

THE PHONETICS OF SINDHI

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Ph.D

UNIVERSITY OF EDINBURGH

1978



ABSTRACT

This thesis presents a phonetic study of Sindhi, a language belonging to the Indo-Aryan family of languages. As far as I can discover, it is for the first time that a detailed synchronic study of Sindhi supported by quantitative data has been attempted on such comprehensive lines with modern linguistic instrumental techniques. Phonetic observations have been made, based on the author's own kinaesthetic proprioception and introspective perception. A large number of instruments have been used to examine and verify the native speaker's proprioceptive impressions and perception. The discussion thus draws heavily on both - the author's own kinaesthetic sensations and on the instrumental data obtained from examining palatograms, labiograms, kymograms, spectrograms and mingograms of airflow, laryngograph and pitchmeter readings/records.

Chapter One gives background information about the Sindhi language and its speakers, the script and the dialects. The chapter ends with a discussion on the place of instrumental techniques in phonetic research.

Chapters Two and Three present a detailed description of consonant and vowel sounds of Sindhi. The relevant allophonic and distributional characteristics of each sound are discussed with illustrative examples.

Help has been sought from the sound spectrograph to check on whether there is any correlation between the traditional articulatory description of the vowels of Sindhi and their acoustic specifications

in terms of formant frequencies, and also to consider whether the vowel continuum can be better described in terms of their acoustic specifications.

Chapter Four examines syllable structure in Sindhi.

The last chapter is a preliminary study and the first attempt at providing a systematic description of intonation patterns in Sindhi. An attempt also is made to relate acoustic characteristics to intonation described in linguistic terms.

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to the following:

1. Mr W.E. Jones, my supervisor, for constant encouragement, kind advice and clarifying criticism he so readily provided at all stages.
2. Professor R.E. Asher for his far-reaching and effective support. I express my infinite gratitude to him for seeing me through a very critical period of this work.
3. Mr J. Anthony of the Department of Linguistics, for his helpful interest. I am grateful to him for letting me use equipment at the Voice and Speech Disorders Clinic, Department of Oto-Laryngology, Royal Infirmary, Edinburgh, for collecting data regarding airflow dynamics.
4. The Department of Language, University of York for giving me a grant for a year. My special thanks are due to Dr M.W.S. DeSilva of the Department of Language, for looking after my well-being during my stay in York.
5. The Hornby Trust for paying fees.
6. The technical staff of the Phonetics Laboratory, Department of Linguistics, for their prompt help.
7. Miss Liz Maguire of Wolfson Microelectronics Liaison Unit, Edinburgh University for typing this thesis.



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## CHAPTER ONE: INTRODUCTION

### 1.1 THE SINDHI LANGUAGE

India represents languages and cultures of diverse linguistic and ethnic groups, which are both sources of its strength and weakness. The extent of linguistic heterogeneity is reflected in the recording of 1652 mother-tongues by the 1961 census.

Sindhi is one of the seventeen national languages of India, officially recognised and incorporated in the eighth schedule of the constitution of India. Sindhi belongs to a family of the Indo-Aryan languages. According to Grierson (1919), it is 'a member of the North-Western, outer-circle of the Indo-Aryan vernaculars spoken in British India'.

Sindhi is the native language currently spoken by about two million people in India, though it is a language primarily used by another fifteen million people in Pakistan.

In 1947, it was the partition of 'Greater India' into two independent sovereign states that led to the radical changes in the development of the Sindhi language. It will not be far from truth to say that Sindhi Hindu scholars had a significant contribution to make to the overall academic and scholarly activity which unfortunately received a serious setback on account of their migration to India in the wake of partition. For quite some time, there was a period of lull in literary circles, because people felt terribly unsettled and were mainly preoccupied with their more pressing problems that concerned their daily immediate needs. But once the political controversy was resolved and the social turmoil subsided, a large number of young Sindhi scholars found a chance to demonstrate their linguistic ability in new bilingual/multilingual environment. These

Sindhi speakers were spread all over the country-with perhaps major concentration in Maharashtra, Gujerat, Madhya Pradesh and Rajasthan. This led to a unique situation for the study of dynamic change in the Sindhi language because of the interaction between the Sindhi speaking immigrants on one hand and the speakers of the Indo-Aryan and Dravidian languages on the other. Khubchandani (1963), influenced by the theories of linguistic acculturation of Haugen and Weinreich, has presented an account of the linguistic aspects of the acculturation of Indian Sindhi. He has also made a preliminary study of the social functions of Sindhi in multilingual India, conditions and types of contact with other permanent languages, and the development of various types of bilingualism.

Needless to emphasise that the difference between the Indian Sindhi and that of Pakistan has been fast increasing on the Indian subcontinent since the advent of Independence in 1947. During the first half of the present century, the language of literature and formal discourse was pre-eminently dominated by Perso-Arabic influences. Even today, the Sindhi language in Pakistan continues to lean heavily towards Perso-Arabic and Urdu styles to identify itself with Islamic culture; whereas the Sindhi language in India does not show much resistance to borrowings from Sanskrit and Hindi. Obviously, the use of Perso-Arabic elements in the colloquial as well as written Indian Sindhi language has been very much on the decline. This change is pretty well reflected, for example, in the phonological patterns of the Indian Sindhi as shown below:

- i) the Perso-Arabic borrowed sounds [x] and [ɣ] are fast losing their distinctiveness in modern Indian Sindhi.

These two sounds most often occur in free variation with [kh] and [g] respectively in the speech of bilingual immigrants. They have, however, for all practical purposes, disappeared from the speech of the younger generation.

- ii) The distribution pattern of Sindhi distinctive sounds is affected to a great extent.

'Sindhi has one important peculiarity it shares with only one or two other Indian languages, viz. that every word must end in a vowel. When that vowel is short, it is very lightly pronounced, so as to be hardly audible to a European...' (Grierson 1919:8). According to the sound laws of Sindhi, all consonant sounds, therefore, occur only in the word initial and word-medial position.

There are, however, a large number of borrowed words from Persian (including Arabic) and English, used very frequently in modern Indian Sindhi wherein consonant sounds do occur in the word-final position; e.g.

- [xɔf] (fear)  
 [ɣəɭəɭt] (wrong)  
 [bəɾəɾ] ( a dam over a river)

A young Sindhi speaker, generally, tends to add a short vowel, either [ə], [ɪ] or [ʊ], at the end of these loan words to fit these into the overall phonotactic pattern of Sindhi.

The process of development has resulted in a deepening of the influence

of Sanskrit and Hindi on Sindhi in India, and that of Persian and Arabic on Sindhi in Pakistan.

## 1.2 THE SCRIPT

One comes across diverse writing systems used for Sindhi until the time of the British conquest of Sindh. Stack (1853) has referred to various forms of Devanagari and Laṇḍa scripts such as Khudāwādī, Shikarpurī, Sākhrū, Thaṭṭai, Larai, Sewhani, Memaniko. In addition to these, Perso-Arabic and Gurumukhi characters also were used for Sindhi religious and literary writings.

It was in 1851 that the British government decided to adopt one single script for the purposes of their administration. Laṇḍa was summarily rejected for the obvious reason that it lacked characters for vowel sounds. The choice, therefore, was reduced to two - either to accept modified Perso-Arabic or Devanagari script for the language. On account of the pressure from Muslims and Persian-oriented Hindu scholars, Devanagari script did not find favour with the rulers. 'Ellis, with the assistance of some native scholars, devised an alphabet extending the 29 Arabic letters to 52'. (Aitken 1907, p 472-476). But the use of Devanagari and Gurumukhi continued for religious purposes and, of Laṇḍa for commercial purposes.

In this connection, Trumpp (1872:1) observes: 'No alphabet suits the Sindhi better than the Sanskrit alphabet, the Sindhi being a genuine daughter of Sanskrit and Prakrit.'

This movement in favour of Devanagari script was revived in India after the partition. It may be observed here that language basically is speech, and the writing system is just a visual representation of what we speak. The script, in other words, is the outer clothing

of a language. Scripts are no more permanent than fashions in clothes. In India, however, values of permanence are attached to the script and even status is ascribed to those languages which have ancient and individual writing systems. In fact, so much religious and emotional significance is attached to script that it is more often extremely difficult to talk in rational terms about script and script reforms, if any. Fortunately, the Government of India has demonstrated a great restraint and taken a neutral stand in respect of this controversy that has led to a sharp division of the Sindhi public opinion. The Government has recognised both Perso-Arabic and Devanagari scripts for the language. As a result, some educational institutions have introduced the teaching of Sindhi in Devanagari script.

A heated debate has gone on in various journals on this controversy. People like Shivdasani (1963), Jetley (1959) and Gajra (1966) represent the feelings of the revivalist movement. They have strongly argued for the revival of Devanagari script for Sindhi, primarily on the linguistic grounds that Sindhi belongs to the Indic family of languages and all Indic languages use one or the other form of Devanagari writing. Orthodox people like Vasant (1958), Aziz (1959) and Wadhvani (1962) favour the retention of Perso-Arabic writing for Sindhi from the point of view of preserving the Sindhi literature. Khubchandani (1959) has suggested a rational and very compromising approach. He suggests: 'As Sindhi immigrants are scattered in different states and the facilities for learning Devanagari script (through Hindi) exist throughout India, it would be convenient to use Devanagari characters for Sindhi. For those specializing in literature, the knowledge of Perso-Arabic writing would be essential to keep in touch with the literary trends in Pakistan'. (Khubchandani 1969:204). The present



author considers Khubchandani's approach very pragmatic and therefore subscribes to this view.

### 1.3 AREAS WHERE SINDHI IS SPOKEN

Sindhi is used as a first language by many people in India. But unlike other languages of India, Sindhi does not have a compact well-defined geographical area where it is spoken. In India, it has been declared as the mother-tongue of many Sindhi Hindus in Maharashtra, Rajasthan, Delhi, Madhya Pradesh besides quite a few other states. In Pakistan, it may be regarded as the mother-tongue of the people who live in Sind which now forms a part of Pakistan. According to the latest (1971) census report of India available there are about 1.6 million people who speak Sindhi in India. The following table (CIIL 1973) gives the exact number of Sindhi speakers in each state in India:

1. Andhra Pradesh	8,408
2. Assam	427
3. Bihar	5,817
4. Gujerat	607,909
5. Jammu and Kashmir	65
6. Kerala	1,740
7. Madhya Pradesh	242,275
8. Maharashtra	432,073
9. Manipur	12
10. Mysore	9,651
11. Nagaland	20
12. Orissa	1,664
13. Punjab, Himachal Pradesh Haryana and Chandigarh	1,471

14. Rajasthan	240,348
15. Tamil Nadu	8,353
16. Tripura	17
17. Uttar Pradesh	76,399
18. West Bengal	5,093
19. Andaman and Nicobar Islands	7
20. NEFA and Arunachal Pradesh	31
21. Dodra and Nagar Haveli	30
22. Delhi	34,619
23. Goa, Daman and Diu	254
24. Laccadive, Minicoy and Amindi Islands	-
25. Pondicherry	50
Total	<u>1,676,728</u>

On page 9, there is a map of India showing the total number of speakers of Sindhi, according to states. Between 1961 and 1971 census report, there has been an increase of Sindhi speakers by 0.31 per cent which has been computed in relation to the total population of the country.

Sindhis are a community of adventurous people and highly enterprising traders. In India, they are popularly referred to as 'Indian Jews'. In order to explore fresh avenues in the field of commerce and trade, many Sindhi Hindus have left the Indian shores and made a fortune for themselves. Sindhis are, therefore, found, no wonder, in every part of the world - Gibraltar, Kenya, Zanzibar, South Africa,

the West Indies, Hong Kong, Singapore, to cite a few.

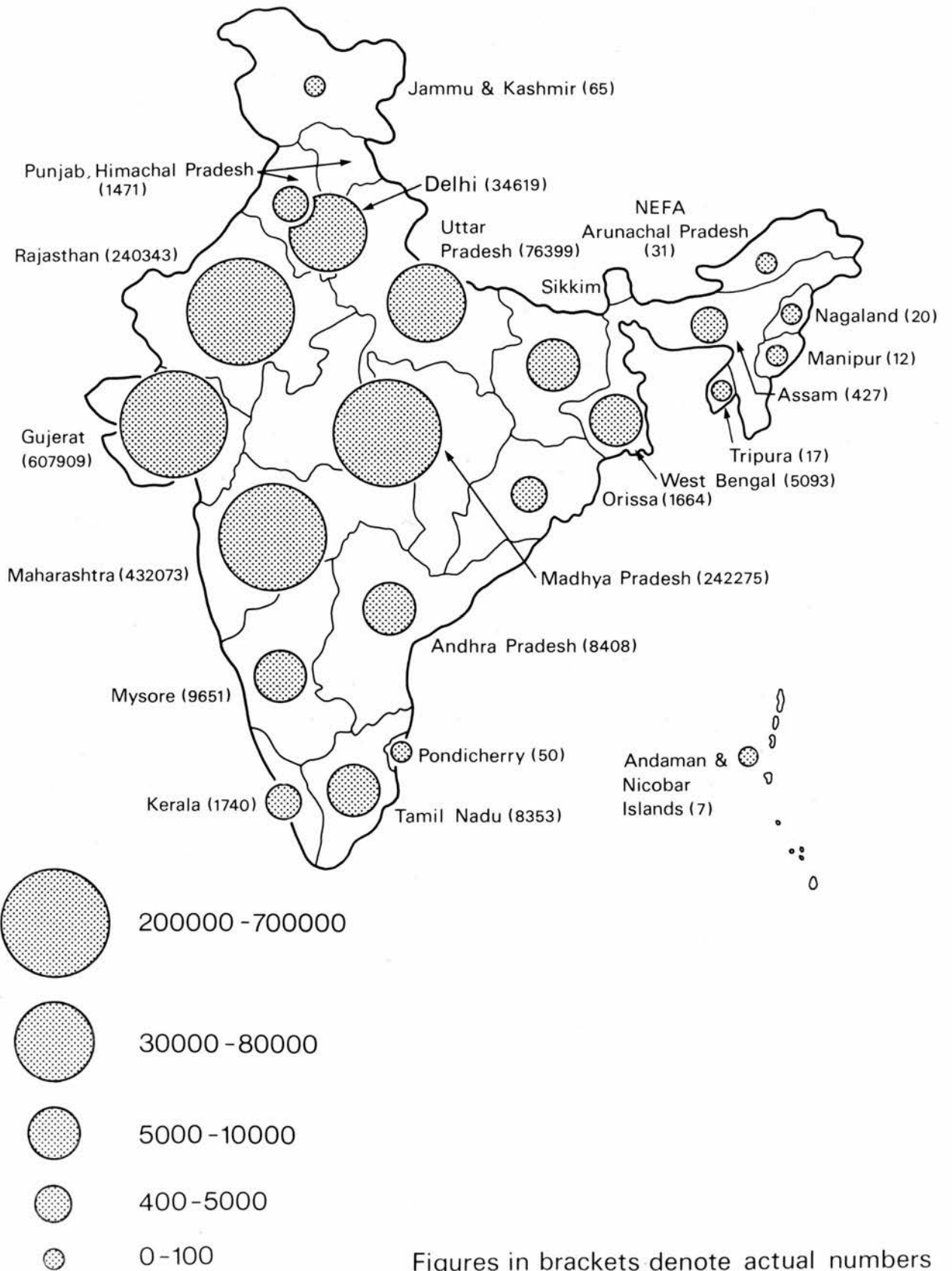
#### 1.4 DIALECTS

Following are the six major dialects of Sindhi:-

- i) Siraiki - The adjectival term comes from 'Siro' or upper Sindh. This variety is spoken in the northern part of Sindh.
- ii) Lari - Spoken in 'Laru' or lower Sindh i.e. the southern part of Sindh.
- iii) Vicholi - Spoken in the central part of Sindh.
- iv) Thareli - Spoken by the hunting tribes of the Tharu or Desert of Sindh which forms the political boundary between Sindh and Marwar, i.e. the eastern part of Sindh and now the Sindh-Pakistan border area.
- v) Kacchi - Spoken in the peninsula of Kutch on the southern border of Sindh.
- (iv) Lasi - Spoken near Karachi and in the south of Las Bela on the western border of Sindh.

The dialect of central Sindh - roughly the part around Hyderabad Sindh which now forms a part of Pakistan - is considered to be the 'Standard' variety (known as 'Vicholi'), used by educated speakers and in literary circles. This variety has special prestige attached to it because the most celebrated poet of Sindhi, called ~~Abdul~~ Latif wrote his much admired classic 'SHAH JO RASALO' in this dialect. Shah Abdul Latif is regarded

## The Distribution of Sindhi Speakers



as the chief poet of Sindh. Grierson (1919) observes: 'His poetry is the delight of all that can understand it. The learned praise it for its beauty and are fond of having it recited to the sound of the guitar. Even the unlearned generally know select poems by heart and take the trouble to become acquainted with the meaning'.

The variety of Sindhi, described here, is roughly representative of the Vicholi dialect. The present writer comes from a middle class Hindu family, born in Gambat, and had his primary education in Pakistan in a Sindhi-medium school. At the age of 10, he migrated to Maharashtra, India, where he has spent the major part of his formative years. He spoke Sindhi at home; Hindi, Marathi and English at school and heard a lot of Gujarati around his home. Thus he has been brought up essentially in a multi-lingual atmosphere.

The description, based on the author's own speech, has been kept fairly close to the colloquial speech.

#### 1.5 SCOPE OF THE PRESENT STUDY

This thesis presents a phonetic study of the standard variety of Sindhi. The study is entirely synchronic and descriptive, entirely based on the author's own pronunciation. The phonetic statements are therefore valid basically for the author's own idiolect; but it is hoped that these will also be valid for almost all other speakers of the same dialect.

There is a paucity of actual descriptive materials in the field of Sindhi phonetics. It is astonishingly true that even during the past decade or so of growing interest in Sindhi linguistics, research work should have been done in contrastive analysis, syntax, lexis but not in the actual phonetics of Sindhi. Segmental aspects have received, no doubt,

some attention in the past decade or two, though much less so than in this description; but very little is available on suprasegmental features, pitch and intonation for instance. Bordie (1958) and Khubchandani (1961) have discussed intonation rather in a very cursory fashion; even their description of segmental sounds is not widely supported by instrumental measurements. Nothing has been said by them about air-flow dynamics, which is an important link between acoustic and the organic phases of speech.

It is for the first time, as far as I can discover, that a detailed synchronic study of Sindhi supported by quantitative data has been attempted on such comprehensive lines with modern linguistic experimental techniques.

#### 1.5.1 Phonetics or Phonology?

The present thesis though concentrates to a large extent on the phonetic element of Sindhi, it inevitably also deals with phonological aspects of Sindhi.

It was a grave error on the part of the Prague School (Trubetzkoy, Jacobson and others) to want to establish a strict dichotomy between phonology on one hand, as a functional linguistic science and phonetics on the other, as an auxiliary natural science which makes use of instrumental means and empirical methods. The present author does not recognise an antithesis between the two disciplines - these are not two autonomous and independent sciences; the two are rather complementary and interdependent. The two may be grouped together under the general heading of 'linguistic phonetics'.

Daniel Jones (1950:7) of the traditional British school of phonetics has defined his phoneme as 'a family of sounds'. Jones's phonemes are established on purely distributional grounds. His physical view excludes all reference to non-phonetic criteria in the grouping of sounds into phonemes. Thus Jones's phoneme is essentially a phonetic

concept. His practical point of view envisaged the 'phoneme' in terms of 'broad' phonetic transcription in which each symbol represents a phoneme.

It is in this tradition of the British school of linguistic phonetics that the description of Sindhi has been attempted here. To quote Matthews (1957-58, p. 268), 'it is not phonology which includes phonetics, but phonetics as the science of speech sounds which includes phonology'. Thus '....the phonetician, and the linguist in his capacity as a phonologist, are one'. (Jones and Laver: 1973, p. vii).

### 1.5.2 Descriptive Procedures

The descriptive procedure followed for the purposes of the investigation is to discuss, after introduction, the detailed description of consonants and vowels in isolation, and then to move on to the syllable and other suprasegmental features in Sindhi. To begin with, phonetic observations have been made, based on the author's own kinaesthetic proprioception and auditory judgements.

Genuine doubts have sometimes been expressed about widely varying statements and assumptions contained in the researches based on impressionistic auditory judgements. The conflicting nature of such contrary statements forces one to look for scientifically valid supporting evidence based on experimental studies, before making any fresh claims. A large number of instruments have therefore been deployed to examine and verify the native speaker's proprioceptive feeling and introspective perception. The discussion thus draws heavily on both - the author's own kinaesthetic sensations and on the instrumental data, obtained from examining palatograms, labiograms, kymograms, spectrograms and mingograms of air-flow, laryngograph and pitch-meter readings/records.



Below each instrumental recording appears a 'broad' phonetic transcription of the utterance concerned. An attempt has been made to delimit certain phonetic features such as voicing, aspiration, nasality and so on. But it may be pointed out that such a delimitation is arbitrary, and does not imply that it is possible to divide an utterance into discrete units. Speech is a continuum, 'a single complex system in which the continuous interacting activities of the various linked components are intricately co-ordinated in time'. (Laver 1970, p. 53). Although the phonetic statements made refer to individual sounds, it may be pointed out that the features observed characterize abstractions rather than individual sounds.

### 1.5.3 Place of Instrumental Techniques in Phonetic Research

Extensive use of instruments has been made to provide empirical evidence for the phonetic facts depending upon which the relevant allophonic and distributional statements have been made at appropriate points in the thesis. A general discussion of the major instrumental techniques is given by Ladefoged (1957), Keller (1971) and Nihalani (1972).

Instrumental methods deriving from physiology and physics were introduced into phonetics in the second half of the last century. The title 'Principes de Phonétique Expérimentale' written almost a century ago by Rousselot (1901), one of the great pioneers of instrumental phonetics, is still considered to be a valuable contribution and worth reading.

While justifying a place for the instruments in the study of phonetics, Keller (1971:2) remarks: 'By means of instrumental studies our knowledge of phonetics has increased. In some cases we have



substantial evidence for what previously were speculations. In other cases, instrumental records bring to our attention features of speech of which we were unaware. As applied to specific languages, the phonetic character of phonological units can be defined more precisely.<sup>1</sup>

Catford (1977), on the other hand, suspects that the laboratory is more often used as a cloak for phonetic incompetence, and that such a thing should be guarded against. While stressing the importance of practical phonetic training, he observes: 'the analysing phonetician has an internalised Kinaesthetic image of what is going on in the speaker's vocal tract. An important part of the task of the student of phonetics is to make these feedbacks conscious when desired, and much of practical phonetic training has been directed to this end.. (Catford 1977:5).

In this connection, Pike (1943:25) remarks: 'The instrumental articulatory technic .... is of special value in measuring movements and positions to define precisely classifications presented by the auditory approach'.

Practical phoneticians such as Sweet (1911), Jones (1938) and others also have pointed out that instrumental phonetics cannot take the place of auditory analysis. Beach (1938:11) remarks: '..... a trained ear must always be the principal stock-in-trade of the phonetician..... the 'ear method' is certainly quicker and generally far more convenient than analysis by means of instruments. It may be called the backbone of phonetic research'. Even Sweet (1911) has sounded a similar note of warning: 'instrumental phonetics is, strictly speaking, not phonetics at all. It is only a help.... The final arbiter in all phonetic questions is the trained ear of the practical phonetician'.

The present author goes along with Ladefoged (1964, p. xvi) where he gives the most befitting answer to Sweet: 'But for those of us who are not as skilled as Sweet, instrumental phonetics may be a powerful aid and a great use in providing objective records on the basis of which we may verify or amend our subjective impression'.

Instrumental techniques are very important and useful tools of a phonetician, in addition to his major tool - his ear. The present author is of the opinion that the 'subjective' methods of analysis by Kinaesthetic sensations and the 'objective' methods of analysis by instruments are not opposed to one another. They are complementary, they rather supplemènt each other.

It is hoped that the instrumental data will be able to test and confirm the author's own initial proprioceptive impressions and also provide detailed and quantified objective specifications of various aero-dynamic, articulatory and acoustic parameters.

## CHAPTER TWO: THE CONSONANTS OF SINDHI

### 2.1 INTRODUCTORY REMARKS

This chapter gives a detailed phonetic description of the consonants of Sindhi. The relevant allophonic and distributional statements are made at appropriate points. No attempt is made to work out the morpho-phonemic statements such as would enable one to rewrite phonemically a morpho-phonemically written utterance.

Initiation, phonation and articulation are three basic components of speech production in the human vocal tract. Before we come to the detailed discussion of the gross postures and movements of 'so called' speech organs involved in the articulation of the consonants in Sindhi, it seems very much in order to examine, in some detail, the initiation (air-stream mechanisms) and phonation processes, as used in Sindhi.

### 2.2 INITIATION

Catford (1977:63) defines initiation as 'a bellows-like or piston-like movement of an organ or organ-group (an initiator), which generates positive or negative pressure in the part of the vocal tract adjacent to it, that is, between the initiator and the place of articulation. The term 'initiation' is used for this component of speech production since it is the activity that 'initiates' the flow of air essential for the production of almost all sounds'.

The production of speech sounds is essentially an aerodynamic phenomenon. An air-stream is the basis of all human speech. An air-stream is initiated by an air-stream mechanism. Catford (1939),

Pike (1943) and, recently, Abercrombie (1967) have discussed three major air-stream mechanisms by which the air is moved to form speech sounds. Each mechanism has a different initiator:

- (i) the pulmonic air-stream mechanism where the initiatory activity is carried out by the lungs. The air in the lungs is moved by the action of the respiratory muscles;
- (ii) the glottalic air-stream mechanism where the initiatory activity is carried out by the larynx. The air in the pharynx is moved either by the closed or vibrating glottis;
- (iii) The velaric air-stream mechanism where the initiatory activity is carried out by the back part of the tongue and the velum, and the air in the mouth is moved.

These are the three initiatory locations (i.e. the lungs, the larynx and the velum) of serious linguistic importance.

The 'direction' of the movement of the initiator is another major parameter of initiation. It is the movement of the initiator that causes pressure changes in the vocal tract. The initiator may move upwards so as to decrease the adjacent vocal tract volume and thus generate positive pressure. This is called 'pressure' initiation. On the other hand, the initiator may move downward so as to enlarge the adjacent vocal tract volume and thus generate negative pressure. This is called 'suction' initiation.

The result of 'pressure' initiation is to push the air out and the initiation is called 'egressive'. The 'suction' initiation, on the other hand, normally pulls the air inwards and is, therefore, called 'ingressive'.

Following Catford (1977:64), the terms 'egressive' and 'ingressive' are used in this thesis to refer to the actual direction of

airflow outward or inwards in the vocal tract. For the basic initiation types themselves, the present author uses the older terms 'pressure' and 'suction' as suggested by Catford (1939).

Pulmonic pressure initiation is the most usual way of talking or singing. But Sindhi uses a glottalic suction initiation also, in addition to the pulmonic pressure initiation. In fact, these two air-stream mechanisms are used simultaneously in the production of some sounds in Sindhi (Nihalani 1972).

The pulmonic pressure initiation will not be discussed here; it appears to be used in essentially the same way as in Indo-European and all other languages. The glottalic suction initiation is not used in the well-known European languages (except as a stylistic variant); but in Sindhi, it is used in the production of implosives in which there is a downward movement of the vibrating glottis, which tends to cause a lowering of the pressure behind the oral stricture.

Published phonetic descriptions available in Sindhi linguistics indicate that there is a lot of confusion about the articulation of these sounds. Stack (1849:19) who first described these sounds (written as g, j, d and b) states:

'b has a peculiar sound.....

d is a harsh d sounded from the palate and throat combined.

j has a peculiar sound only to be acquired by practice.

g has a strange sound, formed by placing the tongue against the palate, keeping the mouth open, and sounding from the throat.

