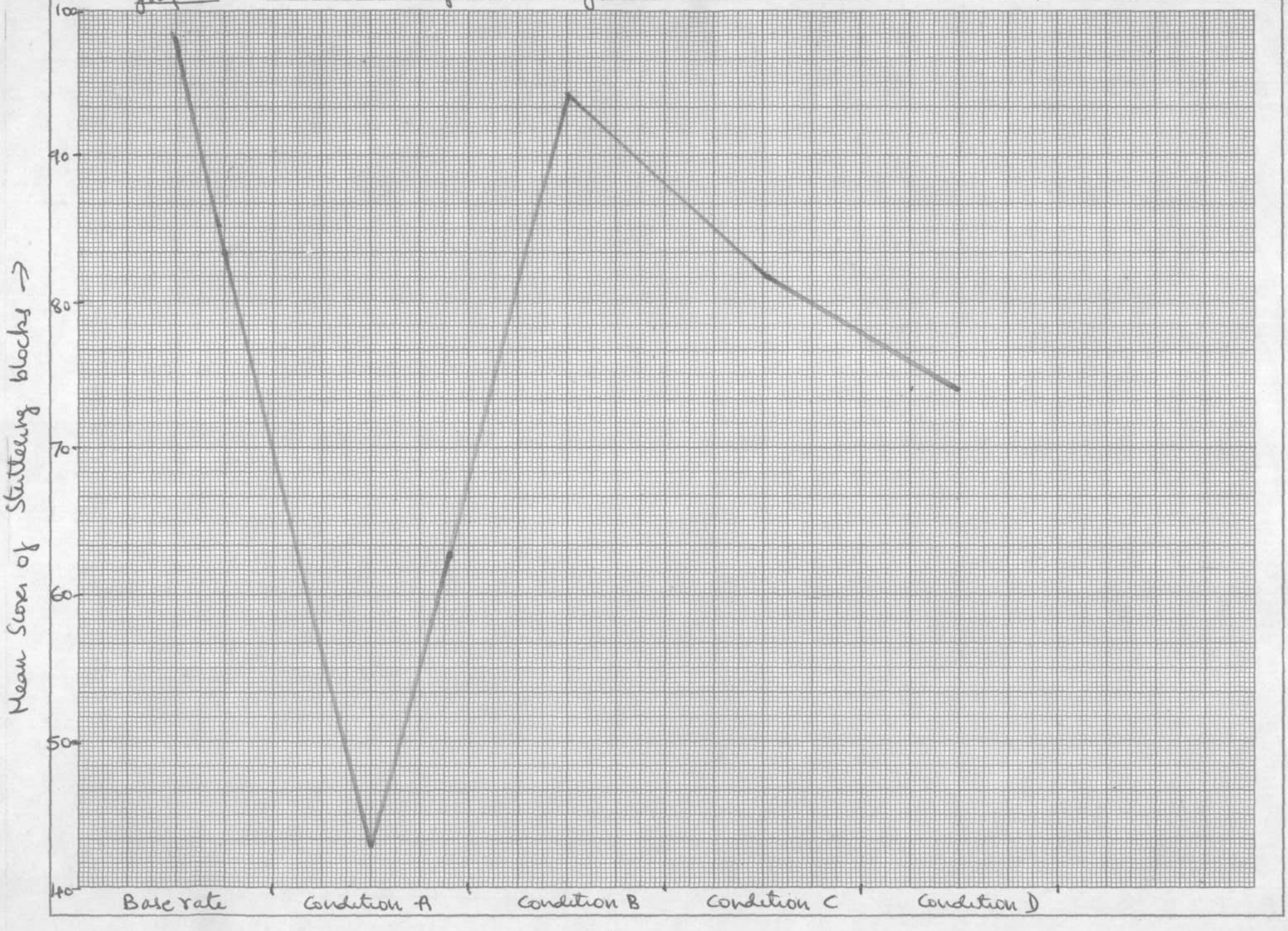
Table 7: The T values and their level of significance for each comparison among pre-experimental, experimental and post-experimental condition for each of conditions A, B, C and D.