Most European scholars failed to perceive any difference between the implosives and their counterparts produced with the pulmonic pressure air-stream mechanism. Grierson (1919:22) describes them

as 'pronounced with a certain stress, prolonging and somewhat strengthening the contact of the closed organ, and are, in fact, sounded as double letters are pronounced in other parts of India, but occur at the beginning of a word ....'

Bailey (1922:37) was the first to speak of them as 'implosives'. He states:

'these sounds are implosives in which the air is drawn in instead of expelled. The larynx is lowered and the glottis closed. This action sucks the air back but no appreciable amount enters the lungs.

Turner (1923:304) gives a more detailed description of the formation and the origin of these sounds. He states:

'Sindhi presents voiced stops accompanied by what appears to be a closing of the glottis ..... Immediately after the occlusion by the lips or tongue has been formed, the glottis also is closed. The larynx is lowered, and there is considerable general muscular tension. The glottis is not opened until the lip or tongue occlusion has been broken so that some air is sucked back behind the point of occlusion. Then the glottis is opened to permit the formation of voice. It is possible that the glottis is again closed before the following vowel is pronounced'.

Chatterjee (1922) has described these sounds as 'stops with glottal closure'. Bordie (1958:23) states:

'The method of production of the implosive stops is essentially the same for all members of the series except

for the point of stopping of the oral cavity. The larynx is lowered producing rarefaction of the air in the oral cavity between the larynx and the point of stopping. While the larynx is being lowered, the oral cavity is opened, as for normal release of the stop, allowing an influx of air with consequent audibility as a 'click'. At this point, air is forced from the lungs, through the vocal cords, producing voice. The voiced air-stream passes through the larynx when it reaches the lower limit of descent. Release is then the same as for explosive stops'.

While giving the articulatory description of implosives in general Gimson (1971:34) states:

'a bilabial stop may be made, with the soft palate raised, as for [b]; but instead of air pressure from the lungs being compressed behind the closure, the almost completely closed larynx is lowered so that the air in the mouth and pharyngeal cavities is rarefied. The result is that the outside air is sucked in once the mouth closure is released; at the same time, there is a sufficient leakage of lung air through the glottis to produce voice. Such ingressive stops (generally voiced) are known as implosives and occur with bilabial [ɓ] dental or alveolar [ɗ] ....'.

As one can notice from the general argument, there seems to be a lot of confusion and lack of scientific precision about the articulation of implosive sounds in general, and in Sindhi in particular. Recently, Ladefoged (1971:25-26) has argued that 'the action of the vocal cords



in the production of these implosive sounds has been one of a leaky piston'. He adds that 'often the piston is so leaky that the air-stream is not actually ingressive nor the sounds really implosive'. In many of the languages I have observed (cf. Ladefoged 1964) the pressure of the air in the mouth during an ingressive glottalic stop is approximately the same as that outside the mouth, since the rarefying action of the downward movement of the glottis is almost exactly counterbalanced by the leakage of lung air up through the vocal cords. Although these sounds may be called implosive, in ordinary conversational utterances air seldom flows into the mouth when the stop closure is released'.

It was these observations which inspired the present author to undertake a very extensive aerodynamic investigation of stops in Sindhi (Nihalani 1972). The conclusions based on the quantitative measurements of the air-pressure and air-flow dynamics run counter to Ladefoged's assumption that there are no real implosives. The kymographic records show that the downward movement of the larynx occurs while the vocal cords are vibrating. This downward movement of the vibrating glottis enlarges the supraglottal cavity behind the closure. These vibrations are maintained by a small amount of lung air which was not of sufficient volume to destroy the partial vacuum (i.e. rarefying action) caused by the laryngeal movement and thus prevent the occurrence of pressure suction and subsequent 'ingressive' air-flow. The negative pressure ranging between -3 and -7 CmH<sub>2</sub>O was generated in the mouth. On the separation of the articulators, the airflow was found to be ingressive. The volume of air taken in ranged between 0.85 and 2.15 ml as against 6.20 and 11.67 ml thrown out for the corresponding



explosives. (Nihalani 1974:208). These figures, of course, are precisely valid only for the specific Sindhi implosives investigated by Nihalani (1972).

The present author finds it highly misleading to say as Ladefoged (1971:27) does that 'the difference between implosives and plosives is one of degree rather than of kind.' He adds that 'in the formation of voiced plosives in many languages (e.g., English; cf. Hudgins and Stetson 1935) there is often a small downward movement of the vibrating vocal cords. This allows a greater amount of air to pass up through the glottis before the pressure of air in the mouth has increased so much that there is insufficient difference in pressure from below to above the vocal cords to cause them to vibrate. An implosive is simply a sound in which this downward movement is comparatively large and rapid.'

Undoubtedly, there are important similarities between the mechanism of voiced plosives and voiced implosives. It is a well established and widely known aerodynamic fact that in order to maintain vocal fold vibrations, it is absolutely essential to keep the supraglottal pressure always lower than the subglottal pressure. If the pressure difference is less than  $2\text{cmH}_2\text{O}$ , the vocal fold vibrations and the flow will cease. Ladefoged (1971) and Catford (1977) seem to suggest that the adequate transglottal pressure difference can be, perhaps, achieved only by the larynx-lowering and the supra-glottal cavity expansion in the articulation of voiced plosives.

Rothenberg (1968) suggests that this is generally achieved either by the expansion of the walls of the supra-glottal cavity or some airflow leakage through an incomplete velopharyngeal closure. Perkell (1969) and Kent and Moll (1969) have also suggested one or the other of the two mechanisms. Recently, Nihalani (1975) has shown that

in Sindhi, this is achieved by an incomplete velopharyngeal closure. As a result, all the 'voiced' and 'breathy voiced' stops in Sindhi are characterised by slight nasalisation. This has also been attested by Prasad (1951) with regard to Hindi, and Rothenberg (1968) with regard to two Indian languages - Hindi and Telugu. Perhaps, Indian languages employ a physiological mechanism which is different from the one (i.e. larynx-lowering) used for English.

It may be pointed out here that the voiced plosives in Sindhi are phonetically different from the voiced plosives in English in that, they are 'fully' voiced during the period of closure unlike the voiced plosives in English, which are reported to be 'partially voiced'. The relative voicelessness of initial [b,d,g] in English was pointed out by Henry Sweet over a century ago (Sweet 1877: 75-78). This phonetic phenomenon can be explained in aerodynamic terms in the following manner.

In voiced stop consonants in English, the air cannot escape from the mouth, which raises the supra-glottal pressure and so tends to abolish the transglottal pressure difference. The larynx-lowering and the resulting supraglottal expansion may obviate this danger by absorbing the transglottal airflow; but there comes a moment during the period of closure when the transglottal pressure difference is lowered, and hence there is a tendency for the frequency of voice to drop almost to zero so much so that the vocal fold activity ceases during these sounds, and hence the label 'partially voiced' or 'devoiced' stops in English.

In Sindhi, however, it is the incomplete velopharyngeal closure which is the additional physiological mechanism absorbing the transglottal airflow and thus helping to maintain the requisite

transglottal pressure difference for the vibrations to be maintained throughout the period of closure. As a result, we have 'fully' voiced stops in Sindhi.

The present author could thus find little evidence in support of Ladefoged's assumption that 'in the formation of voiced plosives in many languages, there is often a small downward movement of the vibrating vocal cords', and that 'an implosive is simply a sound in which this downward movement is comparatively large and rapid', and therefore 'the difference between implosives and plosives is one of degree rather than of kind'.

Ladefoged seems to have lost sight of the crucial initiatory difference between the two sound-types. The implosive sounds are initiated by the downward movement of the larynx, generating negative pressure and the resulting ingressive airflow. Thus the initiation of such sounds is primarily one of glottalic suction type as opposed to one of pulmonic pressure type in the articulation of corresponding voiced explosives. It is thus the relative absence of pulmonic pressure initiatory activity in the implosive sounds in Sindhi that distinguishes implosives from voiced plosives. The present author goes along with Catford (1977:77) with a slight modification that 'the crucial contrasting feature is not the flow' only (the emphasis is mine), 'but rather the different location and direction of the movement of the initiator'. The oral airflow records clearly indicate a very significant volume of air being sucked in at the point of release in the articulation of implosive sounds in Sindhi.

## 2.2.1 Instrumentation\*

### 2.2.1.1 (i) Mingograph

An 8-channel mingograph ink writer, running at a speed of 25 cm/sec, was used to display simultaneously airflow through the mouth and nose, pitch, larynx waveforms and the audio-signal as shown below.

Channel 1	-	Timer
Channel 2	-	Nose Intensity Filter
Channel 3	-	Airflow through the nose
Channel 4	-	Mouth High-Pass Filter
Channel 5	-	Airflow through the Mouth
Channel 6	-	Larynx Waveforms
Channel 7	-	Pitch
Channel 8	-	Audio Signal

### 2.2.1.2 (ii) Pneumotach Head

For measuring the oral and nasal airflow as electrical signals, the transducer used was the pneumotach head. This device employed a shaped hollow tube with a fine wire mesh screen across it which acts as a resistance element. (Farquharson and Anthony 1970:813). Two such transducers were used to measure separately the oral and nasal airflow. The principle of measuring airflow rate is based on the fact that the pressure drop across the resistance (the mesh screen)

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\*I am grateful to Mr J.K.F. Anthony, Department of Linguistics, University of Edinburgh, for allowing me to use the equipment and evincing a great interest in the research project. My special thanks are due to him for having spared time to discuss some of the problems of interpreting the data. I have immensely benefitted from his comments.

which is caused by an air stream, varies linearly with flow rate under certain conditions. Under these laminar-flow conditions, very precise measurements can be obtained.

Both transducers were calibrated at 396 ml/sec/2 cm. In order to obtain the volume of air displaced as a function of time, the volume velocity electrical signals are generally integrated with time. But no such attempt was made in this thesis. Instead the area was firstly worked out by applying the formula:

$$\text{Area} = \frac{1}{2} \text{ height} \times \text{base (ml/sec)}$$

Then, volume of air in ml was obtained from the volume velocity at 396/ml/sec/2 cm. Values of the volume of air for 1 mm area will be =  $\frac{396 \times 1\text{mm}}{2500} = 0.1584 \text{ ml}$ .

The pneumotach head is fitted into an anaesthetic mask and precautions are taken to ensure that it fits tightly to the subject's face. With the pneumotach head fitted tightly to the face, the subject could speak quite naturally as judged from the tape-recording.

#### 2.2.1.3 (iii) Laryngograph

The laryngeal vibrations (Lx) were picked up by superficially applied electrodes placed on the skin of the neck at the thyroid cartilage. The output of the vibration pick-up was amplified in the usual way and displayed on channel 6 of the mingograph. Pitch (Fo) was not calibrated.

#### 2.2.1.4 (iv) Audio-Signal

A dynamic microphone was used to pick up the audio-signals which were then fed through a pre-amplifier to the photographic oscillograph and displayed on the eighth channel of the mingograph.

These simultaneous acoustic oscillograms helped to determine the onset and cessation of vowels and consonants.

A tape-recording of the utterances was also made to verify the identity of the word-items and for use in later experiments, if necessary.

### 2.2.2 Test Materials

Data on the oral and nasal airflow were collected from my own speech. It was impossible to get hold of any other Sindhi speaker in Edinburgh to check the validity of my own proprioceptive impressions. The author was the sole subject for the experiment. The conclusions will, therefore, be based on my own pronunciation. Statements made are valid basically for my own idiolect, and loosely, for any/all of the other speakers of Sindhi.

Minimal pairs representing all the implosive sounds positioned syllable-initially were selected.

[ɕar̥ʱ]	(a child)	
[b ar̥ʱ]	(burden)	
[ɕaβo]	(uncle)	<u>Bi-Labial</u>
[babo]	(father)	
[mɔɕo]	(blunt, not sharp)	
[mɔdo]	(duration)	<u>Post-Alveolar</u>
[d̥ɪɕho]	(seen)	<u>Retroflex</u>
[d̥ɪɕho]	(obstinate)	
[mɔɕu]	(stupid)	
[mɔɕo]	(pleasure)	<u>Palatal</u>

[f̥aɾo]	(cobweb)	
[ɸaɾo]	(a niche)	
[g̊aɾo]	(heavy)	
[g̊aɾo]	(mangy)	
[bhəŋi]	(you broke it)	<u>Velar</u>
[bəŋi]	(a carriage)	

All these words were uttered with a particular context of situation in mind to make them sound natural.

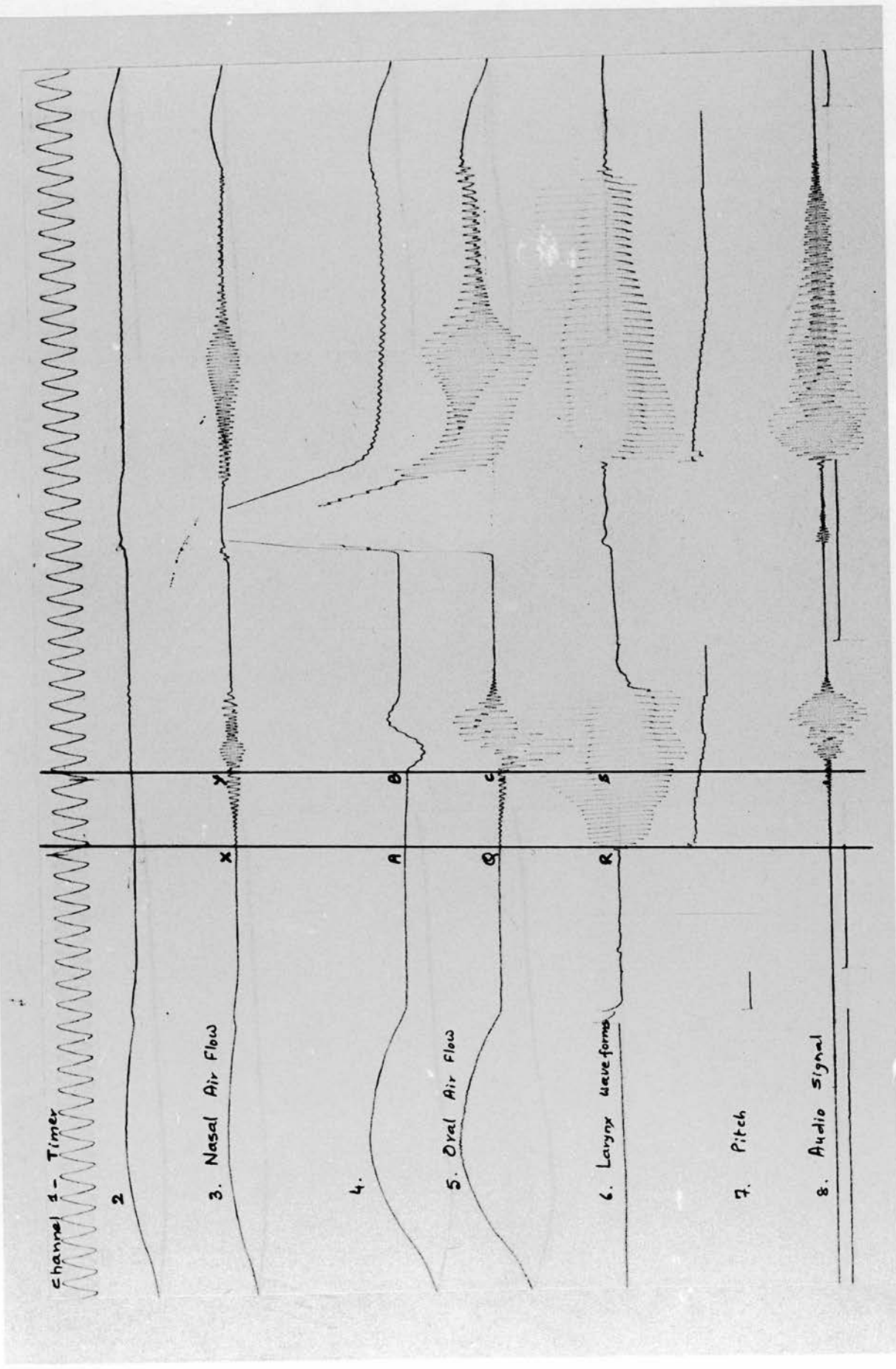
### 2.2.3 Discussion

Figure 1 (p 29) gives the airflow record of the word [d̥iːt̥ho] (seen). The closure-period in the articulation of the implosive sound [d̥] is represented by a straight line Q-C (channel 5) and A-B (channel 4) indicating no airflow in either direction through the mouth. Corresponding to this, the delimited section R-S (channel 6) of the larynx tracing clearly indicates the presence of vocal fold activity during the period of closure.

The downward displacement of the vibrating glottis beginning at R (corresponding to point Q, channel 5) enlarges the supra-glottal cavity behind the oral closure and thus generates negative pressure in the mouth. A slight leakage of air from the lungs passing through the glottis is sufficient to produce vocal fold activity, but it does not destroy the partial vacuum produced by the larynx-lowering. Thus the rarefaction process in the expanding



Figure 1: Mingogram of [d<sub>1</sub>t<sub>h</sub>o] (seen) showing the airflow record





supra-glottal cavities is not affected, so much so that the air is sucked in when the outer closure is released at point C (channel 5) and point B (channel 4). The downward deflection of the tracing below the zero line at point B (channel 4) characterizes the in-rush of the air as soon as the oral closure is released.

Two more features were noted in the production of implosives in Sindhi:

- (i) The mingograph records show that the duration of voicing of implosive stops is much shorter than that of the corresponding explosive stops.

A comparison of implosive and explosive stops in relation to the duration of voicing was attempted.

Minimal pairs representing all the implosive sounds, positioned syllable-initially, were selected and uttered with a particular context of situation on different occasions. Each word was uttered three times and the average of three measurements was taken. Table I presents the duration (in centiseconds) of voicing in both 'implosive' and 'explosive' stops.

Sound	Run I	Run II	Run III	Total	Average	Difference
ɓ	7	5	6	18	6	5.7
b	12	12	11	35	11.7	
ɗ	9	7	8	24	8	7.3
d	16	16	14	46	15.3	
ɟ	10	11	9	30	10	2.3
ɠ	12	12	13	37	12.3	
ɣ	8	10	9	27	9	4.0
g	11	14	14	39	13	

TABLE 1

Data given in Table 1 reveal that the duration of voicing of the implosives ranges from one-half to one-eighth the duration of voicing in the corresponding explosive stops. This phenomenon of shorter duration of voicing of the implosives can be explained in aerodynamic terms. The constant transglottal airflow tends to destroy the partial vacuum in the supra-glottal cavity by raising the pressure in the mouth. It is because of this aerodynamic constraint that the voicing in implosives cannot be maintained for as long a period as ~~it is done~~ in the case of corresponding explosives where the inverse relation between the voicing and supra-glottal pressure can be maintained by incomplete velo-pharyngeal closure so as to help absorb the transglottal airflow. Therefore, the duration of voicing of implosive stops is much shorter than that of the corresponding explosive stops.

- (ii) The laryngograph records indicate the lowering of pitch and greater resonance. Fig 2 (p 32) gives pitch curve obtained with the laryngograph. A sharp steep fall in the pitch beginning at point A and going up to point B may be ascribed to the downward lowering of the larynx during the closure phase of the articulation of the implosive sound [ɖ] in the word [ɖiθo] (seen). Fig 3 (p 32) gives the pitch curve of the word [ɖiθo] (obstinate). A comparison of the two pitch curves shows that the articulation of the corresponding explosive stop [d] is not characterized by such a sharp steep fall in the pitch as noted in the production of the implosive [ɖ].

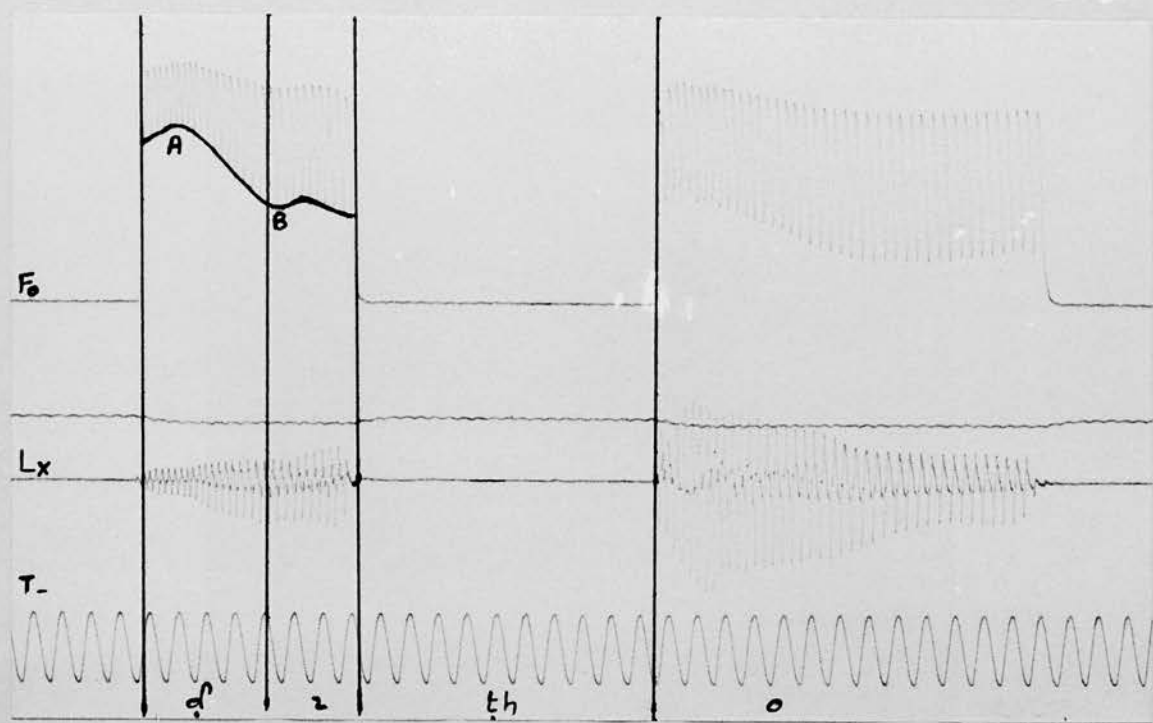


Figure 2 Mingogram of [dɪθo] (seen)  
Pitch Curve obtained with the laryngograph

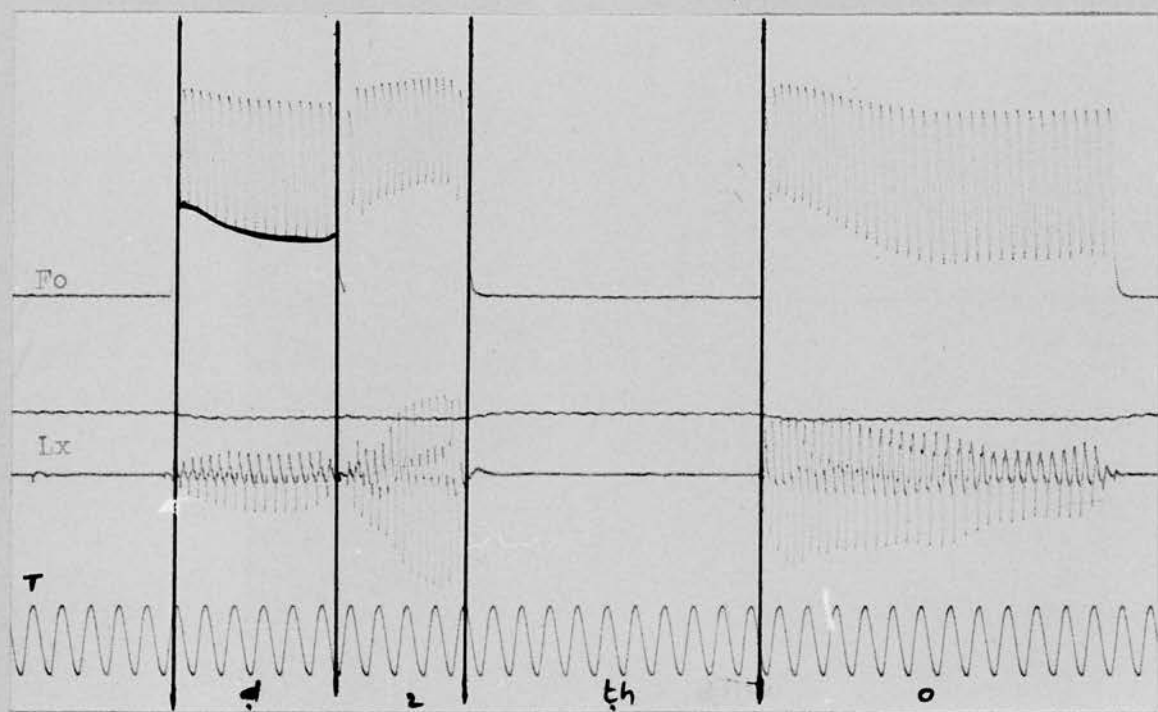


Figure 3 Mingogram of [dɪθo] (obstinate)  
Pitch Curve obtained with the laryngograph

Greater resonance may be due to an increasingly larger cavity behind the oral closure.

### 2.3 Phonation

Phoneticians in the western world have, in general, preferred to confine themselves to European languages which have not more than a three-way contrast with aspiration confined to voiceless sounds only. The terms 'voiced' and 'voiceless' refer to the states of vocal cords during the closure phase in the articulation of a sound, whereas the two terms 'unaspirated' and 'aspirated' refer to the state of the vocal cords immediately after the release of an articulatory stricture. There are thus three distinct possibilities of combination of voicing and aspiration:

1. Voiced stop: Voicing throughout.
2. Voiceless unaspirated stop: Voicing starts immediately after the release.
3. Voiceless aspirated stop: Voicing starts considerably later after the release.

When it came to dealing with one of the Indo-Aryan languages, they followed the traditional Hindu analysis - one of four way contrast.

It is worth special mention here that only Indo-Aryan languages, one of which is Sindhi, have a four way contrast, i.e., voiceless unaspirated, voiceless aspirated, voiced unaspirated and voiced aspirated. Recent researches on the mechanism of the glottis in

its activity of vibration have raised all types of questions. One of these is whether a sound can be voiced and at the same time aspirated. Ladefoged (1971:9) observes that "the fourth possibility, a voiced aspirated sound, would, from the standpoint of these definitions, be a sound in which the vocal cords were vibrating during the articulation and then came apart into the voiceless position during the release of the stricture. Such a sound has not yet been observed in any language".

Ladefoged, therefore, sets up another category for the so called 'voiced aspirated' stops. He observes: "Many sounds cannot be characterised in terms of the two states of the vocal cords, voiced and voiceless. In Gujerati, and in several other Indian languages, there is an apparent opposition in ordinary informal speech between two sets of vowels, in both of which the vocal cords are vibrating. Firth (1957) described one as having tight phonation and the other breathy phonation. I prefer to follow Pandit (1957) in referring to one as voice and the other as murmur. In the one set I can find no difference from the kind of vibrations of the vocal cords described above as voice. The other set is distinguished by a different adjustment of the vocal cords in which the posterior portions (between the arytenoid cartilages) are held apart, while the ligamental parts are allowed to vibrate. There is a high rate of flow of air out of the lungs during these sounds; so the term breathy voice is also appropriate". (Ladefoged 1971:12).

Sindhi, like most other Indo-Aryan languages, has a full series of stops, nasals, flaps with a murmured release; and these murmured

sounds are clearly distinguished by having a different mode of the vibrations of the vocal cords which is due to a different adjustment of the larynx.

The present author feels that setting up another category of 'murmur' or 'breathy voice' seems phonetically well-motivated. In support of this, some quotes from the Hindu phoneticians as translated by Allen (1953) are in order here.

"The air, respiration, or pulmonic emission, at times of vocal activity, becomes breath (śvās) or voice (nāda) according as the glottis is open or closed ..... When the glottis is closed, voice is produced; when it is open, breath ..... Breath is emitted in the case of the voiceless consonants, and voice in the case of the voiced consonants and the vowels..... When the glottis is in an intermediate condition (between closed and open) both breath and voice are produced, .....Breath is emitted for the voiceless sounds and voice for others, except for the voiced fricative (h) and the voiced aspirates, where both breath and voice are emitted..... When the glottis is in an intermediate condition, 'h-sound' is produced; for vowels and voiced (unaspirated) consonants the emission is voice, for voiceless consonants breath, and for h and the voiced aspirates 'h-sound'". (Allen 1953:33-35).

It is amply clear from the above description that the Hindu grammarians knew that 'voiced aspirated' sounds and /h̄/ are distinct from voiced unaspirated, voiceless aspirated and voiceless unaspirated sounds by having a different glottal tone

from both - the tone produced by the intermediate stage of breath and voice. In modern terminology, we can call it 'murmur' or 'breathy voice'. For the purposes of this research, we will adopt the term 'murmur' to refer to this new category.

Regarding this third category 'murmur', Max Muller on RP\* remarks,

Dies ist eine indische Vorstellung, welche wohl nicht zu rechtfertigen ist, (This is an Indian concept which, I suppose, is not justifiable)

and Whitney in a series of unsympathetic comments,

I confess myself unable to derive any distinct idea from this description, knowing no intermediate utterance between breath and sound.....

The attempt to establish this distinction is forced and futile..... That intonated and unintonated breath should be emitted from the same throat at once is physically impossible.

Needless to say, the two western scholars failed to take note of the third phonation process. In connection with this third category 'murmur' (an intermediate stage of 'breath and voice'), Allen (1953: 35-36) remarks: "The modern Indo-Aryan languages bear ample evidence, if evidence were needed that the aspiration of the voiced

\*RP and TP are abbreviations for the names of phonetic treatises written by ancient Hindu grammarians.

TP stands for "Taittriya Prātiśākhyā"

RP stands for "ṚK - Prātiśākhyā"



aspirates (gh, ṅh, etc) is voiced aspiration, and there are strong historical and phonological reasons for believing the Sanskrit h to have been 'voiced h [h̥]; the possibility of such an articulation is no longer a matter of doubt- to quote one of the many available descriptions, - 'A voiced h can be made. For this sound the vocal cords vibrate along a considerable part of their length, while a triangular opening allows the air to escape with some friction'."

In stark contrast with this traditional analysis by the ancient grammarians, some American scholars such as Abramson and Lisker (1967) have suggested that the glottal tone of the voiced aspirates does not have independent status phonetically. They recognise only two different states of the vocal cords - 'voiced' and 'voiceless'. The American phonetic literature refers to aspiration as the retardation in the onset of voicing or 'voice-lag'. Kim (1965) uses the term 'voicing lag' as a cover term for voice and aspiration. Abramson and Lisker (1964) call it 'voice onset time' (VOT), i.e. the moment at which voicing starts in relation to the release of a closure. Thus VOT is clearly a matter of relation between the timing of the release of the articulatory closure and the state of the glottis. This point can be explained most easily by reference to the diagram in Figure 4 (Ladefgoed 1971:10).



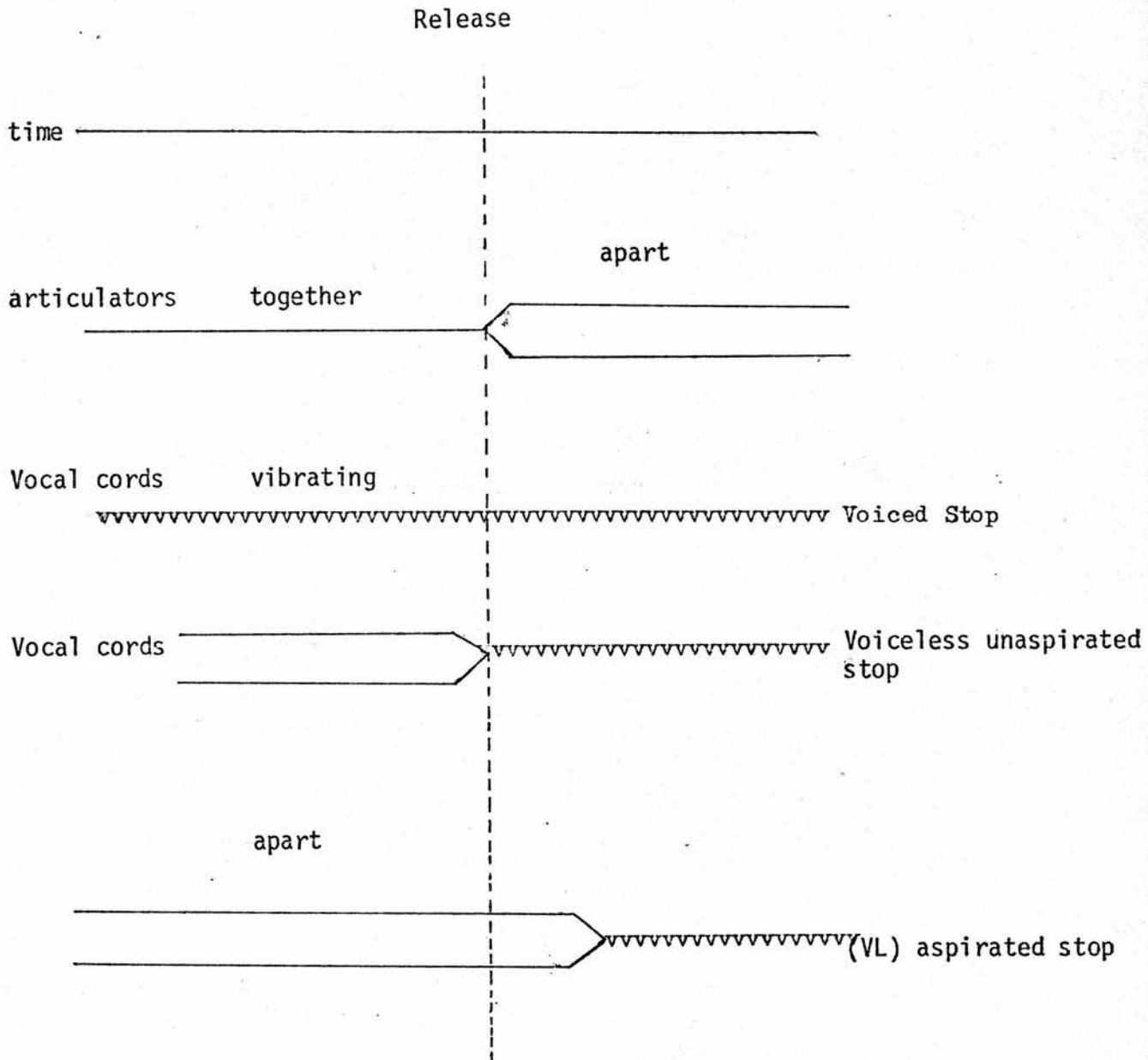


Figure 4: A Diagrammatic Representation of Stops differentiated by Voice Onset Time (VOT).

Abramson and Lisker (1964) studied this phenomenon in a number of languages, including some of the modern Indian languages such as Tamil, Hindi and Marathi.

The Voice Onset Time works fairly well for languages having two-way and three-way contrasts on the dimension of voicing and aspiration as shown in the schematized diagram. The parameter VOT with three cuts, namely voicing at the start, voicing immediately after and voicing considerably later, can account for upto a three-way contrast. The difficulty arose when they had to account for a four-way contrast in the modern Indo-Aryan languages such as Hindi and Marathi. Abramson and Lisker (1964:403) observe: 'The two four-category languages, Hindi and Marathi, present us with our only clearcut cases in which the measure of voice onset time is insufficient for distinguishing among all the stop categories of a language. To be sure, the voiced unaspirated and voiced aspirated stops show differences that are almost systematic; nevertheless, they occupy ranges that are nearly co-extensive. It seems very likely that the voiced aspirates are distinguished from the other voiced category by the presence of low amplitude buzz mixed with noise in the interval following release of the stop.'

In their more recent paper, they further observe: 'In general the stop categories of each language, no matter how they are described in the literature, are effectively separated by the VOT feature. The only categories clearly not distinguishable on this basis are the so called voiced aspirates and voiced inaspirates of Hindi and Marathi; to distinguish these categories, it is apparently necessary to invoke another feature of laryngeal behaviour, that

of partly open glottis that allows turbulent air through to accompany the pulsing.' (Abramson and Lisker 1967<sup>a</sup>:31).

In my view their VOT parameter has failed to account for the four-way contrast of the Indo-Aryan languages. Obviously, one cannot construct a model which will generate these murmured sounds without allowing for three distinct states of the vocal cords, but Abramson and Lisker have circumvented the problem by invoking another feature of laryngeal behaviour, that of 'partly open glottis that allows turbulent air through to accompany pulsing'. Ladefoged's observations, here, are very significant and of great import. The present author goes along with Ladefoged (1971:13): 'There is, it is true, an extra puff of air accompanying both the voiceless aspirated and the murmured stops; but this puff of air is produced in a different way in each case so that the release of the one sounds quite different from the other. Phonemically it may be very convenient to symbolize these sounds as /b, bh, p, ph/, and so on; but when one uses a term such as 'voiced aspirated', one is using neither the term voiced nor the term aspirated in the same way as in the descriptions of the other stops. Murmured stops could be represented on a diagram like Fig 5 only by using a different kind of line to represent a third possible state of the vocal cords as shown overleaf. Murmured sounds are thus characterized by a peculiar adjustment of the vocal cords - 'lig-amentals vibrating and arytenoid apart thus letting the air pass freely through the posterior portions'. This description supports the view of Hindu grammarians that the murmured sounds are clearly distinguished by having a different mode of vibration -

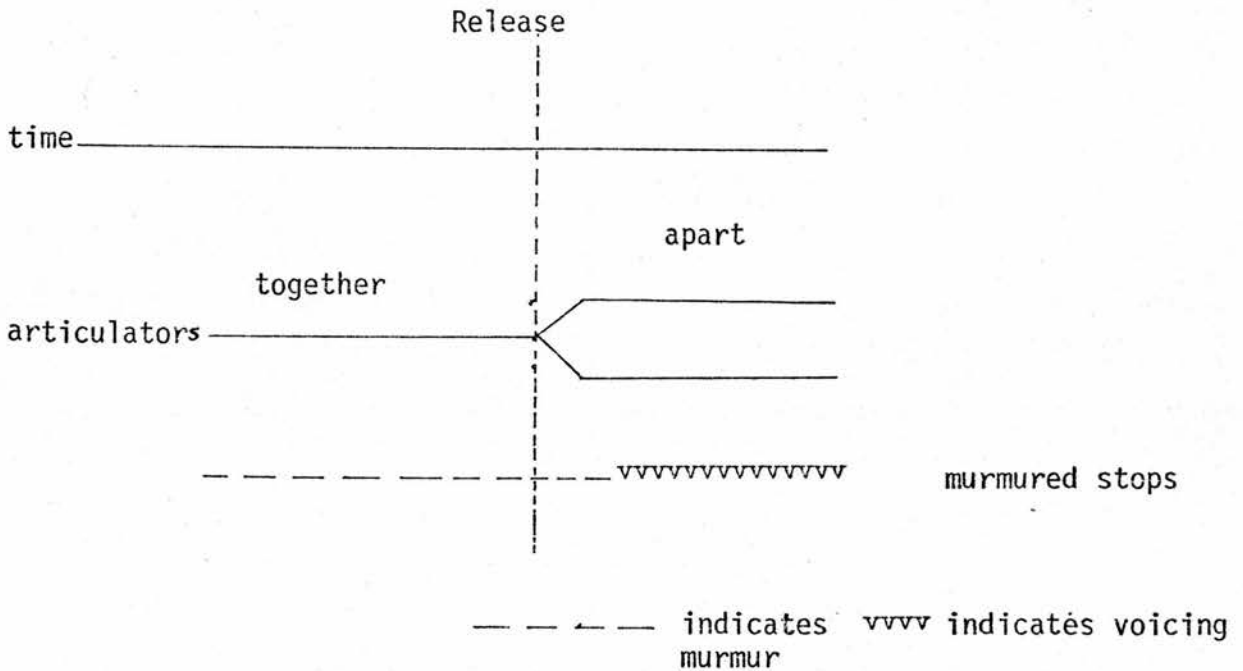


Fig 5: A diagrammatic representation of the Voice Onset Time of a murmured stop.

'the intermediate condition of the glottis when both breath and voice are produced'.

An attempt was made to observe, directly, different adjustments of the vocal cords during continuous speech. A fibre-optics bundle was used to examine and observe particularly this mode of vibration i.e. murmur during speech.

The fibre-optics bundle (Sawashima et al 1970) consists of two groups of glass fibres - the image guide and the light guide. The fibre-bundle, with an outside diameter of about 5.5 mm, was inserted through the nose and positioned in the hypopharynx at the level of the tip of the epiglottis to get a good view of the glottis. Before the use of the laryngoscope, the author was anaesthetized in the left nostril. When the tip of the laryngoscope that houses

an objective lens designed for a straightforward view, reaches near the level of the tip of the epiglottis, the larynx is readily visible through the image finder of the camera.

A close examination of changes in glottal apertures revealed that the 'murmur' state of the glottis was achieved by holding the anterior ligamental part of the glottis sufficiently closed so that the vocal cords vibrated when driven by the pulmonic airflow. Moreover, a wide opening in the rear part of the glottis was also noticed, which accounts for the high rate of flow of turbulent air to accompany the voice during these sounds.

One can venture to speculate that due to relatively open aperture at the glottis in murmured sounds, the vocal vibration will not be as intense as in the case of unaspirated voiced stops, but the force of articulation will be greater than the latter. This is exactly what Abramson and Lisker referred to when they remark: 'It seems very likely that the voiced aspirates are distinguished from the other voiced category by the presence of low amplitude buzz mixed with noise in the interval following the release of the stop'. (Abramson and Lisker 1964:403).

The most obvious characteristic of murmured sounds is an increase of airflow, according to subjective impression. The airflow is largely determined by the nature of impedance caused to the pulmonic airstream by the opening state of the glottis. The airflow is thus tied up with the phonation process.

Sindhi uses voice, voicelessness, aspiration and murmur as four distinctive glottal positions to account for linguistic oppositions. An attempt was made to examine the airflow and provide a quantitative description of airflow rate vis-à-vis different

phonation processes in the formation of stop consonants in Sindhi. The results reveal that 'the airflow rate decreases from the voiceless aspirated through the voiced aspirated (murmur) and the voiced to the voiceless in descending order ..... at 95% confidence level, the differences between the voiceless and the voiced are only by chance and not significant at all. But if these phonation types are classified in two groups - aspirated and unaspirated -, then the difference between the two groups is significant indeed'. (Nihalani 1975a:203).

These observations based on instrumental findings clearly indicate that both 'voiceless aspirated' and 'murmured' sounds differ from the 'voiceless unaspirated' and 'voiced' by having higher airflow rate which concurs with the ~~grammatical~~ and phonetic terminology of the distinction between aspirate and non-aspirate namely 'mahā-prāṇa', lit. 'big-breath' and 'alpa-prāṇa', lit. 'little-breath', as suggested by the ancient Hindu grammarians. (Allen 1953:38).

#### 2.4 Articulation

Articulation is one of the three basic components of human speech mechanism which works like that of a wind instrument such as a clarinet or a flute. In both, sounds are produced by stopping, obstructing, or otherwise interfering with the flow of a column of air through an enclosed passage. Once a flow of air has been set in motion by one of the two initiation processes as seen earlier (in 2.2), the flow may be stopped or impeded at various points along the way, and the shape of the chambers through which it passes may be variously modified. It is this kind of playing on the column of air that is

called 'articulation'. Articulation thus acts upon the airstream to shape it into a sound of a specific quality. The vocal organs that perform these articulations are called articulators.

In order to form consonants, the airstream through the vocal tract must be obstructed in some way. Depending upon the type of stricture provided for the airstream by placing the articulating organs into different positions, the consonants of Sindhi are divided into five major classes:

2.4.1 i) Occlusives - are characterised by a stricture of complete closure in the vocal tract. The articulators make an air-tight contact with each other. For example, in the production of the sound [p] in the word [pəno] (a leaf), the two articulators - the lower and the upper lip - are brought together and a velic closure is formed by raising the soft palate, thus stopping the airstream from escaping through the mouth and the nose. Such sounds, produced with a stricture of complete closure, are called stops.

Depending upon the position of the soft palate, whether raised or lowered, stop sounds are further divided into 'oral' and 'nasal' respectively.

a) Oral - The sound [p] is an oral stop, in the articulation of which the airstream is completely obstructed as seen earlier. Besides the articulatory closure in the mouth, the nasal tract also is blocked by raising the soft palate to form a velic closure. As a result, the airstream

cannot escape through the mouth and the nose. On separating the articulators, the airstream is released only through the mouth, thus justifying the label 'Oral' stop.

- b) Nasal - When the air is stopped in the mouth cavity but the soft palate is lowered so that the air can go through the nose, such sounds are called Nasal stops.

For example, in the articulation of the sound [m] in the word [mɪnd] (mind), the articulatory closure in the mouth is formed by bringing the two lips together, but the soft palate is lowered so that the air is let out through the nose.

Apart from the fact that the nasal tract is blocked off by raising the soft palate in the articulation of [p] as seen earlier, there is absolutely no difference between the stop [p] in [pɪnd] and the one [m] in [mɪnd], but the term 'stop' has come to stand for 'oral' sounds in the phonetic literature. Ladefoged (1975:8) remarks: 'Although both the nasal sounds and the oral sounds can be classified as stops, the term 'stop' by itself is almost always used by phoneticians to indicate an oral stop, and the term 'nasal' to indicate a 'nasal' stop.' Following Ladefoged,



the occlusives [p] and [m] at the beginning of the words [pə̀nə̀] and [mə̀nə̀] will be called, for the purposes of this thesis, a 'bi-labial stop' and a 'bi-labial nasal' respectively. The occlusives in Sindhi have a five-term phonetic contrast in respect of place of articulation. Depending on the different phonation types involved in the articulation of these occlusives in different places of articulation, 32 contrasts are noted in Sindhi. The following table shows the articulatory distribution of 32 occlusives:

Articulation of Occlusives

		Position of the soft palate	Place of Articulation							PHONATION
			Labial	Denti-alveolar	Retro-flex	Palatal	Velar			
INITIATION	Pulmonic Pressure	STOPS	p	t	ṭ	c	k	unaspirated	voiceless	
			ph	th	tḥ	ch	kh	aspirated		
			b	d	ḍ	ʃ	g	Voiced		
	Glottalic suction	NASALS	β	-	ḍ̥	ʃ̥	g̥			
			m	n	ṇ	ɲ	ŋ			
	Pulmonic Pressure	STOPS		mh	nh	nḥ	-	-	Murmured	
				bh	dh	dḥ	ʃh	gh		

TABLE II: Showing the articulatory distribution of stops and nasals in Sindhi

2.4.2 (ii) Constrictives are characterised by a stricture of 'narrowing'. The two articulators are brought in close approximation and the passage is constricted so as to leave only a narrow channel, shaped like a slit or a groove, for the airstream to squeeze through with audible friction. Fricatives are invariably associated with the turbulent airflow or hiss-like sounds. For example, the sound [s] in '[əsi] (eighty).

Depending on the different phonation types involved in the articulation of the fricatives in different places of articulation, the following 7 contrasts are noted in Sindhi as shown in Table III given below:

Articulation of Constrictives

		Place of Articulation					voiceless	phonation
		Labio-Dental	Alveolar	Retroflex	Velar	Glottal		
- on	Pulmonic Pressure	f	s	ʃ	x	h		
			z		ɣ		voiced	

TABLE III: Showing the articulatory distribution of fricatives

2.4.3 (iii) Vibrants are characterised by a stricture of 'intermittent closure' which 'involves the rapid beating or

vibration, of the active articulator against the passive, and therefore the alternate opening and closing of the vocal tract at that point'. (Abercrombie 1967:44).

The active articulator is held loosely in such a position that the airstream, in passing by it, causes it to vibrate and to make a single tap or a rapid succession of taps against the fixed (passive) articulator. Sounds, thus produced are termed 'taps' and 'trills' respectively.

While giving the articulatory description of trills and taps, Ladefoged (1971:50) observes : 'In a trill, the tip of the tongue may be loosely held near some part of the roof of the mouth and set in vibration by the action of the airstream in much the same way as the vocal cords are set in motion during the production of voice. In a typical speech sound produced in this way there may be about three vibratory movements; but even in cases where there is only a single contact with the roof of the mouth, the action is physiologically (but perhaps not auditorily) quite different from that of a tap. A tap is formed by a single contraction of the muscles such that one articulator is thrown against the other.'

Flap is a third variety of vibrants, very common in numerous Indo-Aryan and African languages. Ladefoged defines a flap 'as an articulation which usually involves the curling of the tip of the tongue up and back and then allowing it to hit the roof of the mouth as it returns to a position behind the lower teeth. A

flap is therefore distinguished from a tap by having one articulator strike against another in passing while on its way back to its rest position, as opposed to striking immediately after leaving its rest position'. (Ladefoged 1971:50-51). According to Abercrombie (1967:44-45), a flap 'involves a 'ballistic' movement of an active articulator made in such a way that the articulator strikes in passing against a passive articulator'. He also adds that 'because of the similarity of a 'ballistic' movement of this kind to the movement involved in a one-tap trill, the term flapped is sometimes used for the latter'. (Abercrombie 1967:50). Recently, Catford (1977) has coalesced the two together and called them 'flaps' as opposed to 'trill'. Catford (1977:128) defines the two terms ('flap' and 'trill') as follows: 'Trill can be thought of as a kind of loosely formed stop in which the closure is intermittent, and repeated at least two or three times..... In flap, one articulating organ approaches another, makes momentary contact and then recedes again'. He goes to add that 'the flap is an essentially and obligatorily momentary gesture: a trill is an essentially prolongable posture.....' (Catford 1977:130). Thus flaps are characterised by their momentariness. According to Catford (1977), there are two distinct types of flap. 'In one type the flapping articulator shoots out from its position of rest to flick lightly against the other (stationary) articulator, returning

again to its original position'. (Catford 1977:129). Catford calls this type of flap a 'flick'. In the other type of flap (which he calls a 'transient' type of flap), 'the flapping articulator performs a rapid movement from a starting position to a quite different finishing position, momentarily striking, or 'flapping', against the stationary articulator on the way'. (Catford 1977:129). These two different types of flap have been diagrammatically schematized as given below:

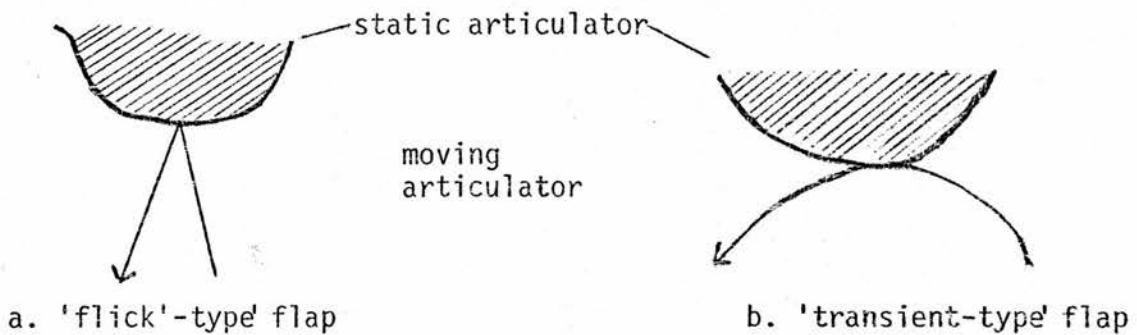


Fig 6: A schematized diagram showing two types of 'flap' articulation

The present author's proprioception runs counter to Catford's classification. A close scrutiny of even the diagram clearly indicates that these sounds are very different from an articulatory point of view. For example, a 'transient-type' flap [ɾ] as in [ghoɾo] (a horse) is made by drawing the tongue tip up and curling back, and allowing <sup>it</sup> to flap against the posterior part

part of the alveolar ridge in passing while on its way back to its rest position, whereas a 'tap' like [ɾ] as in [ratɾ] (night) involves a rapid movement of the tip of the tongue up to tap against the forward part of the alveolar ridge immediately after leaving its rest position. For Sindhi [r], the description of articulation for tap given by Ladefoged (1971:50) seems to fit my observation. A distinction between a flap and a tap, is made in Sindhi. Depending on the different phonation types involved in the articulation of vibrants in two places of articulation, the following 3 contrasts are noted in Sindhi as shown in the table given below:

Articulation of Vibrants

		Place of Articulation			
		Alveolar	Retroflex		
I N T I T I O N	Pulmonic Pressure	r	r̥	Voiced	P H O N A T I O N
			r̄	Murmured	

TABLE IV: Showing the articulatory distribution of 'tap' and 'flaps'

- 2.4.4 (iv) Laterals are characterised by a stricture of 'partial closure'. In the articulation of consonantal

sounds, described so far, there is a contact of articulators at the sides of the vocal tract, and the air stream escapes through the centre. In the articulation of lateral sounds, there is an obstruction of the airstream at a point along the centre of the vocal tract, and the airstream is allowed to escape on one or both sides of the contact. Since the release is lateral, the resulting sounds are known as 'laterals'. For example [l] in [alo] (wet). Depending on the phonation types involved in the articulation of laterals, two contrasts are noted in Sindhi as shown below:

Articulation of Laterals				
		Alveolar		
I A N T I I T O I N	Pulmonic Pressure	l	Voiced	P T H I O O N N A
		lh	Murmured	

TABLE V: Showing the articulatory distribution of laterals

- 2.4.5 (v) Approximants are characterised by a stricture of open-approximation of the articulators which may allow the airstream to pass through without audible friction at the point of articulation.

The term 'approximant' was first used by Ladefoged (1964:25): 'a sound which belongs to the phonetic class vocoid or central resonant oral (Pike, 1943), and simultaneously to the phonological class consonant in that it occurs in the same phonotactic patterns as stops, fricatives and nasals'. Ladefoged (1971:46) revised this definition to read: 'Approximation of two articulators without producing a turbulent airstream'.

For example, the consonant sounds [j] and [ɥ] at the beginning of the words [jarɔ] (a friend) and [varɔ] (a hair) respectively are made by this type of stricture; so are all the vowel sounds (which will be discussed in the next chapter).

Traditionally, these sounds [j] and [ɥ] have been referred to as 'semi-vowels' in the phonetic literature; which has been found rather an unsatisfactory label.

Following a recent suggestion by Ladefoged, the term 'approximant' has been adopted here for them. They are chiefly characterised by lack of friction of non-turbulent airflow.

Approximants in Sindhi have a two-term phonetic contrast in respect of place of articulation. The following 2 contrasts are noted in Sindhi:



Articulation of Approximation					
		Place of Articulation			
		Labio-Dental	Palatal		
Initiation	Pulmonic Pressure	v	j	Voiced	Phonation

TABLE VI: Showing the articulatory distribution of approximants

Sindhi has a system of 46 essential consonants. The chart on p 54. based mainly on that of the IPA with certain modifications\* in the use of symbols and the addition of diacritics gives a classification of the consonantal sound units.