Condition	Pre-experimental Vs experimental	Experimental Vs post-experimental	Pre-experimental Vs post-experimental
A	T = 0 Significant at .01 level	T = 0 Significant at .01 level	T = 8.5 Not significant at .01 level
B	T = 10 Not significant at .01 level	T = 7 Not significant at .01 level	T = 19 Not significant at .01 level
C	T = 2 Significant at .01 level	T = 0 Significant at .01 level	T = 4 Not significant at .01 level
D	T = 0 Significant at .01 level	T = 0 Significant at .01 level	T = 21.5 Not significant at .01 level

Table 8: 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	50	19	45	46	27
2	166	78	159	145	165
3	160	108	158	142	160
4	84	23	82	54	60
5	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

Graph 6: Mean Scores of Stuttering blocks under base rate and experimental Conditions A, B, C, D



All subjects showed a reduction in stuttering during whispering (condition A) when compared with the base rate of stuttering when the scores in condition A and the scores in the base rate were compared. The T value of 0 indicated the difference to be significant 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' is rejected.

On comparing the frequency of stuttering in the experimental conditions (second 6 minutes) of conditions B, C and D, the X_r^2 value of 10.22 was obtained 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 in stuttering in condition C.

On comparing the 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 obtained T value was O which indicated a significant reduction in stutter ing in condition D, at .01 level.

Thus there was a significant reduction in stuttering from

Table 9: The number of words read per minute by all the 9 subjects under 5 conditions. Base rate, Condition A, Condition B, Condition C and Condition D

Subject No.	Base rate	Condition A	Condition B	Condition C	Condition D
1	63	61	60	55	50
2	50	39	48	29	35
3	38	37	40	34	31
4	85	67	83	70	63
5	84	71	85	81	70
6	53	33	52	45	35
7	68	60	66	61	59
8	105	93	103	99	96
9	47	43	48	45	44
Mean	65.88	56	65	57.44	53.66

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

When the number of stuttering blocks in condition D was compared with the number of stuttering blocks in condition A, stuttering was significantly reduced in condition A, than in condition D. Thus, among all the experimental conditions, greatest reduction in stuttering was observed in condition.A.

Table 9 shows the number of words read per minute in the experimental condition (second 6 minutes) for all subjects under base rate and different experimental sessions A, B, C and D. Rate of speech was significantly reduced in conditions A, C and D. That is, in all the conditions in which stuttering was reduced, there was a significant reduction in the rate of speech.

Discussion

From the above results it is evident that changes in phonation have brought about a change in the frequency of stuttering. Stuttering was reduced in all the experimental conditions. The reduction was significant in conditions A, C and D. In condition B, the subjects read at an intensity of

60 dB SPL which is nearer to the loudness of normal conversational voice. Possibly this change in the intensity was not adequate to bring about any significant change in the frequency of stuttering.

Changes in the intensity of voice and whispering were introduced only in the second 6 minutes of the experimental sessions. The reduction in stuttering has been observed only in that period during which, the independent variable was introduced, as it can be visualized in graphs 2, 3, 4 and 5.This Wingate (1969 b) who stated that "the influence of the circumstances which bring about a reduction in stuttering is '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.

1 The results of this study revealed that with changes in the intensity of voice, there was a significant change in the frequency of stuttering. As the intensity of voice was increased, there was increasing reduction in stuttering. There was no significant change in the frequency of stuttering when the subjects read at an intensity of 60 dB SPL which is nearer to their normal intensity level. Stuttering was significantly reduced as the intensity of voice was raised to 70 dB SPL. There was a further decrement in stuttering as the subjects

increased their vocal intensity to 80 dB SPL.

The changes observed in the frequency of stuttering due to changes in the intensity of voice are in accordance with the results of studies by Reis (1974), Adams and Moore (1972), Adams and Hutchinson (1974).

The relationship between vocal intensity and stuttering has not been explained. Some factors in changing the intensity of voice can be related to changes in the laryngeal feedback system which results from changes in Internal laryngeal behaviour.

Markel* (1873) reported that changes in intensity are accompanied by a proper balance between the force of subglottal air and tension of the glottic muscles. Atkinson* (1902) observed that vocal intensity was higher when there was a small glottal opening, i.e., larger area of contact of vocal folds. Fransworth* (1940) noted that as intensity is increased, the folds remain closed for a proportionately longer time during each vibratory cycle. Fletcher* (1950) found that the duration of the closed phase of vibratory cycle increases with intensity.

*in Zemlin, W.R., Speech and Hearing Science. Anatomy and Physiology. Prentice-Hall INC, Englewood Cliffs, New Jersy (1968).

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

All subjects in this study have shown a decrease in the frequency of stuttering in most of the conditions with increase in intensity. However, subjects 1, 6, and 7 did not show reduction in the frequency of stuttering in condition C, when compared with condition B, while subjects 2, 3 and 4 showed no reduction in stuttering in condition D when compared with condition C. In fact, their stuttering increased with increase in intensity. These exceptions could be because of the lack of optimum feedback which would be gained with changing vocal intensity.