## 2.5 DESCRIPTION AND DISTRIBUTION OF CONSONANTS

The present section looks, in more detail, at the consonant segments in accordance with their place of articulation starting in the front of the mouth and then working back.

### 2.5.1 Stops

Besides four implosives initiated by glottalic suction air stream mechanism, there is a full series of voiceless, voiced, aspirated and murmured explosive stops initiated by pulmonic pressure initiation.

The characteristic feature of any stop articulation is the absolute closure of the vocal tract so that the air cannot escape either through the mouth or the nose, as seen earlier. This is achieved by a) raising the soft palate to form velic closure, and by

Place of Articulation

Manner of Articulation	Bi-Labial	Labio-Dental	Denti-Alveolar	Alveolar	Retroflex	Palatal	Velar	Glottal
<u>Plosives</u>								
VL	p		t		ṭ	c	k	
VD	b		d		ḍ	ɟ	g	
Asp	ph		th		tḥ	ch	kh	
Murmured	bh		dh		dḥ	ɟh	gh	
<u>Implosives</u>								
VD	ɓ				ɗ̣	ɟ	ɠ	
<u>Nasals</u>								
VD	m		n		ṇ	ɲ	ŋ	
Murmured	mh		nh		nḥ			
<u>Fricatives</u>								
VL		f		s	ṣ		x	h
VD				z			ɣ	
Tap				r	ṛ			
Flaps					ṛ			
Murmured					rḥ			
<u>Laterals</u>								
VD				l				
Murmured				lh				
<u>Approximants</u>								
VD		ʋ				j		

The symbols that have been traditionally used by IPA for retroflex sounds include [ʈ, ɖ, ɳ]. For purposes of typographical simplicity, these will be indicated here by adding a subscript [̣] beneath the corresponding symbols. For example [ṭ, ḍ, ṇ].

b) bringing two articulators tightly together to form the articulatory stricture of complete closure. Thus every stop involves, in reality, two stops - an oral stop and a velic stop. On separating the articulators, the air under pressure from lungs rushes out with an explosive sound, thus justifying the label 'plosives'.

#### Lip-Position

The release of the stop is assimilated to the following vowel, i.e. the position of the lips during the release of a plosion is conditioned by the following vowel. Unrounded release was noted when the stop was followed by a front unrounded vowel, whereas rounding or labialization for the following back vowel was found to develop during the plosive closure. A cine-photographic examination was undertaken to examine the lip and jaw movements in the explosion phase of the production of stops in Sindhi. The results revealed that 'the lips had already assumed the position for the following back vowel even during the closure phase of the stop' (Nihalani 1973:80). The labiograms also confirmed that the lip position during the articulation of a consonant stop is dependent on the vowel that follows the consonant.

#### Consonant Length

All the stops in intervocalic position when preceded by the phonetically relatively short vowels [ɪ], [ə], [ʌ] tend to be longer than those preceded by phonetically relatively long vowels. The phenomenon of duration was checked with the help of electro-

kymography. The results revealed that 'every time an intervocalic stop segment was preceded by a short vowel, it was found longer by 28 to 65 msec than an intervocalic stop, preceded by a phonetically relatively long vowel, thus justifying the articulatory/auditory label "lengthened stops" for these sounds'. (Nihalani 1972)

The diacritic (: ) written to the right of the symbols denotes lengthened consonant sounds.

Following are the articulatory features common to all the stop sounds.

- i) all the stops belong either to the category of pulmonic pressure or glottalic suction initiation involving either compression or rarefaction,
- ii) the stricture is that of complete closure at some point in the vocal tract,
- iii) there is velic closure during the articulation,
- iv) the release of the stop is assimilated to the following vowel i.e. the lip position is conditioned by the following vowel sound,
- v) intervocalically, all stops after the vowels [ɪ], [ə] and [ʌ] are lengthened.

#### 2.5.1.1 Bi-Labial Stops

[p] represents voiceless unaspirated bi-labial plosive in the articulation of which a complete closure in the mouth is formed by making a firm contact with the external part of the lower and the upper lip; and the soft palate is raised to form velic closure. The air

passage is thus completely blocked. The vocal cords do not vibrate. On separating the lips, the air compressed under pressure from the lungs quickly escapes from the mouth with an explosive sound.

The lips are neutral/unrounded or slightly rounded depending upon the position they have to assume for the following front or back vowel respectively. Thus the release of the stop [p] is assimilated to the following vowel. The same is true of all the other stops. No reference will therefore be made to the lip position.

### Distribution

'In conformity with the sound laws of Sindhi no word can end in a silent consonant' (Trumpp. 1887:99). With regard to the distribution of consonants in Sindhi, Khubchandani (1964) remarks: 'In this respect, Sindhi is unlike other Indic languages. It has retained the old Indo-Aryan short vowel endings in the form of [ɪ], [ə], [ʌ] in word-final position, whereas most of the other Indic languages have lost the final short vowels'.

<u>Sanskrit</u>	<u>Hindi</u>	<u>Sindhi</u>
[kəɾmʌ] (work)	[kam]	[kəɾmʌ]
[kəɾnʌ] (ear)	[kən]	[kəɾnʌ]

There are, however, a few Perso-Arabic and English loan words that are used very freely in people's day-to-day speech. It is in these borrowed words that stop segments do occur in the word-final position; though such consonants occurring in the final position undoubtedly form a low frequency system in Vicholi dialect described here. The occurrence of consonants in the

final position, therefore, is restricted to some loan words whose use in modern Sindhi is gradually on the decline. After the migration of Sindhis to India in 1947, there has been a growing tendency towards borrowing words from Sanskrit and Hindi rather than Persian or Arabic. A Sindhi speaker, generally, tends to add a short vowel at the end of these borrowed words to fit these into the overall pattern of the syllable structure in Sindhi.

All stops occur in word-initial and word-medial position. Whenever they occur in word-final position in the loan words, a mention will be made of such exceptional cases at the appropriate point.

#### Distribution

[p] occurs in the following two positions:

- |                           |        |                 |
|---------------------------|--------|-----------------|
| i) <u>Word-initially:</u> | [pənɔ] | (a leaf)        |
|                           | [pətə] | (sonny)         |
| ii) <u>Word-medially:</u> | [təpə] | (a machine gun) |
|                           | [məpə] | (measurement)   |

#### Other Allophones

Lengthened [p:] occurs intervocalically only when preceded by either [ə], [ɪ] or [ɔ].

- |           |        |           |
|-----------|--------|-----------|
| Examples: | [təp:] | (fever)   |
|           | [kəp:] | (a knife) |

[b] represents the voiced counterpart of voiceless unaspirated bi-labial plosive [p]. It is articulated exactly like [p] except that, for this sound the vocal cords are in vibration.

Distribution

i) Word-initially:	[buṭᵃ]	(shoes)
	[ḅᵃla]	(a snake)
ii) Word-medially:	[ḅabo]	(father)
	[g̣abo]	(a calf)
iii) Immediately after		
homorganic nasal:	[ᵃmḅᵃ]	(a mango)
	[c̣ᵃmbo]	(paws)

Other Allophones

Lengthened [b:] occurs in the intervocalic position when preceded by one of the short vowels [ə], [ɪ] [ᵃ].

Examples: [ᵃb:o] (father)

[ph] symbolises the aspirated counterpart of [p].

Aspirated and murmured sounds are represented in the form of digraphs ph, bh, dh, th....., but these are treated as single distinctive sound units and not as combination of two separate units. They are one effort sounds. [ph] is articulated exactly like [p], except that for this sound the release is accompanied by aspiration, i.e. a strong outflow of breath (mahāpraṇā) on account of the openness of the glottis.

Distribution

i) Word-initially:	[phuᵃᵃ]	(a rift)
	[pḥᵃyo]	(a drop)





[ɸ] represents voiced bi-labial implosive. The closure in the mouth is formed by the two lips, and the soft palate is raised to form velic closure. The vocal cords are in vibration. The downward movement of the vibrating glottis enlarges the supraglottal cavity behind the closure producing negative pressure on account of rarefaction. A slight leakage of air from the lungs passing through the glottis is sufficient to produce vocal fold activity, but it does not inhibit the rarefaction process. The air is sucked in when the outer closure is released.

#### Distribution

- i) Word-initially:      [ɸaɾɔ]      (a child)  
                                  [ɸuthɔ]      (mouth)
- ii) Word-medially:      [ɸaɸo]      (uncle)  
                                  [caɸi]      (key)

#### Other Allophones

Lengthened [ɸ:] intervocalically when preceded by a short vowel:

- Examples:      [dɔɸ:i]      (a can)  
                                  [dɔɸ:o]      (a container)

#### 2.5.1.2 Denti-Alveolar Stops

[t] represents voiceless unaspirated apico-laminal denti-alveolar plosive. The nature of stricture involved in the formation of this sound is one of complete closure. The air passage is

blocked by a) raising the soft palate to form velic closure and b) making a firm contact with the tip of the tongue touching the backs of the upper teeth and the blade of the tongue touching the teeth-ridge. The tongue lies relatively flat and spread out in the mouth. The vocal cords do not vibrate. On separating the articulators, the air compressed under pressure from the lungs quickly escapes from the mouth with an explosive sound. The lip-position is assimilated to the following vowel.

This sound has been traditionally described as either "gingival" (Bordie 1958) or 'alveolar' (Khubchandani 1961). Bordie (1958:13) states: 'these stops are formed by closure of the oral cavity at the gingival line of the upper teeth by the tongue tip'. Both descriptions given by Bordie and Khubchandani run counter to the present author's proprioception which has been illustrated by instrumental data and has been adequately confirmed that it is not only the tip, but both—the tip and the blade—make a contact against the inner side of the upper teeth and the alveolar ridge. 'We thus find a wide band of contact area, including both the upper front teeth and the front part of the teeth-ridge, i.e. the dental and the denti-alveolar regions ....' (Nihalani 1974<sup>b</sup>:204). The phonetic label 'apico-laminal 'denti-alveolar' would therefore best describe the articulation of this sound.

#### Distribution

- |                    |         |                 |
|--------------------|---------|-----------------|
| i) Word-initially: | [tə̃ɔ]  | (bottom)        |
|                    | [top̃]  | (a machine gun) |
| ii) Word-medially: | [poto]  | (a sack)        |
|                    | [mɔ̃tɔ] | (death)         |

Exception:

- iii) Word-finally in loan words : [ʔə1əʔt] (wrong)

#### Other Allophones

Lengthened [t:] intervocalically when preceded by either [ə], [ɪ], or [ʊ]:

- Examples: [pəʔt:o] (whereabouts)  
[məʔt:o] (principle)

[d] represents the voiced counterpart of voiceless unaspirated denti-alveolar plosive [t]. It is articulated exactly like [t] except that, for this sound the vocal cords are in vibration.

#### Distribution

- i) Word-initially: [dʌnʌ] (navel)  
[dɪlɪ] (lentils)
- ii) Word-medially: [nʌdʌ] (obstinate)  
[mado] (ability)
- iii) Immediately after homorganic nasal: [indo] (will come)  
[gəndo] (dirty)  
[kəndo] (will do it)

#### Other Allophones

Lengthened [d:] occurs in intervocalic position when preceded by one of the following three short vowels - [ə, ɪ, ʊ]

Examples:                    [m̄d:u] (intelligence)  
                                  [m̄d:o] (period)

[th] symbolises the aspirated counterpart of [t]. Aspirated and murmured sounds, though represented in the form of digraphs, are treated as single distinctive sound units. [th] is articulated exactly like [t] except that, for this sound the release is accompanied by aspiration, i.e. a strong outflow of breath (mahāprāṇa) on account of the openness of the glottis.

#### Distribution

- i) Word-initially:        [th<sub>h</sub>li]        (a plate)  
                                  [th<sub>h</sub>lhi]        (a fat woman)
- ii) Word-medially:        [motho]        (dull)  
                                  [pothi]        (a book of scriptures)

#### Other Allophones

Lengthened [th:] in intervocalic position when preceded by a short vowel [ə, i, ə]:

Examples:                    [m̄th:o]        (head)  
                                  [kith:e]        (where)

[dh] represents murmured correlate of [d] articulated exactly like [d], except that [dh] is pronounced with the vocal cords in position for murmur.



Tamil and Marathi.

Traditionally, this sound in Sindhi has been classified as a usual retroflex or cacuminal stop (Bordie 1958, Khubchandani 1961). While giving the articulatory description of these sounds, Bordie (1958, p 15) states: 'These stops are formed by closure of the oral cavity in the alveo-palatal area by the retroflexed tongue blade'. The term 'retroflex' is in fact unusually imprecise and tends to be quite loosely used here. It is a somewhat confusing and widely misinterpreted notion. It can be viewed from two different angles. Sometimes, it has been associated with 'place of articulation' which is generally between alveolum and palate. Ladefoged associates retroflex with post-alveolar place of articulation. According to him, retroflex sounds 'are made by curling the tip of the tongue up and back so that the underside touches or approaches the back part of the alveolar ridge' (Ladefoged 1975, p 139).

Allen (1953:32) remarks: 'To consider the retroflex articulations on the same terms as the velars, palatals, dentals or labials is, even from the point of view of the Indian descriptive framework, not entirely justified'. He goes on to add that 'the retroflex series involves a special process rather than a place of articulation'. (Allen 1953, p 52). The term retroflex thus specifies a particular gesture of the tongue rather than a place of articulation like dental, alveolar etc.....

While describing the Marathi retroflex sound [ɖ], Firth (1957:150) remarks: 'the blade of the tongue is retroflexed with the under edge of the tip opposite the post-palatal zone beyond

the third molar line.... The retroflex flapped articulation in the Marathi word is regarded as entirely in the palatal zone'. The instrumental records from the use of palatography and x-ray photography have illustrated the fact that in the articulation of the sound [ɖ] in the present author's speech, the black medium is wiped off from the canines and the front molar, i.e. the alveolar and post-alveolar zones (zone 3 and 4). The black medium sprayed on the lateral incisor (i.e. dental and denti-alveolar zones) remains absolutely untouched. The sagittal section shows the area of contact to be in the alveolar and post-alveolar regions'. (Nihalani 1974b:205). No bunching or curling of the tip of the tongue was noted. Thus the author's own proprioception, further supported by instrumental records has led the present author to the conclusion that the stop sound [ɖ] in his speech cannot be described as a true representative of the traditional phonetic category of sounds known as 'retroflex' stops. The phonetic label 'apical post-alveolar' would best describe the articulation of the sound [ɖ] in the present author's speech.

#### Distribution

- |                    |         |                    |
|--------------------|---------|--------------------|
| i) Word-initially: | [topi]  | (a cap)            |
|                    | [ɖari]  | (branch of a tree) |
| ii) Word-medially: | [moto]  | (fat)              |
|                    | [khoto] | (counterfeit)      |

#### Other Allophones

- i) Lengthened [ɖ:] intervocalically when preceded by either [ə,ɪ] or [ə], for example:

[pət̪:o] (belt)

[kʰət̪:o] (sour)

ii) Slightly retracted when followed by a back vowel, e.g.

[but̪ʌ] (shoes)

iii) Slightly advanced when followed by a high front vowel,  
e.g.

[t̪ip̪ə] (a life sentence)

iv) There are dialectal variants of the apical post-alveolar stop. The release of [t̪] is sometimes associated with the homorganic voiced tap [r], e.g.

[t̪re] (three)

[p̪ət̪r̪ə] (sonny)

The variant of the cluster [t̪r] functions as a unit phoneme. But this feature is a free-variant, generally used by the speakers of Siraiki dialect in the north.

[d̪] represents the voiced counterpart of voiceless unaspirated post-alveolar plosive [t̪]. It is articulated exactly like [t̪] except that, for this sound the vocal cords are in vibration.

#### Distribution

i) Word-initially: [d̪əp̪ə] (fear)

[d̪or̪ə] (a run)

ii) Word-medially: [lud̪o] (the name of a game)



- iii) Immediately after a homorganic nasal :
- |  |          |        |
|--|----------|--------|
|  | [ə̃ndo]  | (egg)  |
|  | [kə̃ndo] | (nail) |

### Other Allophones

- i) Lengthened [d:] intervocalically when preceded by either [ə,ɪ] or [ə], e.g.

[cə̃d:i]	(diaper)
[d̃d:i]	(a helping hand)

- ii) Release of [d] associated with the homorganic tap [r], e.g.

[dr̃rə̃]	(a boast)
----------	-----------

[t̃h] symbolizes the aspirated counterpart of [t̃]. Aspirated and murmured sounds, though represented in the form of diagraphs are treated as single distinctive sound units. [t̃h] is articulated exactly like [t̃] except that, for this sound the release is accompanied by aspiration, ie, a strong outflow of breath (mahāpraṇā) on account of the openness of the glottis.

### Distribution

- i) Word-initially:
- |  |            |           |
|--|------------|-----------|
|  | [t̃h̃r̃ə̃] | (be cool) |
|  | [t̃h̃ok̃ɪ] | (hit it)  |
- ii) Word-medially:
- |  |           |           |
|--|-----------|-----------|
|  | [k̃oth̃i] | (a room)  |
|  | [k̃ath̃i] | (a stick) |

Other Allophones

i) Lengthened [t̥h:] intervocalically when preceded by [ə,ɪ] or [ə], e.g.,

[ət̥h:ə]	(eight)
[pət̥h:i]	(back)

[dh] represents murmured correlate of [d] articulated exactly like [d], except that [dh] is pronounced with the vocal cords in position for murmur.

Distribution

- i) Word-initially: [dhəkə] (sips)  
 [dkəkənə] (a lid)
- ii) Word-medially: [adhə] (rubbing with oil)  
 [adhe] (having rubbed with oil)
- iii) Immediately after : [g̊əndho] (candy)

Homorganic nasal

Allophones

- i) Lengthened variety of [d̥h:] intervocalically when preceded by either [ə, ɪ or ə], e.g.

[əd̥h:ə] (to inherit)

[d̥] represents voiced post-alveolar implosive. The closure in the mouth is formed by the tip of the tongue against the posterior part of the alveolar ridge, and the soft palate is raised to form velic closure. The vocal cords are in vibration. The downward movement of the vibrating glottis enlarges the supraglottal cavity behind the closure producing negative pressure on account of rarefaction. A slight leakage of air from the lungs passing through the glottis is sufficient to produce vocal fold activity, but it does not inhibit the rarefaction process. The air is sucked in on the release of the outer closure.

Distribution

- i) Word-initially: [d̥arə] (a crevice)  
                           [d̥andə] (an ox)
- ii) Word-medially: [pad̥o] (crooked)  
                           [ɡad̥o] (a van)

Other Allophones

Lengthened [d̥] when preceded by a short vowel, e.g.

[mɒd̥:o] (not sharp)

[ʊəd̥:o] (elder)

#### 2.5.1.4 Palatal Stops

Palatal stops are described by some phoneticians as affricates rather than plosives. The ancient Indian grammarians have, however, described them as the sounds articulated with 'sparṣha' i.e. contact, and treated them as occlusives. These sounds in the present author's speech are phonetically realised as affricates, i.e. there is a combination of fricative modulation with stop articulation - the sound begins with stop articulation and releases into homorganic continuant articulation. Palatal stops tend to be affricated, perhaps because of the anatomical constraint that the blade of the tongue cannot be quickly withdrawn from the upper articulator. The airflow records have clearly shown that 'a palatal stop is not a real stop, but rather one in which the last phase of release is accompanied by a lot of friction. Thus it is phonetically realised as an affricate, i.e. closure plus friction'. (Nihalani 1972:84).

These sounds, however, have been classified here as stops instead of affricates because the palatal series functions as other stop series - it has an aspirate, a murmured, a nasal and an implosive like other stop series.

Secondly, there is a great deal of variation in the application of the term palatal with regard to the actual point of articulation. Ladefoged (1975:141) observes 'Palatal sounds can be defined as being made with the front of the tongue approaching or touching the hard palate. But there is no clear cut distinction between these sounds and palato-alveolar sounds'. The ancient Hindu grammarians state: 'In the c-series contact is made with the

middle of the tongue upon the palate' (Allen 1953:52).

The 'so-called' palatal sounds in Sindhi are certainly not typical palatal sounds. The description of these sounds based on the instrumental findings has illustrated that the traditional term 'palatal' which has been used by Bordie (1958) and Khubchandi (1961) to describe these sounds is not very precise and that it needs modification. A scrutiny of the palatograms of these sounds in different phonetic environments revealed that 'the marking medium is removed from the canines, zone 3 (i.e. the alveolar zone) and this extends slightly into zone 4 (i.e. the post-alveolar zone) occasionally'. (Nihalani 1974b, p 207). Since these so-called palatal sounds in Sindhi do not have their characteristic contact  $\tau$  the point of contact seldom goes beyond the post-alveolar zone - there is no phonetic justification for identifying these sounds as true palatals.

Moreover, the x-ray photographs have revealed that it is not the front but the blade of the tongue that makes the contact. Thus the phonetic label 'laminal post alveolar' would best describe the articulation of these sounds in the present author's speech. This incidentally reminds us to bear in mind that there are ~~no~~ absolute categories of place of articulation.

[c] symbolises voiceless unaspirated laminal post-alveolar plosive, articulated with a complete closure by raising the soft palate to form velic closure and blocking the air passage in the mouth for a very short time with the blade of the tongue placed against the extreme back of the alveolar ridge -

near the convex part of the alveolar ridge. The tip of the tongue just lies behind the frontal incisor. Thus the contact is laminal. The closure is released in such a manner that some friction is produced between the passive articulator and the blade of the tongue. The vocal cords are wide apart, i.e. they do not vibrate. The lip-position is assimilated to the following vowel.

### Distribution

- |                           |         |                   |
|---------------------------|---------|-------------------|
| i) <u>Word-initially:</u> | [cə̌di] | (diaper)          |
|                           | [cālu]  | (clever, cunning) |
| ii) <u>Word-medially:</u> | [sā̃co] | (a sharpener)     |
|                           | [mocə̌] | (sprain)          |

### Other Allophones

- |   |         |                  |
|---|---------|------------------|
| i) Lengthened [c:] intervocalically when preceded by a short vowel: |         |                  |
|   | [ə̌c:o] | (come in)        |
|   | [ə̌c:o] | (good quality)   |
| ii) Slightly advanced when followed by a high front vowel:          |         |                  |
|   | [cɪrə̌] | (a crevice)      |
|   | [cɪpi]  | (push-formation) |
| iii) Slightly retracted when followed by a back vowel:              |         |                  |
|   | [cupɨ]  | (lick it)        |
|   | [cɪri]  | (bangles)        |

[ʃ] represents the voiced counterpart of voiceless unaspirated post-alveolar plosive [c]. It is articulated exactly like [c] except that, the vocal cords are in vibration.

### Distribution

- |                               |         |                              |
|-------------------------------|---------|------------------------------|
| i) <u>Word-initially:</u>     | [ʃamo]  | (gown)                       |
|                               | [ʃadu]  | (magic)                      |
| ii) <u>Word-medially:</u>     | [aʃo]   | (tired and anxious to leave) |
|                               | [gaʃə]  | (a kind of wheat)            |
| iii) <u>Immediately after</u> |         |                              |
| <u>nasal consonant:</u>       | [pəʃo]  | (paws)                       |
|                               | [gəʃo]  | (bald)                       |
| Exception:                    |         |                              |
| iv) <u>Word-finally in</u>    | [bəraʃ] | (dam over river)             |
| <u>loan words:</u>            |         |                              |

### Other Allophones

- |  |         |             |
|--|---------|-------------|
| i) Lengthened [ʃ:] intervocalically when preceded by a short vowel, e.g. |         |             |
|  | [məʃ:o] | (enjoyment) |
|  | [gəʃ:ə] | (foam)      |
| ii) Slightly advanced when followed by a high front vowel, e.g.          |         |             |
|  | [ʃaro]  | (a niche)   |





[chɪpə] (calamity)

[ʃh] represents murmured correlate of [ʃ] articulated exactly like [ʃ], except that [ʃh] is pronounced with the vocal cords in position for murmur.

### Distribution

- i) Word-initially: [ʃhəko] (faint)  
                           [ʃhətʌ] (immediately)
- ii) Word-medially: [koʃhi] (ugly)  
                           [oʃho] (look there!)
- iii) Immediately after  
       nasal consonant: [məŋʃhi] (boat man)

### Other Allophones

- i) Lengthened [ʃh:] intervocalically when preceded by a short vowel, e.g.
- [əʃh:o] (shelter)  
                   [məʃh:o] (pleasure)
- ii) Slightly retracted when followed by a back vowel, e.g.
- [ʃhɔkɔ] (bend down)
- iii) Slightly advanced when followed by a high front vowel, e.g.



### 2.5.1.5 Velar Stops

[k] symbolizes voiceless unaspirated velar plosive in the articulation of which the airstream is held back dorsally with the back of the tongue against the front part of the soft palate, and the soft palate itself is raised to form velic closure so as to shut off the nasal passage. The vocal cords do not vibrate. On separating the articulators, the air compressed under pressure from the lungs quickly escapes from the mouth with an explosive sound. The lip-position is assimilated to the following vowel.

The exact point of articulation varies from back to front (i.e. slightly retracted or advanced) depending upon whether the following vowel is back or front. 'A tracing of three x-ray photographs ..... brings out the fact that even during the consonant closure, the body of the tongue takes up the posture for the adjacent vowel, and thus the phonetic environment (depending upon the adjacent vowel) affects the place of articulation of the velar stop sound [k]'. (Nihalani 1974b, p 210). This is true of all the velar stops.

#### Distribution

- |                           |        |                   |
|---------------------------|--------|-------------------|
| i) <u>Word-initially:</u> | [kəmə] | (a piece of work) |
|                           | [kano] | (a straw)         |
| ii) <u>Word-medially:</u> | [caku] | (a knife)         |
|                           | [paki] | (a razor)         |

Other Allophones

Lengthened [k:] intervocalically when preceded by a short vowel, e.g.

[chək:i] (suspicious)

[mɒk:ð] (a fist)

[g] represents the voiced counterpart of voiceless unaspirated velar plosive [k]. It is articulated exactly like [k], except that, for this sound the vocal cords are in vibration.

Distribution

- |                           |        |                 |
|---------------------------|--------|-----------------|
| i) <u>Word-initially</u>  | [gabo] | (a calf)        |
|                           | [gɑdo] | (a van)         |
| ii) <u>Word-medially:</u> | [bagi] | (revolutionary) |
|                           | [dagɒ] | (a spot)        |

Other Allophones

Lengthened [g:] intervocalically when preceded by a short vowel, e.g.

[bəg:i] (a carriage)

[kh] symbolizes the aspirated counterpart of [k]. This sound is articulated exactly like [k], except that, the release of this sound is accompanied by aspiration, i.e. a strong outflow of breath on account of the openness of the glottis.

Distribution

- |                           |          |               |
|---------------------------|----------|---------------|
| i) <u>Word-initially:</u> | [khot̪o] | (counterfeit) |
|                           | [khub̪ɔ] | (plenty)      |
| ii) <u>Word-medially:</u> | [ɔk̪ho]  | (difficult)   |
|                           | [lek̪ho] | (account)     |

Other Allophones

Lengthened [kh:] intervocalically when preceded by a short vowel, e.g.

- |           |             |
|-----------|-------------|
| [cəkh:i]  | (taste it!) |
| [d̪əkh:ɔ] | (pain)      |

[gh] represents murmured correlate of [g] articulated exactly like [g], except that [gh] is pronounced with the vocal cords in position for murmur.

Distribution

- |                           |          |           |
|---------------------------|----------|-----------|
| i) <u>Word-initially:</u> | [ghoro]  | (a horse) |
|                           | [ghər̪ɔ] | (house)   |
| ii) <u>Word-medially:</u> | [soghi]  | (tight)   |
|                           | [səgh̪i] | (strong)  |

Other Allophones

Lengthened [gh:] intervocalically when preceded by a short vowel, e.g.

[əgh:ə]	(price)
[cəgh:ə]	(dent) (plural)

[gʰ] represents voiced velar implosive articulated with the closure in the mouth formed by the back part of the tongue against the front part of the soft palate, and the soft palate itself is raised to form velic closure. The vocal cords are in vibration. The lowering of the vibrating glottis enlarges the supra-glottal cavity behind the closure producing negative pressure on account of rarefaction. A slight leakage of air from the lungs passing through the glottis is sufficient to produce vibrations of the vocal cords, but it does not prevent the rarefaction process. The air is sucked in on the release of the closure.

#### Distribution

i) <u>Word-initially:</u>	[gʰəro]	(heavy)
	[gʰalɦɜ]	(story)
ii) <u>Word-medially:</u>	[moɡʰo]	(dull)
	[saɡʰa]	(same)

#### Other Allophones

Lengthened [gʰ:] intervocalically when preceded by a short vowel, e.g.

[dəgʰ:ə]	(way)
[bhəgʰ:o]	(broken)

### 2.5.2 Nasals

The series of nasals in Sindhi parallels the series of voiced stops in articulatory position. Like stops, nasal consonants are articulated by blocking the air passage in the mouth completely at some point; but they differ in that the soft palate is lowered so that the air escapes through the nasal passage in the articulation of nasal sounds. Thus both nose and mouth are involved, with the articulators as for the corresponding oral consonants.

The position of the lips during the articulation of nasal consonants is conditioned by the nature of the following vowel. Since the tongue is free to assume any position, unrounded release was noted when the nasal sound was followed by a front unrounded vowel; whereas slight lip-rounding or labialization for the following back vowel was found to develop during the phase of closure for the nasal sound.

Following are the articulatory features common to all the nasal consonants.

- i) the nasal sounds resemble the voiced stops in that the stricture involved in the articulation of these sounds is one of complete <sup>oral</sup> closure;
- ii) unlike stops, the soft palate is lowered so as to allow the air to pass through the nose;
- iii) the phonation types involved in the production of nasal consonants in Sindhi are voice and murmur;







[nh] represents murmured correlate of [n] articulated exactly like [n], except that [nh] is pronounced with the vocal cords in position for murmur.


Distribution: it occurs only intervocally, e.g.

[sənhə] (thin)

[n] symbolizes voiced alveo-palatal/retroflex nasal. It is articulated with the mouth passage completely blocked by making a firm contact with the curling of the tip of the tongue up and back so that the underedge of the tip of the tongue (under blade) (i.e. sublamina) touches the extreme back of the alveolar ridge and the pre-palatal arch. The soft palate is lowered so that, when the air is emitted by pressure from the lungs, it escapes through the nose only. The vocal cords are in vibration.

Pgms 2 and 3 (p. 26) illustrate the articulation of the nasal [n] in the words [nə] (the name of a letter) and [məni]. (a diamond) The black medium has been wiped off from almost the second molar line, zone 5 (i.e. the pre-palatal zone) to the first molar line, zone 4 (i.e. the post-alveolar zone). The marking medium in the first three zones (i.e. dental, denti-alveolar and alveolar zones) remains absolutely untouched. Obviously, the nasal sound [n] truly represents the traditional category of retroflex sounds.

#### Distribution

- i) Word-initially: Never occurs initially except in the name of the written letter , e.g.   
[nə] (the name of a letter)

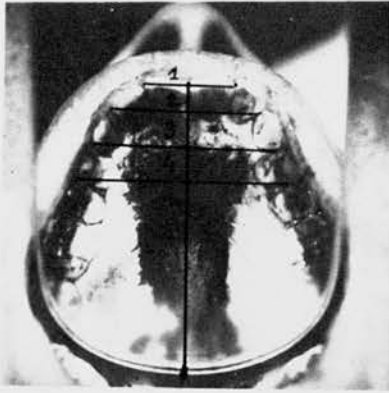


Fig. 1 [pəni]  
(a thin sheet of  
paper)

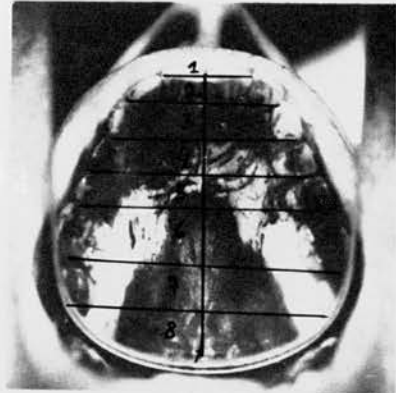


Fig. 2 [nə]  
(the name of a  
letter)

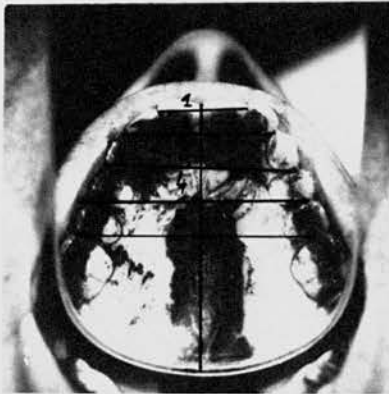


Fig. 3 [məni]  
(a diamond)

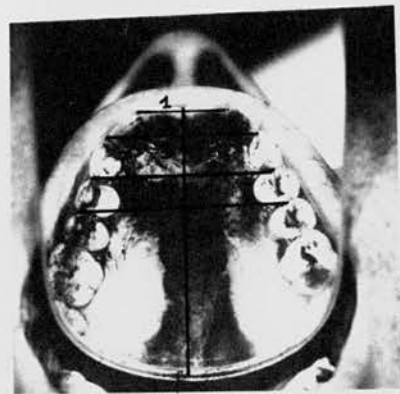


Fig. 4 [əpə] (thirst)

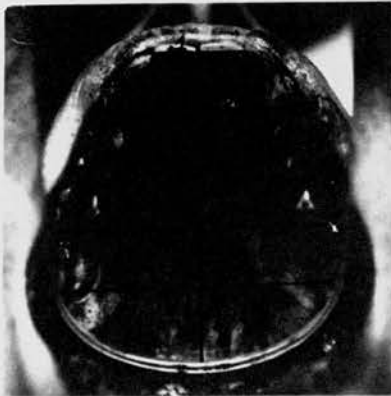


Fig. 5 [bhəyo]  
(a share)

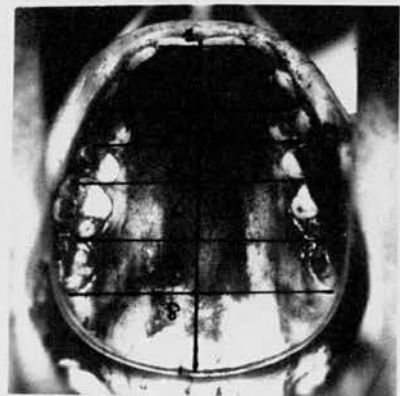


Fig. 6 [bhəngi]  
(a scavenger)

- |                                |          |                     |
|--------------------------------|----------|---------------------|
| ii) <u>Word-medially:</u>      | [phə̃ni] | (a hood of a snake) |
|                                | [mə̃ni]  | (a diamond)         |
| iii) <u>In the medial con-</u> |          |                     |
| <u>sonant group:</u>           | [ə̃ndo]  | (an egg)            |
|                                | [pə̃ndo] | (a priest)          |

[nh] represents murmured correlate of [n] articulated exactly like [n], except that [nh] is pronounced with the vocal cords in position for murmur.

Distribution: occurs only intervocalically, e.g.

[manhu] (a human being)


[ɲ] denotes voiced laminal post-alveolar nasal, articulated with the mouth passage completely blocked by making a firm contact with the blade of the tongue against the back of the alveolar ridge. The tip of the tongue just lies behind the frontal incisor. The soft palate is lowered so that, when the air is emitted by pressure from the lungs, it escapes through the nose only. The vocal cords are in vibration.

Pgm 4 (p. 86) illustrates the articulation of the nasal sound [ɲ] in the word [ə̃pə̃] (thirst). The black medium is wiped off from the canines, zone 3 (i.e. the alveolar zone) and this extends slightly into zone 4 (i.e. the post-alveolar zone). Thus the point of contact extends from the alveolar to the post-alveolar zone. The phonetic label 'laminal post-alveolar' would best describe the articulation of so called palatal nasal [ɲ] in the



followed by a front vowel in pgm 6 of the word [bhəŋgi] (a scavenger); whereas in the articulation of [ŋ] followed by a back vowel [o] in pgm 5 of the word [bhəŋo] (a share), the limit of the centre contact area is much further back. Thus the two palatograms reveal that in the articulation of velar nasal [ŋ], the point of contact varies according to the nature of adjacent vowels.

### Distribution

- i) Word-initially: Never occurs initially except in the name of the written letter   
[ŋə] (the name of a letter)
- ii) Word-medially: [cəŋo] (good)  
[ləŋo] (bad)
- iii) In the medial consonant group: [rəŋgə] (colour)

### 2.5.3 Fricatives

Fricative sounds in Sindhi are articulated with a stricture of 'narrowing' or close approximation of the two articulators so that the air-passage is constricted in order to leave only a narrow channel, shaped either like a slit or a groove, for the air stream to squeeze through with audible friction. Some phoneticians (for example, Pike 1943) have used the terms 'grooved' and 'slit/flat' to divide fricatives into those sounds such as [s],

in which the tongue is grooved and the airstream passes out through a narrow articulatory channel; and those such as [f] in which the tongue is flat and forms a wide slit through which the air flows. Thus the terms 'groove' and 'slit' refer to different shapes of the articulatory channel, both of which create some friction during the passage of the airstream through the constriction in the vocal tract. Sindhi has only one slit fricative [f]; whereas the grooved fricatives include [s, z] and [ʒ]. This distinction is irrelevant for fricatives made with the back of the tongue. The sound [h] is neither a slit nor a groove fricative because it does not require any closure in the vocal tract.

Following are the articulatory features common to all the fricative sounds in Sindhi:

- i) the stricture involved is that of 'narrowing' or 'close-approximation' of the two articulators at some point in the vocal tract;
- ii) the fricative sounds are invariably associated with turbulent airflow or hiss-like sounds;
- iii) there is only a two-term phonetic contrast in respect of phonation: voice and voicelessness;
- iv) there is velic closure during the articulation;
- v) the lip-position is conditioned by the nature of the following vowel; and
- vi) all fricatives, intervocalically when preceded by a short vowel, tend to <sup>be</sup> ~~get~~ slightly lengthened.

Since items (v) and (vi) are true of all fricative sounds in Sindhi, no reference will be made to the lip-position and the lengthened variant, while discussing allophonic variants.

[f] represents voiceless labio-dental fricative. It is articulated by the contact of the inner surface of the lower lip with the edges and the front of the upper teeth; the tongue lies flat and forms a wide slit so as to allow the air to force its way through the narrow articulatory channel, with audible friction. The soft palate is in its raised position to form velic closure. The vocal cords are wide apart.

#### Distribution

- |                           |          |             |
|---------------------------|----------|-------------|
| i) <u>Word-initially:</u> | [fanuso] | (a lamp)    |
|                           | [fðrasi] | (bed cover) |
| ii) <u>Word-medially:</u> | [sufɔ]   | (apple)     |
|                           | [xɔfɔ]   | (fear)      |

sometimes the last vowel [ɔ] is dropped in the speech of conservative speakers; but not in the present author's speech.

There is no voiced counterpart of the labio-dental fricative [f] in Sindhi.

[s] symbolizes a voiceless apical-alveolar fricative. It is articulated by raising the apex of the tongue towards the upper



gums. The tongue is grooved and a narrow articulatory channel is thus formed between the tip and blade of the tongue and the alveolar ridge, through which the air passes out with a hissing sound. The soft palate is raised to form velic closure and the vocal cords are wide apart.

Pgm 7 (p 93) illustrates the articulation of the sound [s] in the word [əsi] (eighty). A careful look at the palatogram reveals that there is a wipe-off on the right and left sides of the central part of zone 3 (i.e. the alveolar zone); whereas the middle of the alveolar zone (zone 3) is absolutely free from any wipe-off. The resultant gap symbolizes the presence of a groove formed between the tip and the blade of the tongue and the teeth ridge thus forming a narrow channel for the air to squeeze through, with audible friction.

#### Distribution

- i) Word-initially: [sirə] (midstream)  
[sufə] (apple)
- ii) Word-medially: [məsə] (ink)  
[əsɪ] (we)
- iii) Word-final in  
some inflected : [cəjəɪs] (he told him)  
forms (very  
exceptional).

NOTE: Some people add a short vowel [ɪ] at the end to fit it into the over-all phonotactic pattern.

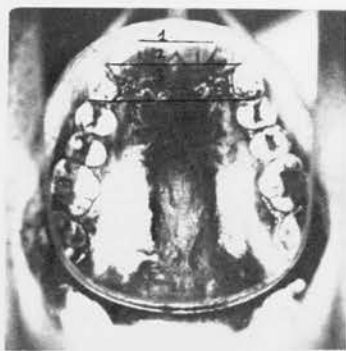


Fig. 7 [əsi] (eighty)

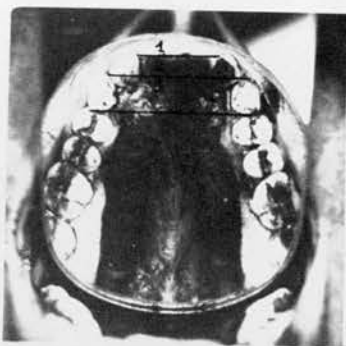


Fig. 8 [bazə] (eagle)



Fig. 9 [əfi]  
(given to comforts)

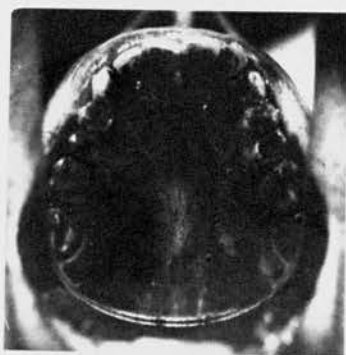


Fig. 10 [kəpə]  
(consumption)

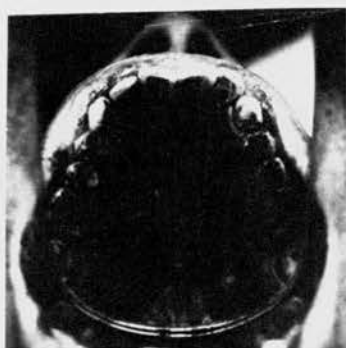


Fig. 11 [yərə]  
(sorrow)

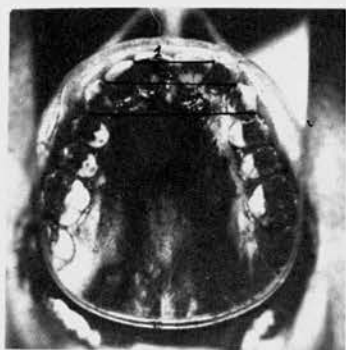


Fig. 12 [lələ]  
(a moment)

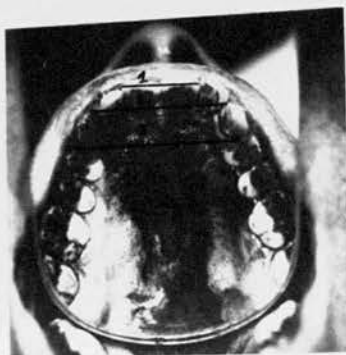


Fig. 13 [bəri]  
(a crowbar)



Fig. 14 [furi]  
(a ladder)

[z] represents the voiced counterpart of voiceless apico-alveolar fricative [s]. It is articulated exactly like [s] except that, for this sound the vocal cords are in vibration.

Pgm 8 (p 93) illustrates the articulation of the sound [z] in the word [bazɔ] (eagle). The black medium has been wiped off on the sides of the alveolar zone (zone 3), but the wipe-offs do not join up in the central zone. The narrow space represents the presence of a groove between the teeth ridge and the blade of the tongue for the airstream to come out with audible friction.

#### Distribution

- |                           |        |                 |
|---------------------------|--------|-----------------|
| i) <u>Word-initially:</u> | [zalθ] | (wife)          |
|                           | [zθro] | (a small piece) |
| ii) <u>Word-medially:</u> | [bazi] | (a bet)         |
|                           | [mezθ] | (a table)       |

[s] denotes the voiceless retroflex/post-alveolar fricative. The stricture of close approximation is effected by raising the tip and the blade of the tongue up against the posterior part of the alveolar ridge so that the space between them is very narrow and the tongue forms a sort of groove, through which the air under pressure from the lungs flows out with audible friction. The soft palate is in raised position and the vocal cords do not vibrate.

See pgm 9 (p. 93) of the word [eʃi] (given to comforts) where the wipe-off can be seen on the sides of zone 4 (i.e. the post-

alveolar region) almost up to the level with the canine line. The middle of the post-alveolar zone (zone 4) is free from any wipe-off, representing a groove between the teeth ridge and the tip and the blade of the tongue, thus forming a narrow articulatory channel for the air to flow out with audible friction.

It may be pointed out that the channel area (i.e. the space between the blade of the tongue and the teeth ridge) in the articulation of the fricative sound [ʃ] is narrow, but somewhat larger and therefore wider than that for the fricative sound [s] as seen in pgm 7. Recently Catford (1977) has shown that the velocity of the airflow is inversely related to the cross-sectional area of the channel in the articulation of fricatives, i.e., the smaller the channel, the higher the velocity of airflow. This means that for a given volume velocity, the velocity of airflow through the [s] channel is slightly more than that of flow through the [ʃ] channel. An extensive cine-radiographic examination could be, perhaps, undertaken at some later date so as to examine the aerodynamic correlates of the cross-sectional area in respect of fricative sounds in Sindhi. Due to exposure to heavy dosage <sup>of</sup> ~~to~~ x-rays, radiography was avoided for this study.

#### Distribution

- |                           |          |                     |
|---------------------------|----------|---------------------|
| i) <u>Word-initially:</u> | [ʃɛ]     | (a thing)           |
|                           | [ʃorʌ]   | (noise)             |
| ii) <u>Word-medially:</u> | [ɛʃi]    | (given to comforts) |
|                           | [hamesʌ] | (daily)             |

Exception:

- iii) Word-finally in [xʌs] (happy)  
loan words :

[ʃ] does not have a voiced counterpart in Sindhi.

[x] symbolizes the voiceless velar fricative. The stricture of close-approximation is effected by raising the back part of the tongue against the forepart of the soft palate. The soft palate itself is in raised position and the vocal cords do not vibrate. The air under pressure from the lungs flows out through a fairly narrow channel.

Pgm 10 (p. 93) illustrates the articulation of the sound [x] in the word [xapo] (consumption). There is no suggestion of any wipe-off anywhere\*. It has already been, therefore, pointed out that the distinction between 'groove' and 'slit' is irrelevant for fricatives made with the back of the tongue.

Distribution

- i) Word-initially: [xɔfʌ] (fear)  
 [xʌtʌ] (a letter)

---

\*The bright shiny spots in the dome of the mouth may be ignored because they are clearly not wipe-offs but reflection of light from the shining hard palate. Because of the difficulty in getting the powder to stick to the teeth also, the whiteness of the teeth may be ignored too.

- ii) Word-medially: [səxi] (generous)  
 [bɔ̃xarɔ̃] (fever)

[ɣ] represents the voiced counterpart of the voiceless velar fricative. It is articulated exactly like [x], except that, for this sound the vocal cords are made to vibrate.

Pgm 11 (p 93) illustrates the articulation of the sound [ɣ] in the word [ɣə̃mɔ̃] (sorrow). There is no suggestion of any wipe-off anywhere.

#### Distribution

- i) Word-initially: [ɣarə̃] (cave)  
 [ɣə̃mɔ̃] (sorrow)
- ii) Word-medially: [baɣɔ̃] (garden)

It is interesting to note that velar fricatives tend to get replaced by corresponding plosives in the speech of a young Sindhi speaker who has been born and brought up in India. Thus in quite a number of instances in Sindhi, [x] and [kh] are interchangeable, and so are [g] and [ɣ]. For example:

[baɣɔ̃]	[bagɔ̃]
[ɣɪlmɔ̃]	[gɪlmɔ̃]
[xɔ̃fɔ̃]	[khɔ̃fɔ̃]

There is, however, insistence on acquiring this distinction which carries fairly a high-functional load in the language.

[h] represents voiceless glottal fricative articulated with a slight constriction in the glottis. The vocal cords do not vibrate. The mouth is held in a vowel-position and the air is

emitted through the constriction in the glottis, with audible friction. The soft palate is raised.

Distribution

- |                           |         |               |
|---------------------------|---------|---------------|
| i) <u>Word-initially:</u> | [harɔ]  | (a necklace)  |
|                           | [hathi] | (an elephant) |
| ii) <u>Word-medially:</u> | [nuhə]  | (attitude)    |

Allophones: voiced [ɦ] in the intervocalic position, e.g.  
[aɦe] (is)

2.5.4 Laterals

Following are the articulatory features common to lateral sounds in Sindhi:

- i) The stricture involved is one of complete obstruction of the airstream at a point along the central line of the vocal tract, allowing the air to escape on one or both sides of the contact. In the present author's speech, however, the passage is always unilateral on the left side;
- ii) there is a two-term phonetic contrast in respect of phonation: voice and murmur;
- iii) there is velic closure during the articulation;
- iv) the lip-position is conditioned by the nature of the following vowel; and
- v) laterals, intervocalically when preceded by a short vowel tend to be lengthened.

No reference will be made to the lip-position and the lengthened variant while discussing the allophonic variants.

[l] represents the voiced alveolar lateral articulated with the tip of the tongue making a contact against the teeth ridge and behind the lateral incisors in such a way that there is a complete closure in the central line of the vocal tract, but the lateral edges of the tongue are lowered so as to allow the air to escape unilaterally on the left side. The soft palate is raised to form velic closure and the vocal cords are made to vibrate.

Pgm 12 (p. 93) illustrates the articulation of the sound [l] in the word [pəl̩] (a moment). A vertical white dot like wipe-off in the central line of the vocal tract represents a contact made by the tip of the tongue against the teeth-ridge and behind the lateral incisors. The wipe-off extends from zone 2 (i.e. the denti-alveolar region) to zone 3 (i.e. the alveolar zone) which is characteristic of denti-alveolar sounds.

#### Distribution

- |                           |        |            |
|---------------------------|--------|------------|
| i) <u>Word-initially:</u> | [limo] | (a lemon)  |
|                           | [liko] | (a line)   |
| ii) <u>Word-medially:</u> | [alo]  | (wet)      |
|                           | [alu]  | (potatoes) |

There is only 'clear' variety of [l] in Sindhi.



[ɭh] is the murmured correlate of [ɭ] articulated exactly like [ɭ], except that [ɭh] is pronounced with the vocal cords in position for murmur.

Distribution: occurs only intervocalically, e.g.,

[thɔɭhi]	(fat)
[mɔɭhɔ]	(a wrestler)

### 2.5.5 Tap and Flaps

Tap and Flaps are characterised by a stricture of 'intermittent closure'. The phonetic term 'flap' in this study designates a sound made by drawing the tongue tip up and curling up, and allowing it to flap against the posterior part of the alveolar ridge in passing while on its way back to its rest position. A tap, however, involves a rapid movement of the tip of the tongue up to tap against the alveolar ridge immediately leaving its rest position.

Following are the articulatory features common to both the vibrant sounds in Sindhi:

- i) the stricture is effected by the tip of the tongue in the alveolar region.
- ii) the phonation processes involved in the articulation of vibrant sounds are voice and murmur.
- iii) there is velic closure.
- iv) the lip-position is conditioned by the nature of the following vowel.

[r] represents the voiced apical alveolar tapped sound in the articulation of which the tip of the tongue shoots out from its position of rest and moves rapidly up to tap against the forward part of the teeth ridge, without either hollowing or raising the back of the tongue. The soft palate is raised and the vocal cords are made to vibrate.

Pgm 13 (p. 93) illustrates the articulation of the word [b̄ari] (a crow bar). The area of wipe-off extends from part of zone 2 (i.e. the denti-alveolar zone) to and verges on the canine line, zone 3 (i.e. the alveolar zone), which is characteristic of the alveolar sounds. The wipe-off in central part behind the frontal incisors and the teeth ridge represents a single tap of the tip of the tongue; whereas the tiny indistinct spots of contact on the sides indicate the contact of the rims of the tongue - obviously a 'momentary' stricture of closure as opposed to 'sustained' stricture of closure made in the articulation of stops, nasals and lateral sounds.

#### Distribution

i) <u>Word-initially:</u>	[ratɪ]	(night)
	[rolu]	(a wanderer)
ii) <u>Word-medially:</u>	[kori]	(a weaver)
	[tir̄]	(an arrow)

[r̄] symbolizes the voiced retroflex flap articulated with the tip of the tongue curled up and back. From this retroflex position, the underedge of the tip of the tongue then flaps

against the pre-palatal arch and the extreme back of the alveolar ridge on its way back to its rest position. The soft palate is in raised position and the vocal cords vibrate.

Pgm 14 (p 93) of the word [puri] (the ladder) shows the black medium wiped off on the sides from the second molar line, zone 5 (i.e. the pre-palatal zone) to almost the first molar line, zone 4 (i.e. the post-alveolar zone). The messy patch of wipe-off in the central contact area of zone 5 and zone 4 indicates the flapping forward movement of the underedge of the tip of the tongue against the pre-palatal arch and the back of the teeth ridge, and thus slightly removing some marking medium in these zones.

Distribution:

- i) Word-initially: Never occurs initially except in the name of the written letter [r̥] र̥
- ii) Word-medially:
- |                        |          |
|------------------------|----------|
| [pho <sub>o</sub> r̥o] | (a sore) |
| [ko <sub>r̥</sub> i]   | (twenty) |
| [pho <sub>o</sub> r̥o] | (a drop) |

[r̥h] represents the murmured correlate of [r] articulated exactly like [r], except that [r̥h] is pronounced with the vocal cords in position for murmur.

Distribution: occurs only intervocalically, e.g.

- |                        |               |
|------------------------|---------------|
| [po <sub>o</sub> r̥ho] | (an old man)  |
| [pə <sub>o</sub> r̥ho] | (you study!). |

It may be pointed out that there is a growing tendency towards gradual disappearance of this distinction between the retroflexed flap and the alveolar tap. A young speaker of Sindhi shows a lot of confusion in this connection - both varieties are heard and in quite a number of instances this alternation does not contribute to any unnatural situation. For example: the word for

horse is pronounced as either [ghoro] or [ghoro]

bangle is pronounced as either [kəro] or [kəro]

There is very little insistence, except among the conservatives, on acquiring the distinction which carries rather marginal functional load. This distinction is however, maintained in the present author's speech and the dialect described here.

#### 2.5.6 Approximants

The category of approximants in Sindhi comprises two sounds [j] and [ɥ] characterised by a stricture of 'close-approximation of the two articulators so that the space between them is narrow, but not narrow enough to cause any audible friction; the air escapes through the space between the two articulators without any turbulent airflow.

Following are the articulatory features common to both approximants:

- i) the stricture involved is that of close approximation;
- ii) there is non-turbulent airflow which means there is a total lack of friction;

- iii) there is only one phonation process involved: voice;
- iv) the soft palate is in raised position;
- v) the lip-position is conditioned by the nature of the following vowel.