In the present study all the subjects showed a significant reduction in the frequency of stuttering when they used whispering. Similar findings have been reported by Johnsen 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. During conventional phonation, the artynoid cartilages are approximated so that their medial surfaces are in direct contact and the vocal folds lie parallel to one another, in whispering the arytenoids are slightly abducted and 'toed in' so that there is a small triangular chink in the cartilagenous glottis (Zemlin 1968, page 211).

The ability to move differentially, without activating all of the synergism in which the movement is embedded depends on inhibiting the unwanted components of the synergism. (Kinsbourne 1981 Goldstein* (1942) remarked "movements continued to (their extreme) are simpler than those which must be stopped at a certain point. . . . ."

Therefore, one needs to exercise greater control over phonatory mechanism while whispering than while vocalizing normally. In whispering there will be a need for better laryngeal feedback than auditory feedback alone for controlling the speech. Margriet Boels-Van Dijk* (1972) opined that during whispering there should be a greater control which is indispensable for the stutterer to overcome his speech defect. Van Riper (1972) had stated that stutterers have no difficulty

*Gold Stein (1942) in Kinsbourne, M., Cognitive deficit and the unity of brain organization. Gold Stein's perspective updated. J. Comm. Dis., 14, 181-195 (1981)

Magriet Boels-Van Dijk. Distraction in the treatment of stuttering in reference when they whisper. Concentrating their attention on the feel of their musculature, the stutterers would be forced to what normal speakers probably do - controlling speech primarily by proprioceptive tactile feedback.

In this study, the rate of speech was significantly reduced during whispering which is in accordance with Van Riper (1971). Increase in intensity of voice was also accompanied by reduction in rate of speech. Similar findings were reported by Reis (1974), Adams and Moore (1972) and Adams & Hutchinson (1974).

However, in the present study it has not been accounted for the changes observed in the rate of speech. More information is needed in this regard.

It is concluded from this study that phonation is an important factor influencing stuttering. Changes in intensity of voice bring about a significant change in the frequency of stuttering. Stuttering is significantly reduced with increase in intensity and stutterers become more fluent when they whisper. In both the conditions the observed changes could be accounted on the basis of enhanced laryngeal feedback.

CHAPTER V

SUMMARY AND CONCLUSIONS,

The present study was designed to investigate the effects of whispering and varying the intensity of voice on stuttering.

9 stutterers (8 males and 1 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.

Initially the number of stuttering blocks during 18 minutes of reading were recorded on 2 consecutive days for each subject. After establishing a stable base rate of stuttering, each subject was exposed to four experimental sessions:

1) Condition A - Whispered reading
2) Condition B - Reading at 60 dB SPL
3) Condition C - Reading at 70 dB SPL
4) Condition D - Reading at 80 dB SPL

In each of the experimental sessions, the subject read for 18 minutes. Each experimental session was divided into 3 parts. The first 6 minutes pre-experimental/base rate, second 6 minutes for experimental condition during which, the independent variable was introduced and third 6 minutes for post-experimental base rate.

A voice light designed at the Electronics Department of the Institute was used to change the intensity of voice objectively in known steps and to provide visual monitoring of the loudness.

The number of stuttering blocks and the rate of speech for each subject under all the experimental conditions were recorded. The data obtained was then subjected to statistical analysis and the results obtained were discussed.

The results showed a significant reduction in stuttering in whispering when compared to normal voice condition. Stuttering was significantly reduced with increase in intensity of voice. Therefore, the hypothesis (l) that"there will be no significant difference in the frequency of stuttering during whispering when compared to the frequency of stuttering in base rate" and hypothesis (2) stating that "there will be no significant change in the frequency of stuttering as the intensity of voice is increased" are rejected.

The rate of speech was significantly reduced in conditions in which there was a significant reduction in stuttering.

Conclusions:

1. Increase in intensity of voice brings about increasing reduction in stuttering.

2. Whispering significantly reduces stuttering.

3. Rate of speech may be a variable related to stuttering.

Limitations of the present study:

1. Number of subjects was limited.

2. Other variables associated with change in intensity like rate of speech, pitch, were not controlled.

3. Only 3 levels of intensities were studied.

Recommendations for further study:

1. Controlling the rate of speech, the effect of increased vocal intensity should be studied.

2. Spectrographic analysis of the stutterers speech with changes in intensity of voice may be carried out to find salient features, if any.

3. It would be interesting to study the effect of

elimination of voice (as in silent speech) and while using electrolarynx.

4. The effect of change in intensity may be found at 5 dB steps on a wider range.

5. The influence of change in intensity may be clinically tried as a therapeutic method.

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