[v] represents the voiced labio-dental approximant articulated by the middle of the lower lip making a light contact with the edges of the frontal incisors (upper teeth), and the air escapes mainly at the corners of the mouth without any audible friction. The soft palate is in its raised position and the vocal cords are made to vibrate.

#### Distribution

- |                           |         |              |
|---------------------------|---------|--------------|
| i) <u>Word-initially:</u> | [ʋarɔ]  | (hair)       |
|                           | [ʋɔɪ̯ɔ] | (a tree)     |
| ii) <u>Word-medially:</u> | [cɔʋo]  | (you say it) |
|                           | [lɔʋo]  | (moors)      |

[j] symbolizes the voiced palatal approximant in the articulation of which, the front of the tongue is raised towards the hard palate nearly to high front vowel position and then quickly moves to the position of the following vowel. The edges of the middle of the tongue make a contact on the palate. There is a velic closure by raising the soft palate and the vocal cords are made to vibrate. The actual quality of the sound depends on the nature of the following vowel.

Distribution

i) <u>Word-initially:</u>	[jarɔ]	(a friend)
	[jane]	(it means)
ii) <u>Word-medially:</u>	[ajo]	(he came)
	[saja]	(shadows)

## CHAPTER THREE: THE VOWELS OF SINDHI

The vowels of Sindhi will be considered in terms of articulatory features, their acoustic specifications, vowel length and nasality.

### 3.1 ARTICULATORY FEATURES

#### 3.1.1 Preliminary Remarks

There are inherent differences in the overall principles underlying the articulation of consonant and vowel sounds. One important difference is that the articulation of consonants involves, in the vocal tract, discrete articulatory contacts which can be fairly easily ascertained; whereas the vowel sounds are made with 'open approximation' of the articulators, and the passage of the airstream unobstructed. Needless to emphasize that there is little or no contact at all involved in the production of vowel sounds. This makes the articulatory description of vowel sounds rather difficult and less tangible than that of consonants.

The characteristic quality of any vowel sound largely depends upon the general shape of the oral cavity modified by the movement of the tongue and the lips. The tongue and the lips may be looked upon as the main factors in the articulation of vowels. The general shape of the oral cavity partly depends upon the position which the tongue takes up in the mouth, and partly on the sort of exit the lips provide, from the cavity. Thus, traditionally, the vowel sounds have been described in terms of the position of the tongue (vertical and horizontal) and the accompanying position of the lips.

### 3.1.2 Vertical Tongue Position (High-Low/Close-Open)

The movement of the tongue along the vertical axis is referred to as tongue-height. In descriptive phonetics, four degrees of the tongue-height are distinguished, viz; close, half-close, half-open, and open. The tongue is at its highest position, i.e. close to the roof of the mouth, to produce close/high vowels like [i] as in [pi] (drink) and [u] as in [hu] (he); and the tongue is at its lowest position to produce open vowels such as [a] in [ha] (yes).

The distance between the highest tongue position (i.e. close) and the lowest (i.e. open), could be divided into three auditorily equidistant steps. The intermediate tongue-heights are known as 'half-close' and 'half-open'. Thus the tongue may be moved nearer or further from the palate in order to close or open the passage in the mouth to lesser or greater degrees. The progression from a 'close' vowel [i] through a 'half-close' vowel [e] and a 'half-open' vowel [ɛ] to an 'open' vowel [a] forms a vowel continuum.

### 3.1.3 Jaw Opening

Lindblom and Sundberg (1969) have shown that the height of the tongue is largely dependent on the position of the jaw. The progression from a 'close' vowel [i] to an open vowel [a] involves the increasing openness that is achieved by increased lowering of the jaw. Sweet (1890) pointed out clearly that 'it is possible to produce a particular height of the tongue with either



a certain jaw position and a relatively flattened tongue, or a lower jaw position and a bunched up tongue; bunching the tongue by pulling the root of it forward toward the mandible results in the main mass of the body of the tongue being displaced upward'.

One can, thus, hold the jaw in a fixed position, and the tongue movement alone will be sufficient to produce different vowel qualities; or one can produce the same series of vowel sounds by lowering the jaw while keeping the tongue static. Catford (1977:71) has beautifully summed up the controversy: 'the difference between [i, e, ε, a] depends on the distance between the surface of the tongue and the roof of the mouth, however that is achieved. In 'real life' it may always be achieved by a combination of tongue and jaw movements'.

#### 3.1.4 Horizontal Tongue Position

Vowel production is also accomplished by the positioning of the tongue in three general locations along the horizontal axis of the oral cavity. The front of the tongue may be advanced or raised towards the hard palate to produce front vowels, or retracted and the back part of the tongue may be raised towards the soft palate to produce back vowels. Vowels may also be formed by the tongue centrally located. This broadly gives us three classes of vowels - front, back and central vowels.

#### 3.1.5 Lip-position

The vertical and horizontal tongue positions show how the tongue modifies the shape of the vocal tract, but the lip



Lgm. 1 [i]



Lgm. 2 [ɨ]



Lgm. 3 [e]



Lgm. 4 [ɛ]



Lgm. 5 [a]



Lgm. 6 [ɔ]



Lgm. 7 [ɔ̄]



Lgm. 8 [o]



Lgm. 9 [ɛ̄]



Lgm. 10 [u]

posture provides a characteristic exit for the airstream. The position of lips varies considerably in different vowels.

'For practical purposes, two categories are enough: rounded when the corners of the lips are brought forward, and unrounded when the corners of the lips are pulled back' (Abercrombie 1967:57).

In Sindhi, front and central vowels are spread or unrounded and back vowels are characterized by lip-rounding, increasing with tongue-height: the higher the tongue the greater the rounding (i.e. the smaller the labial aperture). Thus back vowels have progressively more lip-rounding as the tongue is raised from the open/low back position of [a] through [o] to the high back position of [u].

Labiograms of the vowels of Sindhi are reproduced on the previous page. Labiograms 1-6 clearly indicate that the lips are spread or unrounded in the articulation of 5 front and 1 central vowels. The lips are noted to be rounded in the articulation of 4 back vowels (see Lgm 7-10). Labiograms 7-10 show that the mid-back vowels [ɔ] and [o] are characterized by 'open' lip-rounding, whereas the high back vowels [ɒ] and [u] are characterized by 'close' lip-rounding. Lgm 10 proves that the labial-aperture is the smallest in the articulation of [u], thus justifying the assumption that the lip-rounding is directly related to the tongue-height: the higher the tongue, the greater the rounding.

Combining the phonetic parameters of the tongue and lip positions, the vowels of Sindhi are symbolized and described as follows:

[i]	Close Front unrounded
[ɨ]	Between close and half-close, Front, unrounded
[e]	Half-close Front unrounded
[ɛ]	Between Half-open and open, Front, unrounded
[a]	Open (somewhat retracted), Front, unrounded
[ə]	Half-open, central, unrounded
[ɔ]	Half-open, Back, rounded
[o]	Half-close, Back, rounded
[ɔ̄]	Between Half-close and close, Back, rounded
[u]	Close, Back, rounded

Although the symbols of the nearest cardinal vowels are used, the vowels of Sindhi should not be considered as being absolutely identical with Cardinal vowels. These vowels are assigned appropriate positions on the Cardinal vowel chart of Daniel Jones as shown in Fig 7.

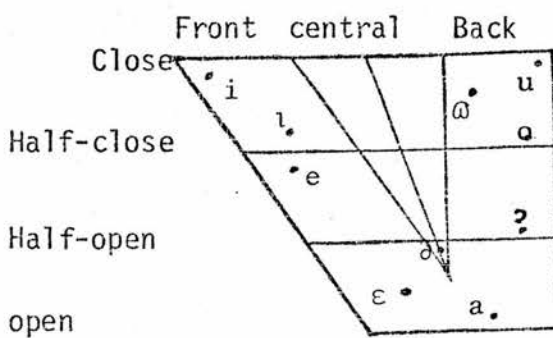


Figure 7: Cardinal Vowel Chart Showing 10 Vowel Positions in Sindhi

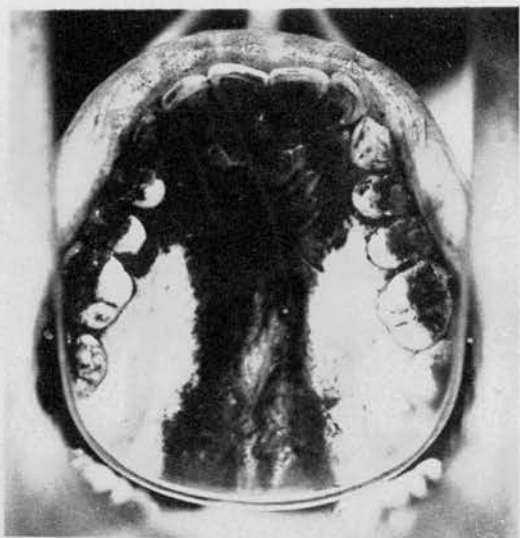
It may be pointed out that these positions refer to areas rather than specific points.

### 3.1.6 Position of the Sides of the Tongue

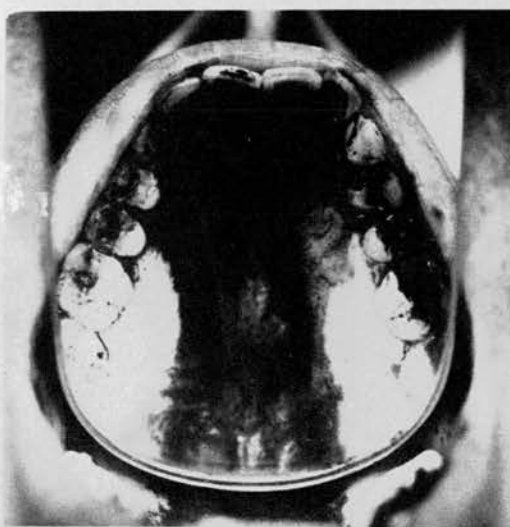
Though the stricture involved in the articulation of vowels is one of 'open approximation' and there is no audible friction, varying degrees of contact between the sides of the tongue and the upper molar and the sides of the roof of the mouth were noted in the articulation of a few Sindhi vowels such as [i], [ɪ], [e] and [ɛ]. Palatograms of the monosyllables of cv structure with [p] as the releasing consonant were made in order to check the position of the sides of the tongue during the articulation of different vowel sounds in Sindhi. A few palatograms made for this study are reproduced on the next two pages.

A careful examination of the palatograms reveals that while articulating the front vowels [i], [ɪ], [e] and [ɛ] in Sindhi, the sides of the tongue touch the sides of palate and the side-teeth; whereas the sides of the tongue do not make any contact in the articulation of back vowels and the central vowels in Sindhi. The marking medium has remained absolutely untouched in the palatograms 19-24 of the back and central vowel nuclei [ə], [a], [ɔ], [o], [ɔ] and [u], except that there is a suggestion of wipe-off beyond the fourth molar in pgm 24 of the close vowel sound [u].

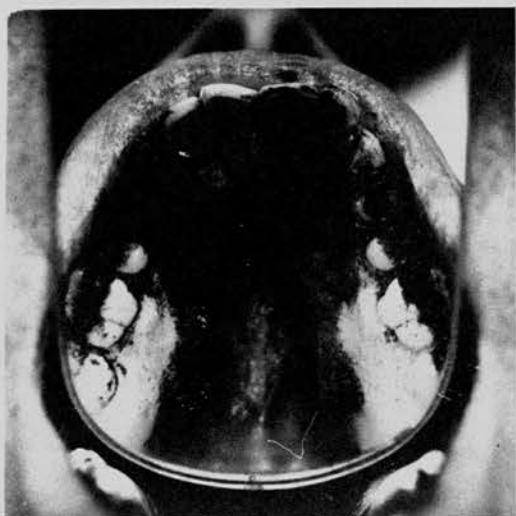
Of all the front vowels that give palatograms, [i] has the most extreme wipe-off. See the word palatogram 15 of [pi] (drink).



Pgm.15 [pi]  
(drink)



Pgm.16 [pɿ]  
(name of a letter)



Pgm.17 [pe]  
(name of a letter)



Pgm.18 [pɛ]  
(name of a letter)



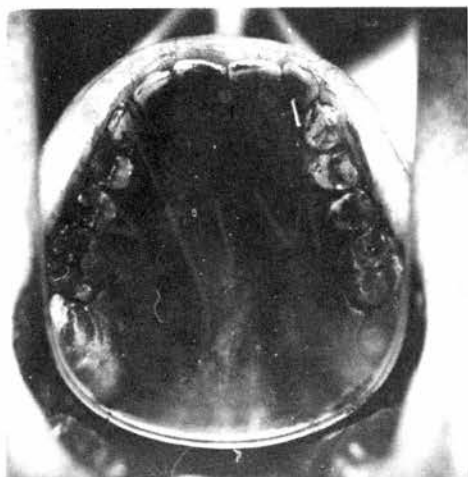


Fig. 19 [pə]  
(name of a letter)

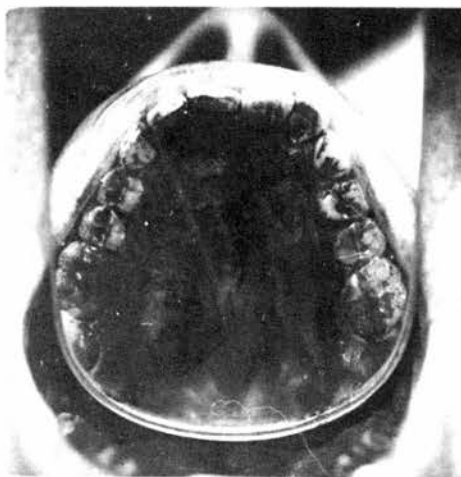


Fig. 20 [pa]  
(name of a letter)

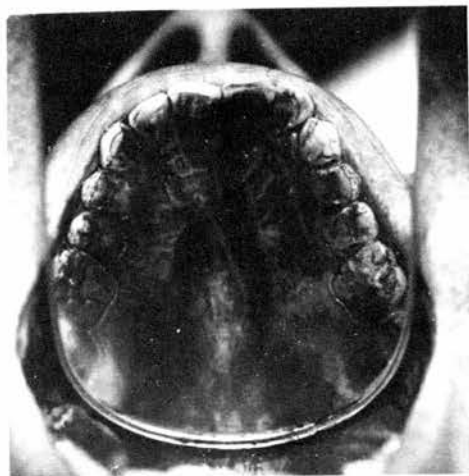


Fig. 21 [pɔ]  
(sleep)

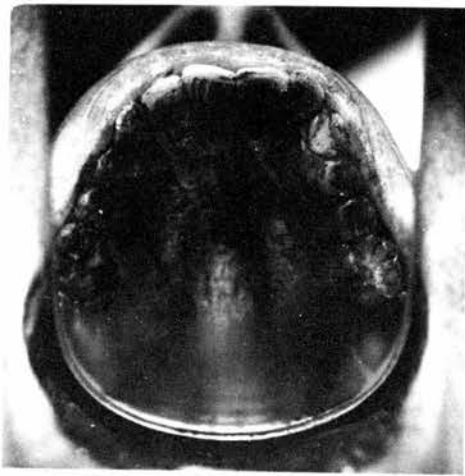


Fig. 22 [po]  
(afterwards)

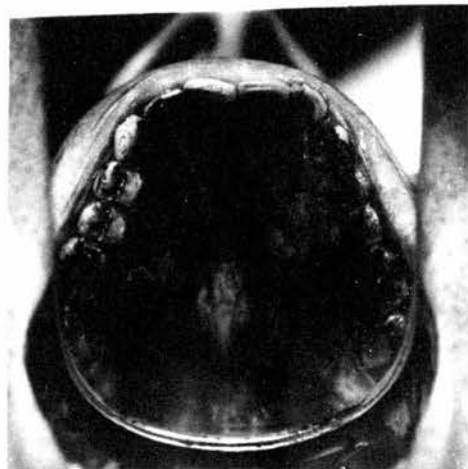


Fig. 23 [pʌ]  
(name of a letter)



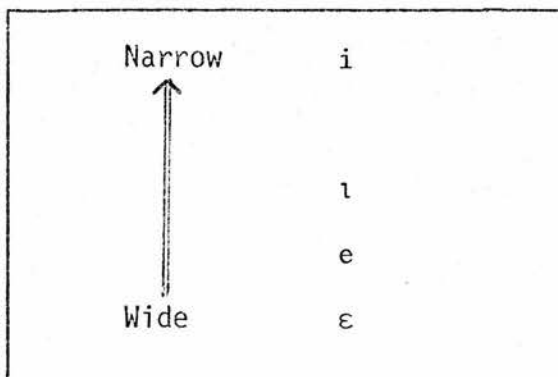
Fig. 24 [pu]  
(name of a letter)

It goes right up to the canine line. The area of wipe-off is widest near the third molar line, having the narrowest articulatory channel. The width of the channel at the narrowest point was measured to be three-fifths of an inch (.6"). The measurements for the vowel nuclei of 4 Sindhi words are given below in tenths of an inch.

<u>Vowel Nucleus</u>	<u>Word</u>	<u>Gloss</u>	<u>Channel Width</u>
[i]	[pi]	(drink)	.6"
[ɪ]	[pɪ]	(name of a letter)	.7"
[e]	[pe]	( " " " " )	.8"
[ɛ]	[pɛ]	( " " " " )	.12"

These measurements indicate the articulatory channel width in the articulation of the four front vowels in Sindhi. It is absolutely clear from the measurements that the articulatory channel provided for the air is the narrowest for the front high vowel and is widest for the front open vowel [ɛ]. It is less wide for [e], still less for [ɪ] and the narrowest for [i].

The following table shows the vowel nuclei of the four Sindhi words arranged according to channel width.





On the basis of the palatograms and from the tables, it can be seen that the air channel is narrower for [i] than for [ɪ], and for [e] than for [ɛ]. This suggests the appropriateness of the terms 'narrow' and 'wide' to distinguish [i] from [ɪ] and [e] from [ɛ].

It has sometimes been claimed that most of the consonant production always involves a direct contact between the articulators, thus providing more direct and easily identifiable kinaesthetic sensations; whereas in the articulation of vowels, such sensations are less evident. The palatographic investigation undertaken here has revealed that such sensations are not completely absent. Considerable contact can be felt, as seen earlier, between the sides of the tongue and the upper teeth. 'In experiments with vowels, as with consonants, silent articulation, by abolishing the masking effect of the auditory sensation, enables one to concentrate on the kinaesthetic sensations'. (Catford 1977:168).

### 3.1.7 Tense and Lax Vowels

Vowels are also classified by some phoneticians according to the muscular tension of the tongue. If there is strong muscular tension in the tongue, the quality of the vowel is said to be tense or fortis; and if there is looseness in the organs of speech, vowels are said to be lenis or lax. Such a classification obviously seems to be only relative. Bell (1867) called the tense/lax distinction primary/wide, and Sweet (1877) called it narrow/wide. Sweet (1877) observes: 'in forming narrow sounds,

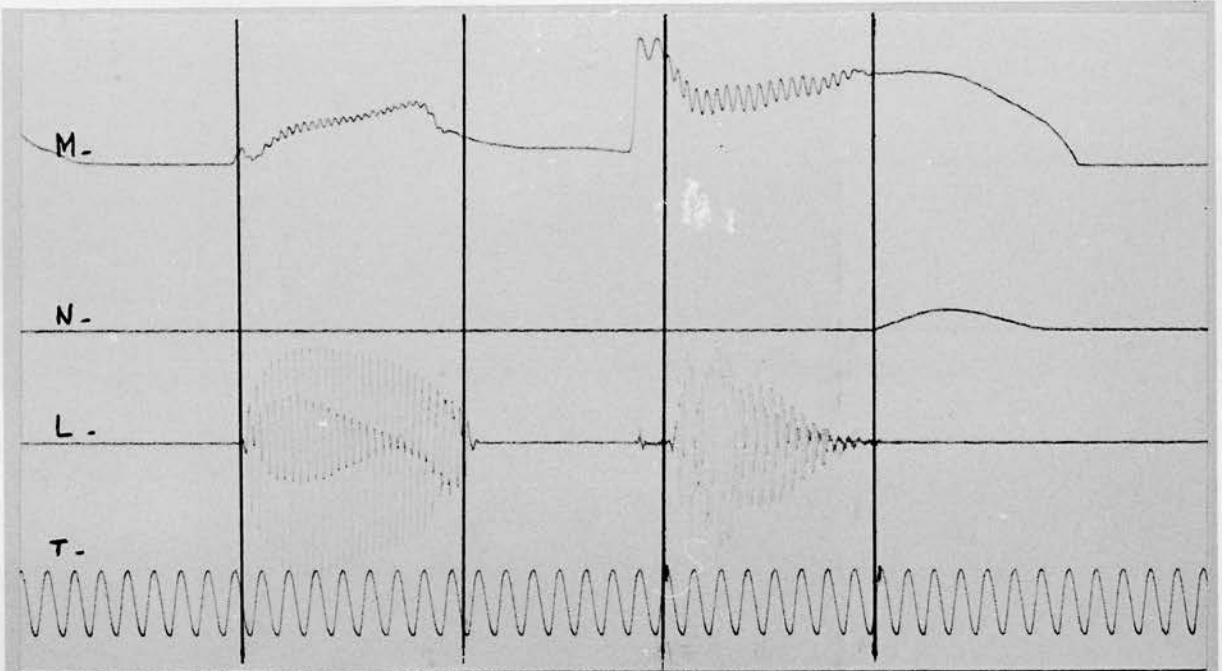
there is a feeling of tenseness in that part of the tongue where the sound is formed, the surface of the tongue being made more convex than in its natural "wide" shape in which it is relaxed and flattened. This convexity of the tongue naturally narrows the passage - Whence the name'.

Sweet's successor Daniel Jones discarded this phonetic parameter when he developed the system of Cardinal vowels. Daniel Jones included only three dimensions - vertical tongue position, horizontal tongue position and the lip-position. Jakobson and Halle (1964) point out that 'the heightened sub-glottal air pressure in the production of tense vowels is indissolubly paired with a longer duration'. This runs counter to the conclusions based on the kymographic investigation of the duration of vowels in Sindhi, discussed in 3.3. It has been conclusively shown on the basis of kymographic findings that duration is independent of the so-called tense/lax distinction. The so-called lax vowel [ɪ] or [ə], for instance, is much longer, under certain phonetic environments (i.e. Word-final position) than so called tense vowel [e], and is as long as [i] in the word-initial position.

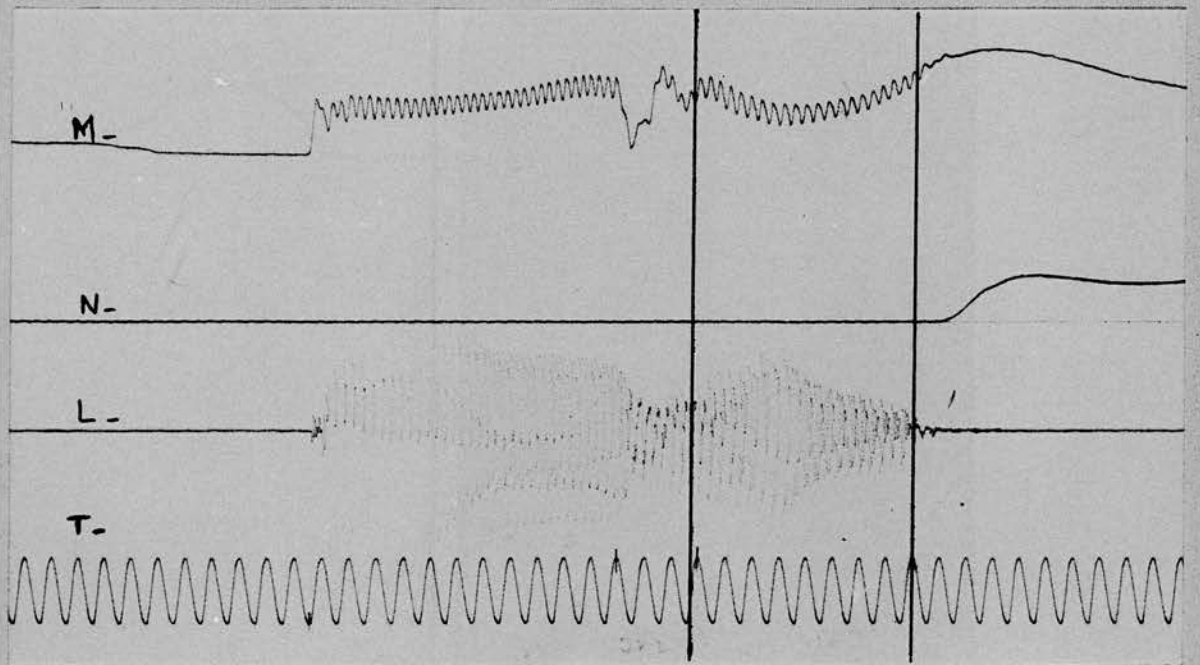
See

Kgm 1	[iɟə] (a brick)	i	16 csec
		ə	16 csec
Kgm 2	[ɔr <sup>l</sup> ] (a spice)	ɪ	16 csec
Kgm 3	[esi] (up to that)	e	11 csec
Kgm 4	[eko] (unity)	e	8 csec

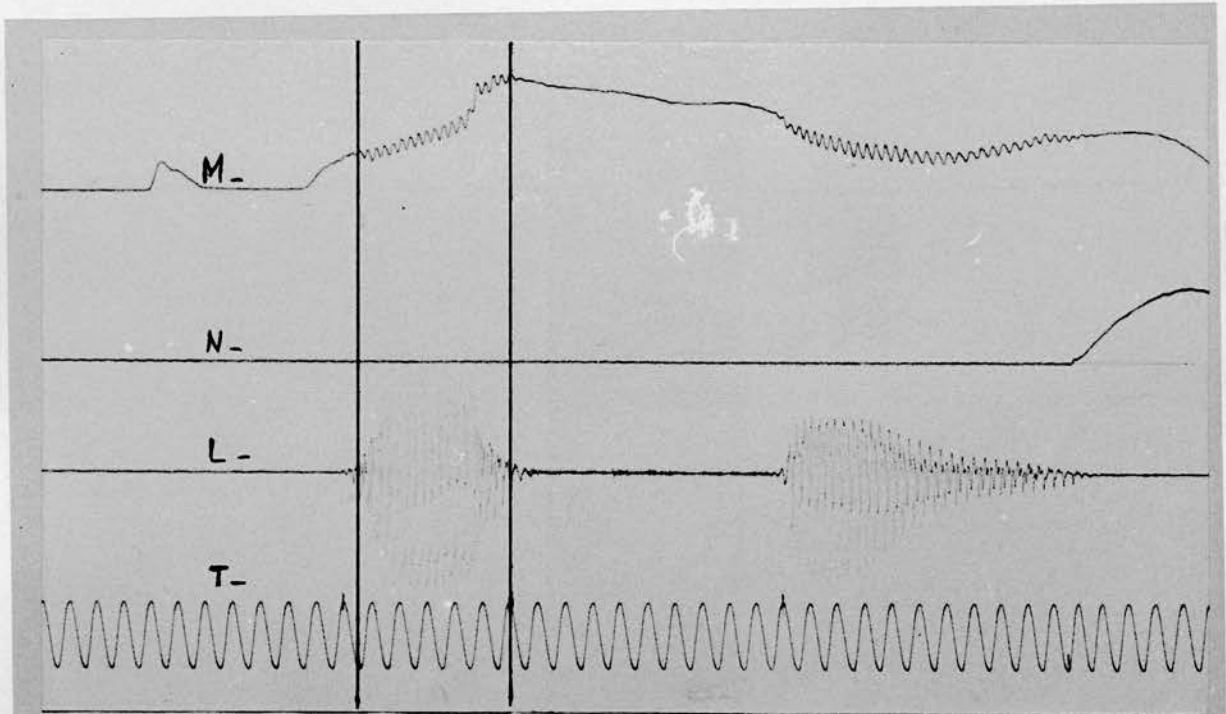
These are a few kymograms reproduced on the next few pages to show that duration is independent of the so-called lax/tense distinction.



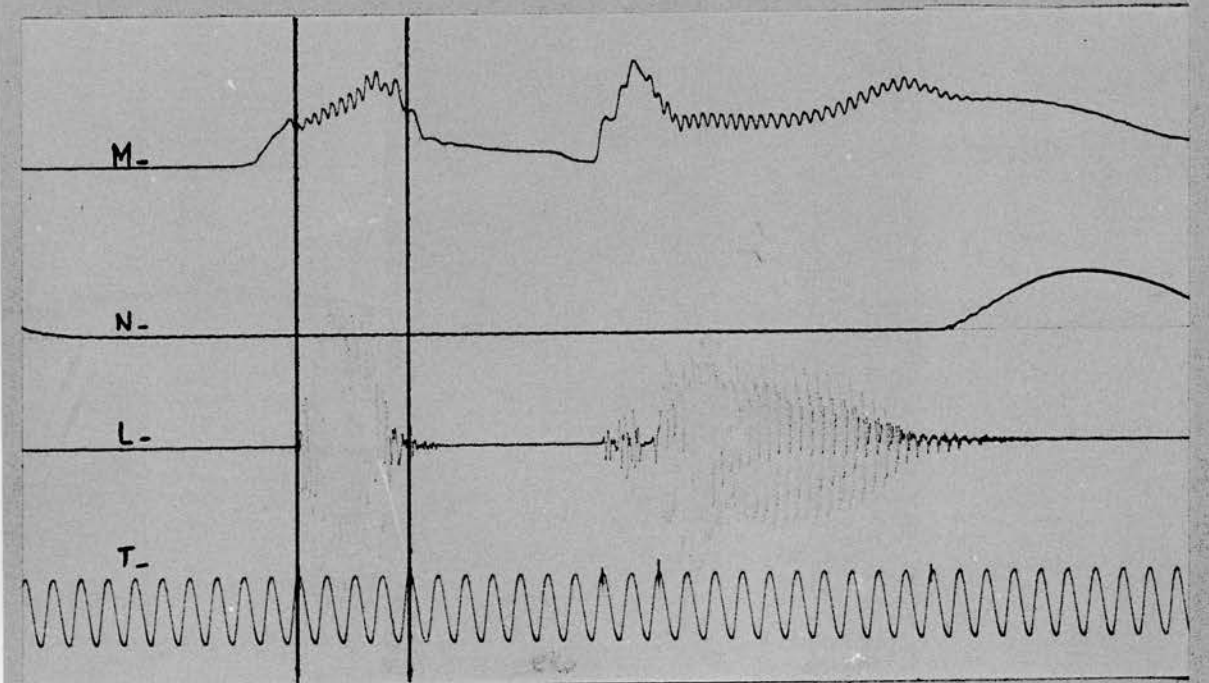
Kgm.1 [itə] (brick)



Kgm.2 [ɔri] (a spice)



Kgm.3 [esi] (upto that)



Kgm.4 [eko] (unity)

According to Catford (1977) the tense/lax distinction is extremely dubious. He observes: 'There may be differences of tension of various muscles involved in positioning the tongue for vowels, but we are far from knowing enough about these differences to be able to utilize them as a phonetic parameter'. Perhaps, electromyographic investigation of the tongue muscles may be undertaken, at some later date, to examine, in great detail, this phonetic parameter.

It may, however, be pointed out with regard to Sindhi that the difference of quality in respect of tenseness and laxness is easily observable in the case of high/close vowels as seen in 3.1.6 where varying degrees of contact between the sides of the tongue and the upper molar were noted. My proprioceptive kinaesthetic sensations, however, indicate that the vowels of Sindhi, in general, are pronounced without much muscular tension. They sound more natural if the tongue and the lips are held together loose in their articulation.

### 3.1.8 Action of the Vocal Cords

All the vowels in Sindhi are voiced, i.e., the vocal cords vibrate during the articulation of vowel sounds.

### 3.1.9 Position of the Soft Palate

The position of the soft palate is also important in the articulation of vowels. The soft palate may be lowered or raised to combine the resonances of the mouth and the nose. Depending, thus,

upon the position of the soft palate, there are two categories of vowels:

- i) Pure oral or non-nasalised vowels - articulated with a velic closure so that the air passes only through the mouth, and the nasal passage is blocked by raising the soft palate.
- ii) Nasalised vowels - articulated with the soft palate, lowered, so that the air passes simultaneously out of both - the mouth and the nose. Nasalisation is usually symbolized by the diacritic tilde placed over the vowel symbol. For example [i] in [əsĩ] (we). This phonetic feature of 'nasality' is discussed at great length later in section 3.5.

### 3.1.10 Retroflexion

The blade and the tip are extremely mobile and are capable of independent movement. The position of the tip of the tongue is known to change the configuration of the vocal tract and consequently the auditory quality of the vowels, independent of the way the vocal tract is shaped by the main body of the tongue. With the curling up of the tip of the tongue and the retraction of part of the tongue, there is usually a constriction in the pharynx, and the resulting quality of vowels is 'retroflexed'.

All the vowels in Sindhi are subject to retraction process when they precede a retroflex flap [ɾ] or [ɾh] and undergo a retroflexed



modification owing to the curling up of the tip of the tongue for the following flap sound.

It may be of interest to note that the extent of retroflexion/retraction in Sindhi is not as striking as in the case of the Dravidian languages like Tamil (Firth 1934: p xxii), and Malayalam.

### 3.2 ACOUSTIC SPECIFICATIONS

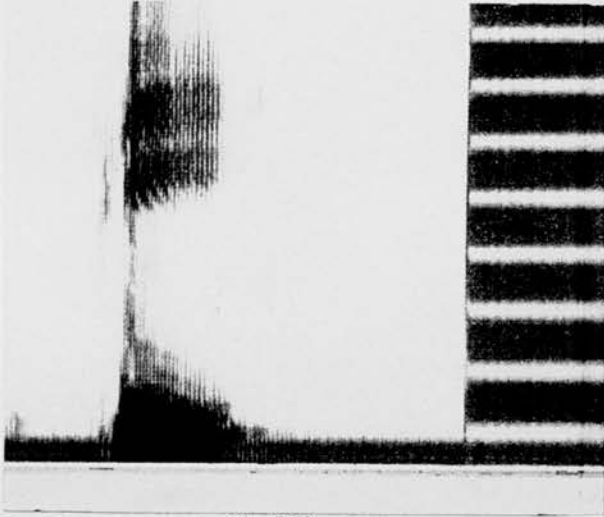
Recent researches in speech science have suggested that the articulatory description of vowels is not entirely satisfactory, and that the simplest and the most adequate description of vowel sounds can be given in terms of formant frequencies which characterize each vowel. In this connection, Ladefoged (1971:7) observes:

'although a pseudo-articulatory terminology may provide an adequate set of labels for auditory description, we have seen that we do not have as yet, a set of articulatory parameters which will specify vowel quality'.

Wide-band spectrograms with frequency range of up to 4 KHz were made in order to check on whether there is any correlation between the traditional articulatory description of the vowels of Sindhi (3.1) and their acoustic specifications in terms of formant frequencies, and also to consider whether the vowel continuum can be better described in terms of these acoustic specifications (i.e. formant frequencies).

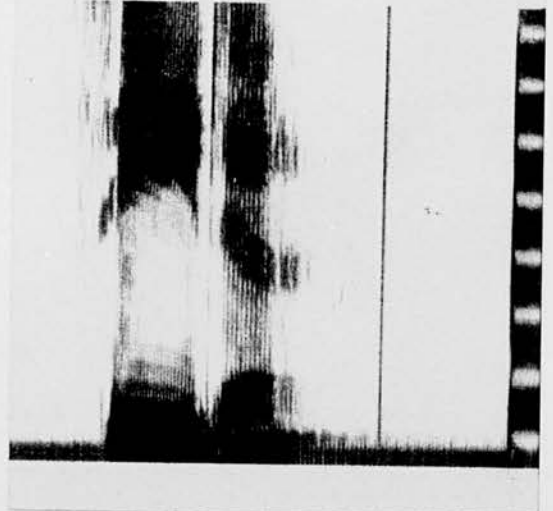
The characteristic quality of a vowel sound depends upon its overtone structure. A vowel sound consists of a pitch at which it is spoken, which is due to the rate of vibrations of the vocal cords.

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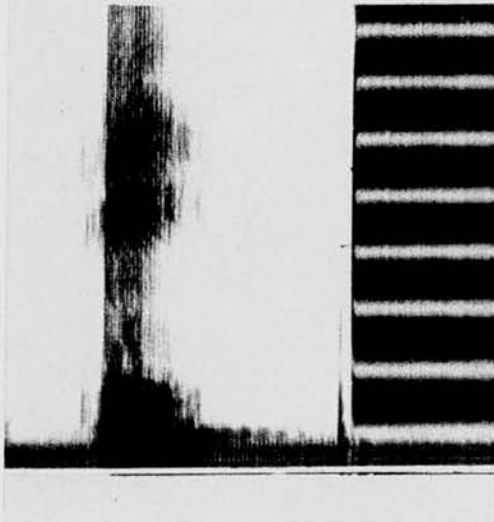
Sgm. 1 [dri]  
(drink)

J.



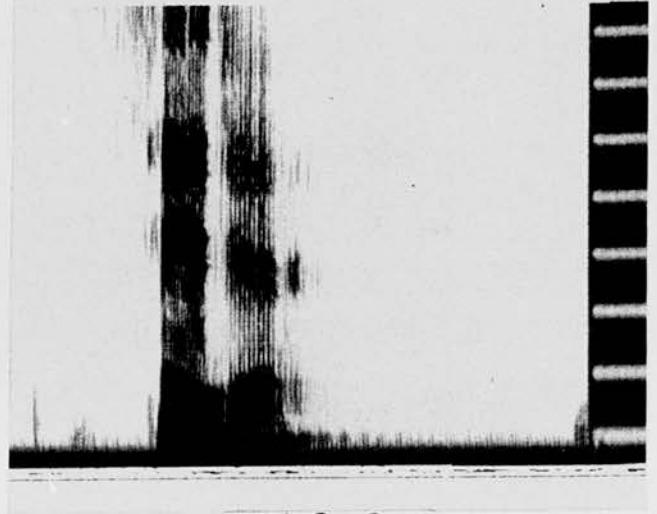
Sgm. 2 [sira]  
(midstream)

t. J.



Sgm. 3 [ri]  
(name of a letter)

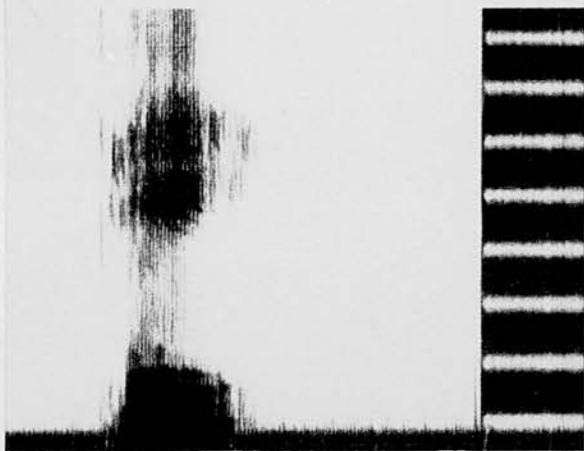
METRICS CO. PINE BROOK, N. J.



Sgm. 4 [sira]  
(brick)



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Sgm. 5 [e]  
(name of a letter)

PINE BROOK, N. J.



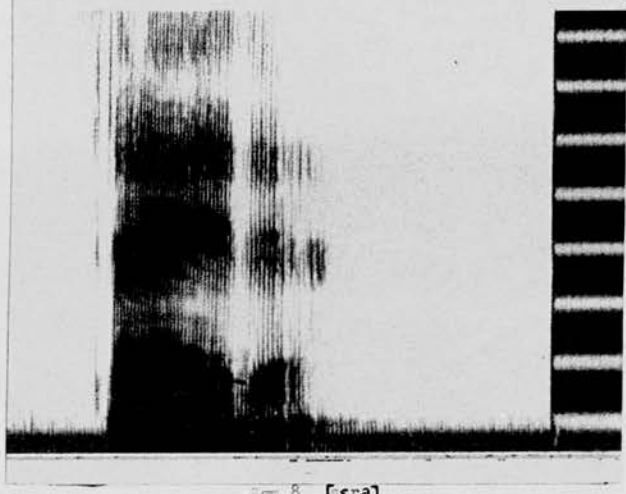
Sgm. 6 [era]  
(two pounds of weight)

ELEMETRICS CO. PINE BROOK, N. J.



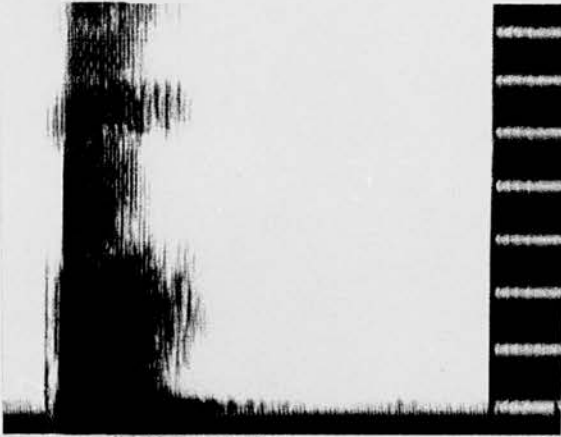
Sgm. 7 [e]  
(name of a letter)

ELEMETRICS CO. PINE BROOK, N. J.



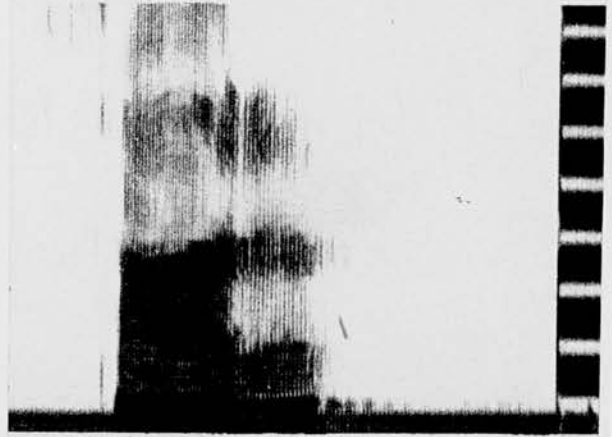
Sgm. 8 [era]  
(walks)

METRICS CO. PINE BROOK, N. J.



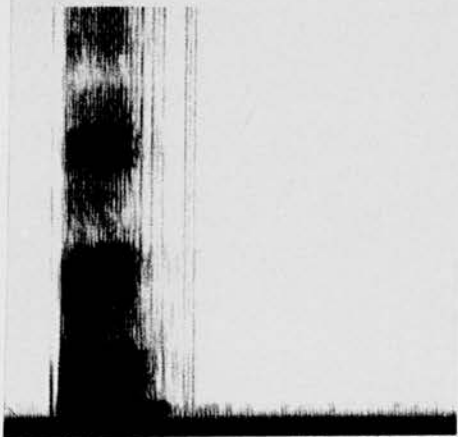
Sgn. 11 [pa]  
(name of a letter)

METRICS CO. PINE BROOK, N. J.



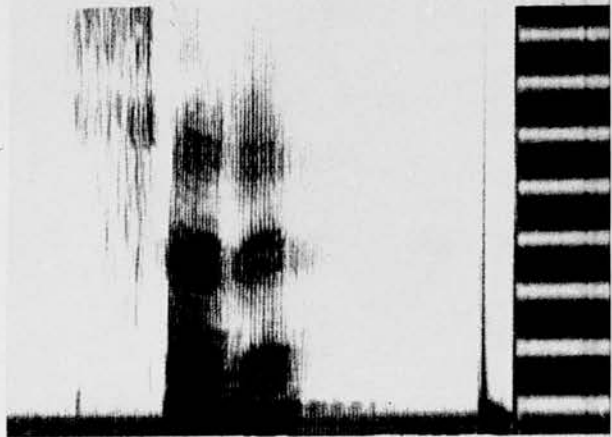
Sgn. 12 [sara]  
(longing)

M • KAY ELEMETRICS CO. PINE BROOK, N. J.



Sgn. 9 [pa]  
(name of a letter)

10. PINE BROOK, N. J.



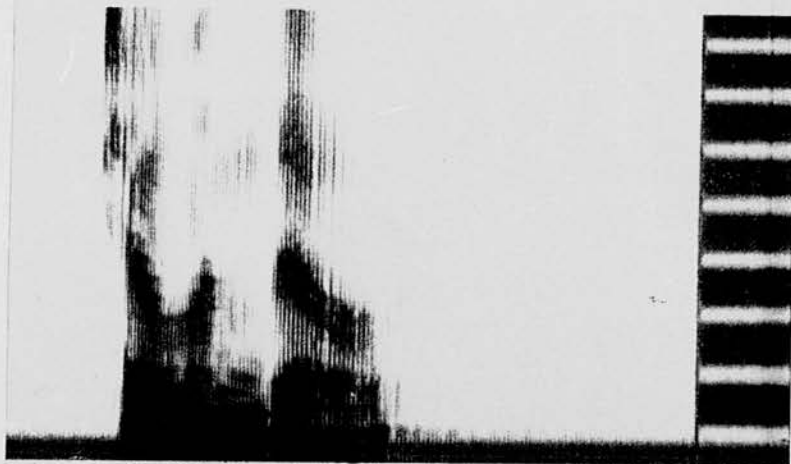
Sgn. 10 [sara]  
(funeral procession)

TRICS CO. PINE BROOK, N. J.



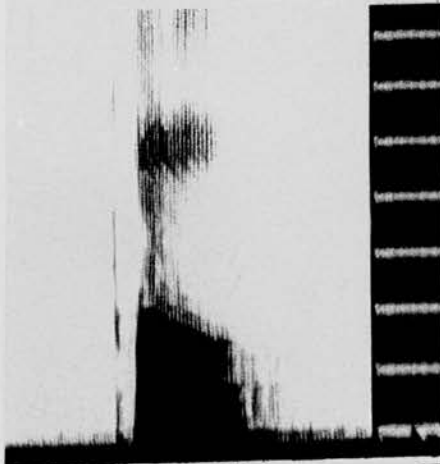
Sgm. 13 [no]  
(name of a letter)

KAY ELEMETRICS CO. PINE BROOK, N. J.



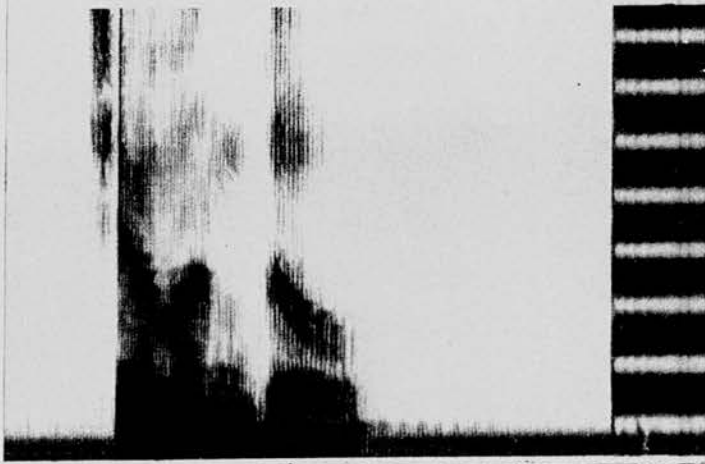
Sgm. 14 [cau?hdo]  
(you(pl.)will say)

C. N. J.



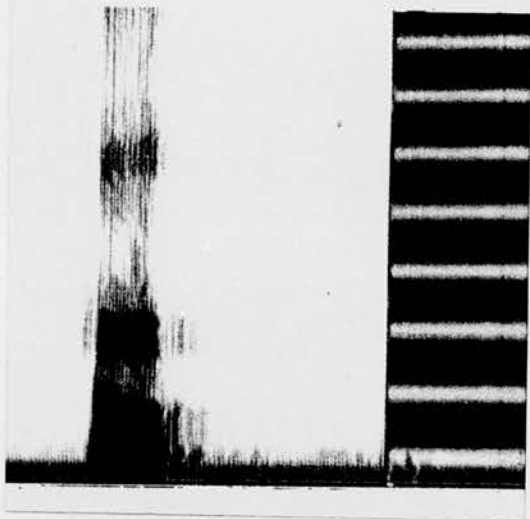
Sgm. 15 [no]  
(afterwards)

ETRICS CO. PINE BROOK, N. J.



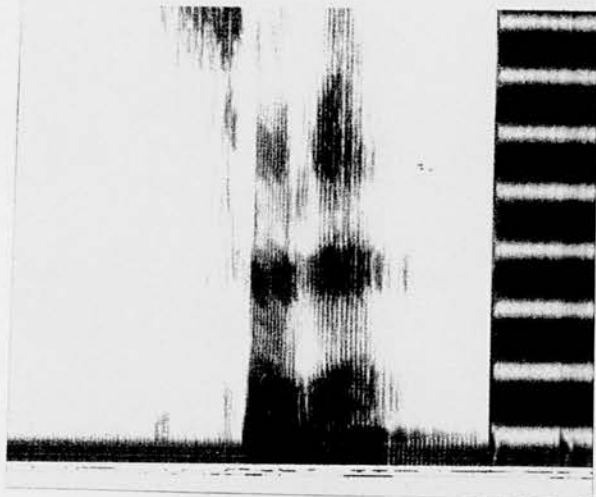
Sgm. 16 [cau?hdo]  
(he will say)

C. N. J.



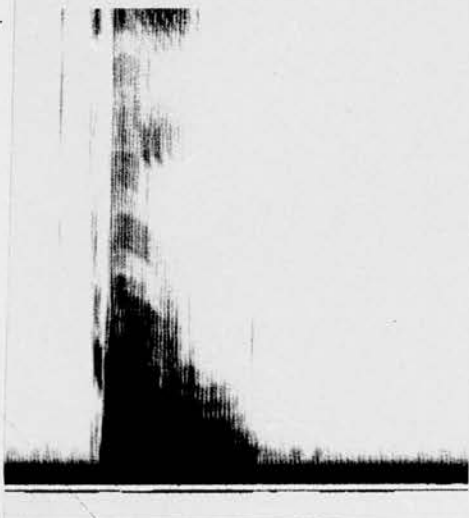
Sgm. 17 [pa]  
(name of a letter)

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Sgm. 18 [sara]  
(tuner)

IMETRICS CO. PINE BROOK, N. J.



Sgm. 19 [pu]  
(name of a letter)

CO. PINE BROOK, N. J.



Sgm. 20 [surə]  
(pains)

This is called the fundamental frequency produced by the vocal cords. The configuration of the tongue and the lips and the resulting vocal tract shape superimposed on the fundamental frequency, produces a group of various overtone pitches which are called the 'formants' of vowels. It is these formants that characterize different vowels and distinguish one vowel from another.

Twenty spectrograms were made of the meaningful words with vowels in the word-medial and word-final position. The values of the formant frequencies were then obtained by determining the centre of the width of each formant, also known as the centre of the formant frequency. Tables VII and VIII show the values of F1 and F2 in the articulation of vowels in Sindhi, calculated when vowels were in steady state.

Word	Gloss	F1	F2
pi	(drink)	300	2400
pɪ	name of a letter	375	2200
pe	" " "	475	2250
pɛ	" " "	700	1800
pə	" " "	600	1500
pa	" " "	850	1750
pɔ	(sleep)	550	1150
po	(afterwards)	450	900
pɔ̄	name of a letter	400	1150
pu	" " "	320	750

TABLE VII: Showing the values of F1 & F2 for 10 Sindhi vowels in word-final position.

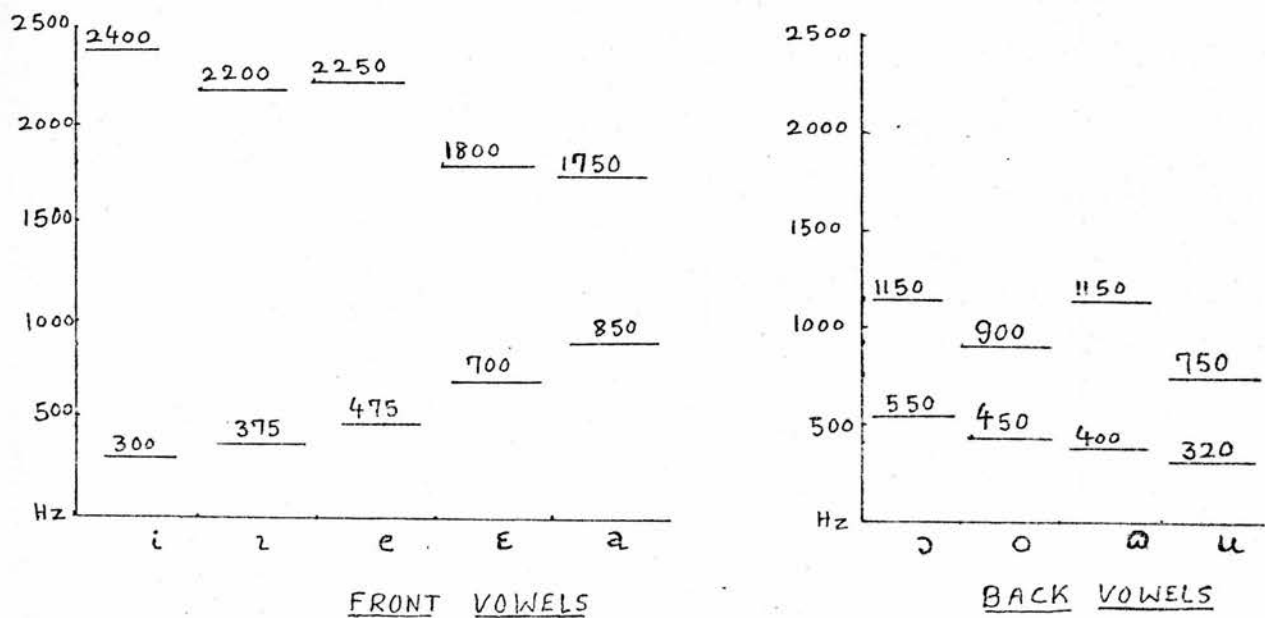


Figure 8: The frequencies of the first two formants in Sindhi vowels in word-final position

Word	Gloss	F1	F2
sirə	(midstream)	300	2450
sɪrə	(brick)	390	1950
serə	(two-pound weight)	450	2150
sɛrə	(walks)	700	1750
sərə	(funeral procession)	600	1450
sarə	(longing)	750	1450
cəʋəndə	(you (pl) will say)	600	1250
cəʋəndo	(he will say)	490	1050
sərə	(tunes)	450	1350
surə	(pains)	350	750

TABLE VIII: Showing values of F1 & F2 for Sindhi vowels in word-medial position.

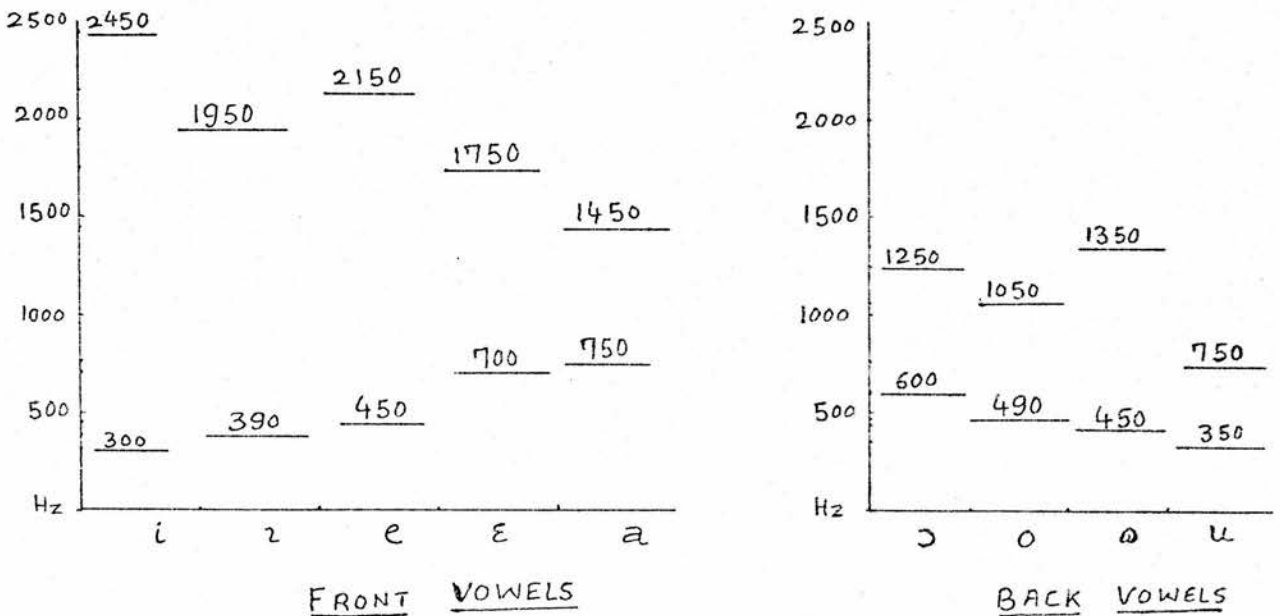


Figure 9: The frequencies of the first two formants in Sindhi vowels in word-medial position.

A close examination of the formant chart in Figures 8 and 9 makes it clear that

- a) the first formant frequency goes on increasing as a speaker moves from the close/high vowel [i] in [sɪrð] (midstream) through the more open/low vowel [ɛ] in [sɛrð] (walk) to the most open/low vowel [a] in [sarð] (longing).



- b) It decreases as the speaker moves from the low vowel to high vowel [u] as in [surə] (pains).

Thus the formant ( $F_1$ ) is inversely related to the articulatory feature: 'tongue height', which may be, hereinafter referred to as 'vowel height'.

There is a gradual but continual decrease in the second formant frequency. Measurements of second formant frequencies are not so simply related to the other traditional articulatory labels such as horizontal tongue position (front-back) or lip-position spread or rounded. 'But perhaps our mistake is in expecting all three of the traditional terms to have simple auditory/acoustic correlates. If we neglect the rounding dimension, then we can say that what a phonetician characterizes as front-back is, in acoustic terms, the distance between the first formant and the higher formants; and we have already seen that there is a good correlation between high-low and the frequency of the first formant'. (Ladefoged 1971:74).

Table IX shows mean values of  $F_1$  and  $F_2$ . These formant frequencies of 10 Sindhi vowels have been plotted on the logarithmic scale with  $F_1$  on the ordinate, reading downwards on the vertical axis and the distance between the formant two and one ( $F_2-F_1$ ) on the abscissa reading right to the left as shown in Fig 10 which is not very dissimilar in arrangement from the shape of the articulatory vowel diagram in Fig 7 on p.111.

F1					F2			
Vowel	Sample 1	Sample 2	Total	Mean	Sample 1	Sample 2	Total	Mean
i	300	300	600	300	2400	2450	4850	2425
ɪ	375	390	765	380	2200	1950	4150	2075
e	475	450	925	460	2250	2150	4400	2200
ɛ	700	700	1400	700	1800	1750	3550	1725
ə	600	600	1200	600	1500	1450	2950	1475
a	850	750	1600	800	1750	1450	3200	1600
ɔ	550	600	1150	575	1150	1250	2400	1200
o	450	490	940	470	900	1050	1950	975
ɔ̄	400	450	850	425	1150	1350	2500	1250
u	320	350	670	340	750	750	1500	750

TABLE IX: Showing mean values of formant one and formant two for vowels in Sindhi.

As can be clearly seen from the figure, F1 shows a relationship with tongue vowel height, and the distance between two formants (F2-F1) shows an obvious relationship with tongue advancement (front versus back).

From the acoustic chart given in Fig 10, one can unhesitatingly say that the traditional articulatory descriptions of vowels are related to the acoustic specifications. It is

Vowel	i	ɨ	e	ɛ	ə	a	ɔ	o	ɒ	u
F2	2425	2075	2200	1725	1475	1600	1200	975	1250	750
F1	300	380	460	700	600	800	575	470	425	340
F2-F1	2125	1700	1740	1025	875	800	625	505	825	410

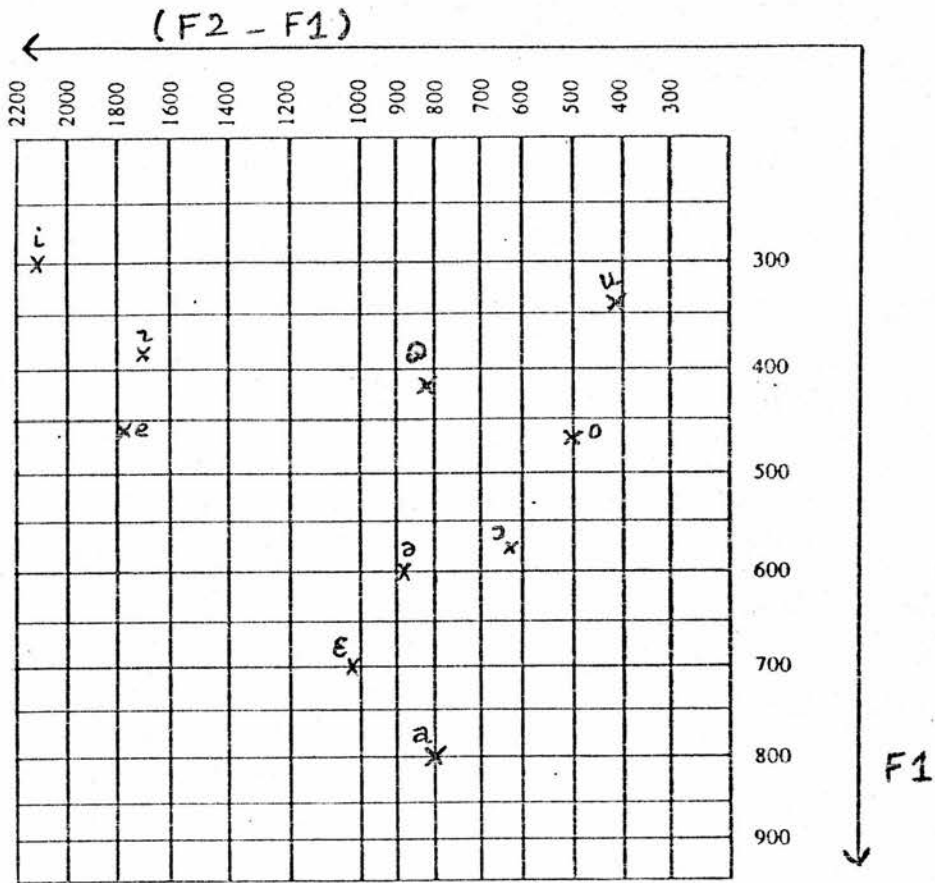


Figure 10 An acoustic chart showing the frequency of the first formant on the ordinate (the vertical axis) plotted against the distance between the frequencies of the first and second formants on the abscissa (the horizontal axis) for vowels in Sindhi.

now more than a hundred years that phoneticians have been describing vowels in articulatory terms such as close, half-close, half-open, open, and front versus back. Undoubtedly, these articulatory terms have adequately served the purpose of describing the auditory relationships between different vowel qualities, though one of the pioneers in x-ray studies of vowels has remarked: 'Phoneticians are thinking in terms of acoustic fact, and using physiological fantasy to express the idea'. (G. Oscar Russell 1928).

Ladefoged (1975:174) also suggests that 'phoneticians may have been using these terms as labels to specify acoustic dimensions rather than as descriptions of actual tongue positions'. He adds: 'They set out to describe the positions of the vocal organs during the production of different sounds; but their success in the enterprise was only partial. They did, however, succeed in producing categories with which to describe their auditory impressions'. (Ladefoged 1967, ch 2). According to Catford (1977), 'they were providing categories to describe proprioceptive impressions received from their tongue muscles.'

The remarks of Sweet (1877) are highly illuminating in this connection. He observes: 'Whispering the vowels will be found a great help in analysing their formation. After a time, the student will be able to recognise each vowel solely by the muscular sensations associated with its formation; he will be able to say to himself: "Now my tongue is in the position for

(i)", "Now I have changed (i) into (ih)", etc., while not uttering the slightest sound, confident that if voiced or whispered breath is allowed to pass through the mouth the required sound will be produced'. Thus Sweet's description of vowels in terms of articulatory labels such as 'high-low' and 'front-back' was solely based on the proprioceptive kinaesthetic feedback.

A real 'break-through' in vowel classification can be attributed to Melville Bell who remarked as early as 1867: 'In fact, any desired sound, known or unknown, could be produced at pleasure by first adjusting the organs tentatively for its neighbour-sounds, and then allowing these to coalesce, as it were, into an intermediate'.

Obviously, the applied phoneticians like Sweet and Bell have based their highly sophisticated scheme of vowel classification on the direct estimates of the articulatory features such as general shape and location of the tongue based on proprioceptive kinaesthetic feedback. It will be, therefore, rather unfair to say that the articulatory descriptions are not entirely satisfactory. But perhaps, those of use who are not as skilled as Sweet and Bell organise two aspects of vowel quality (tongue-height and tongue advancement) in auditory/acoustic terms; and have other additional features such as rounding of the lips and tension, which are based on articulatory properties. Thus listeners and speakers perhaps make use of both - acoustic and articulatory features - in the articulation of vowels.

### 3.3 VOWEL LENGTH

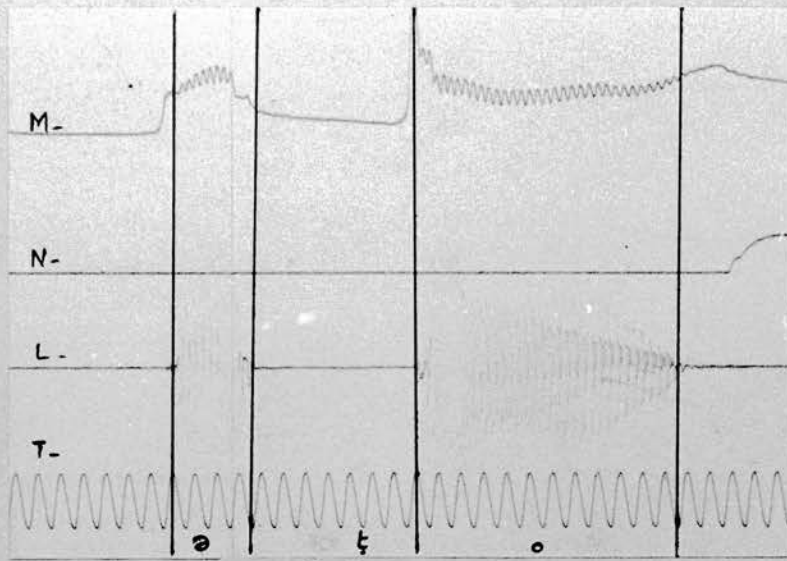
In a word uttered in isolation or in connected speech, some vowel sounds are held on relatively longer than others. Vowel length is not distinctive in Sindhi from the meaning point of view, in that, there are no minimal pairs found, based solely on the phonetic contrast of vowel length. What is meant by length is duration. For purposes of the present research, it is the relative duration of vowels that will be considered here. Relative duration means that a vowel may be longer or shorter than those said in the same phonetic environment. Several degrees of duration were observed, but it was found adequate to show only two degrees of duration - 'long' and 'short'.

Extensive kymographic investigation was undertaken in order to examine this phonetic feature - vowel duration. Vowels show a wide range of variations. The so-called 'short' vowel [ə], for example, was measured to be:

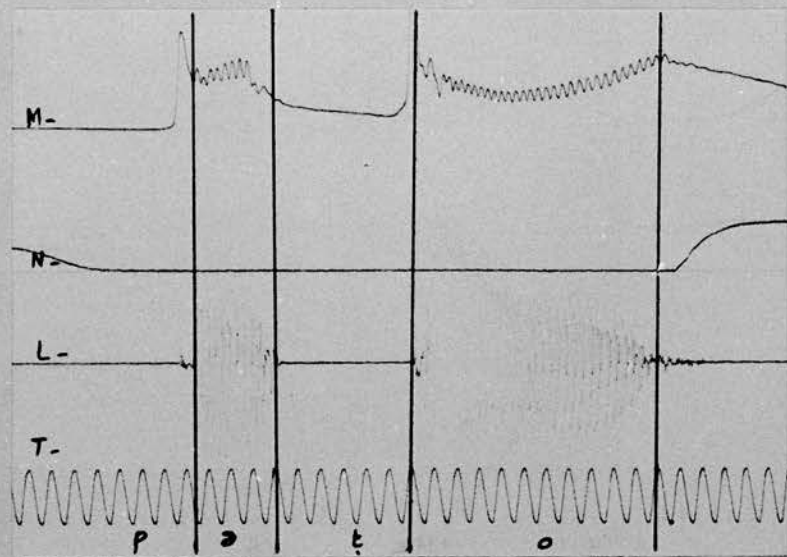
- 7 csec word-initially as in [ə̣to] (flour) Kgm 5
- 7 csec word-medially as in [pə̣to] (belt) Kgm 6
- 15 csec word-finally as in [pə̣tə] (floors) Kgm 7

The so-called 'long' vowel [a] was measured to be:

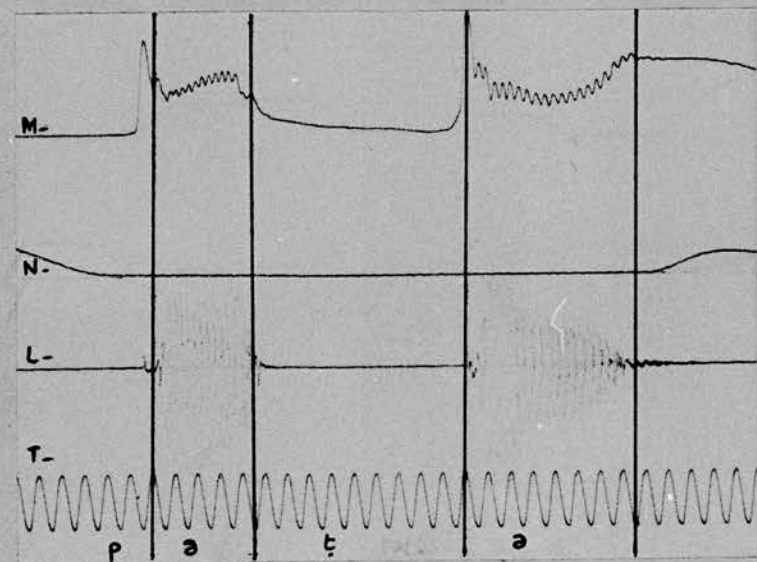
- 11 csec word-initially as in [apo] (intimacy) Kgm 8
- 12 csec word-medially as in [lapo] (to grab) Kgm 9
- 20 csec word-finally as in [ala] (wet) Kgm 10



Kgm.5 [ətɔ] (flour)

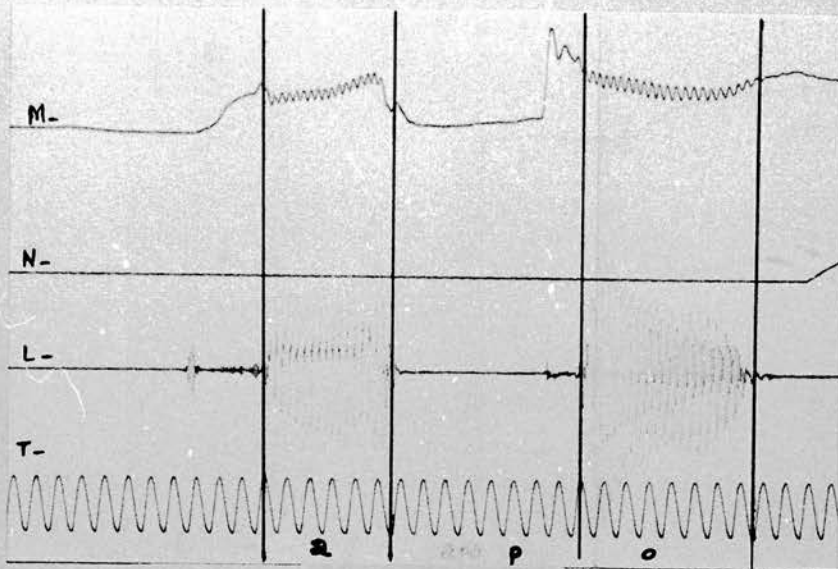
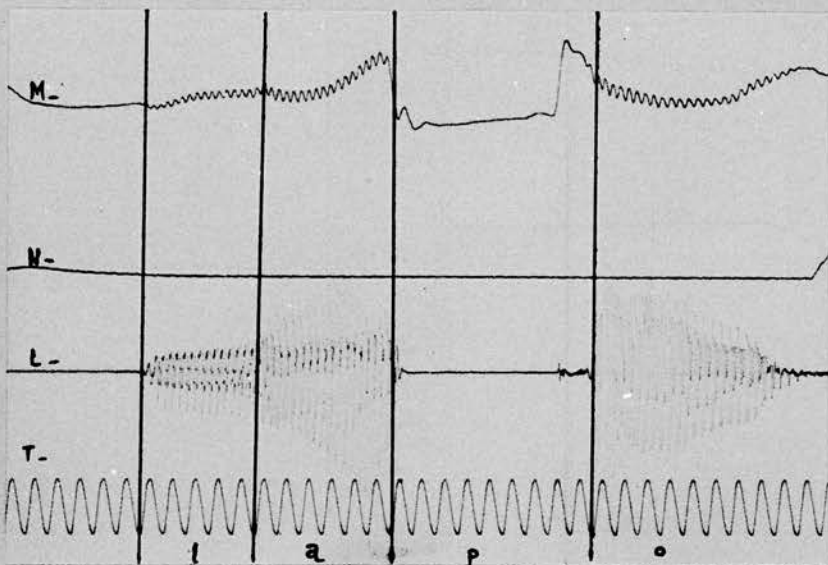
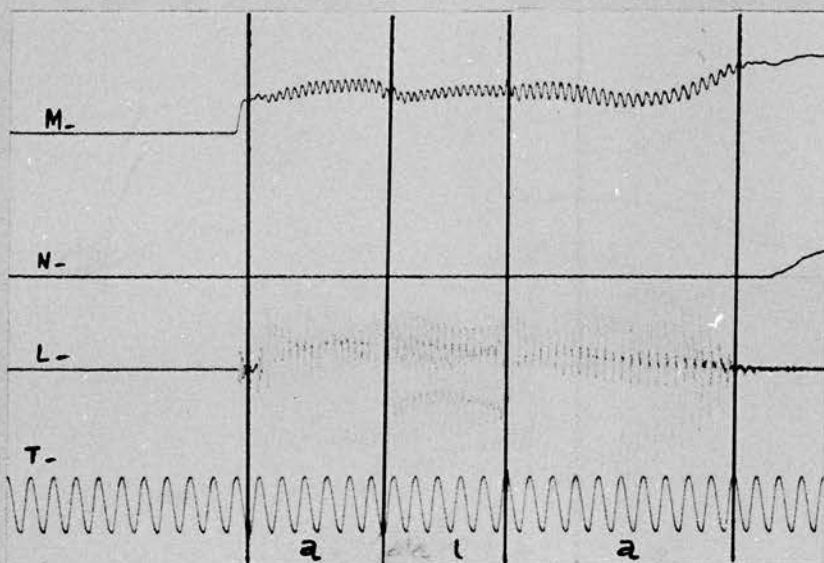


Kgm.6 [pətɔ] (belt)



Kgm.7 [pətə] (floors)



Kgm.8 [apo]  
(intimacy)Kgm.9 [lapo]  
(to grab)

Kgm.10 [ala] (wet)



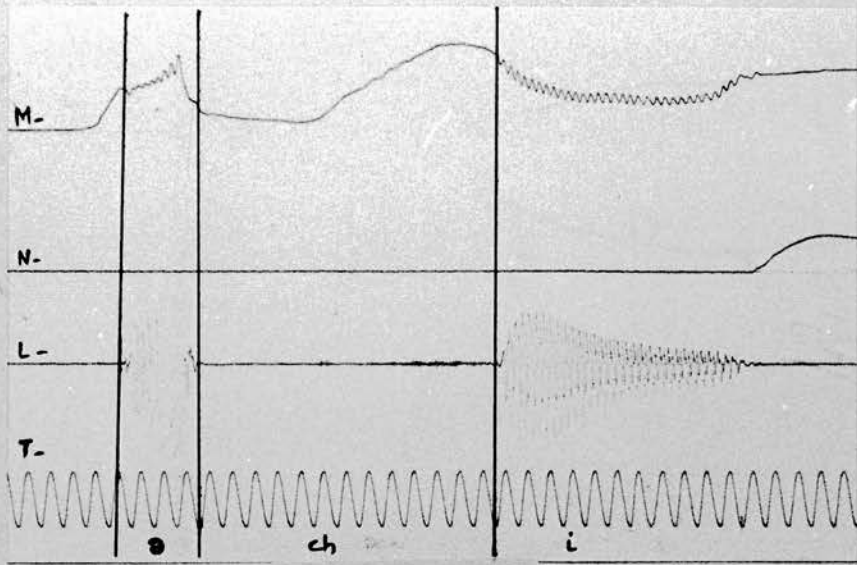
It may be pointed out that the so-called short vowel [ə] in the word-final position was 15 csec which is much longer in duration than the so-called long vowel [a] which measured 11csec and 12 csec word-initially and word-medially. This clearly indicates that no absolute length can be fixed for a vowel to be long or short. From a purely physical point of view, we have a long vowel [a] in [apo] (intimacy) and a short vowel [ə] in [əto] (flour).

Ordinarily, however, it will be seen that a vowel with relatively long duration is about twice as long as a corresponding vowel with relatively short duration in the same phonetic environment. For example:

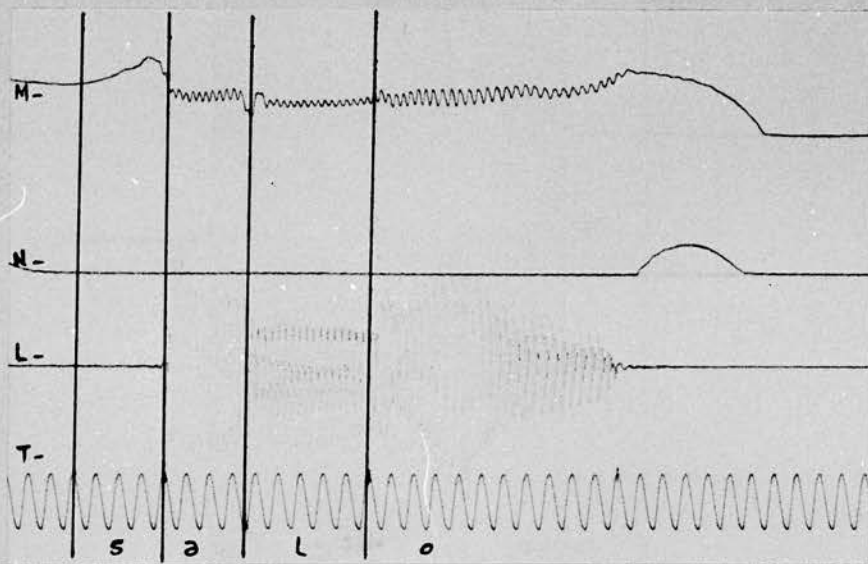
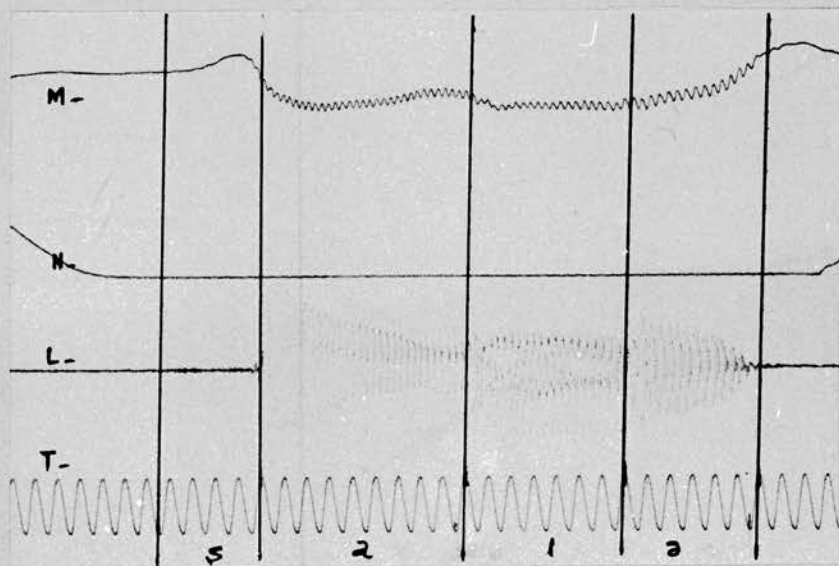
[ə]				[a]			
[əchi]	(white)	7 csec	(Kgm 11)	[achi]	(offered)	13 csec	Kgm 14
[səlo]	(sprout)	7 csec	(kgm 12)	[salə]	(brother-in-law)	13 csec	Kgm 15
[salə]	(years)	12 csec	(kgm 13)	[salə]	( " " " pl)	21 csec	Kgm 16

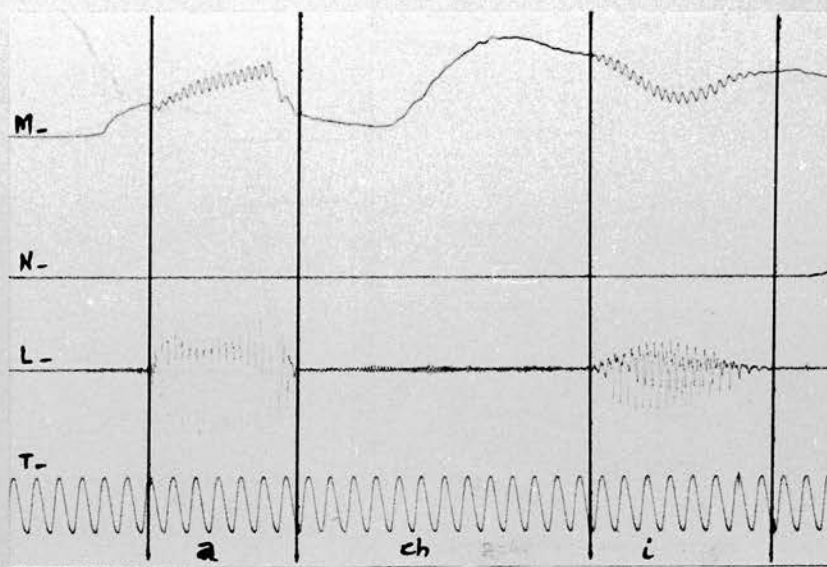
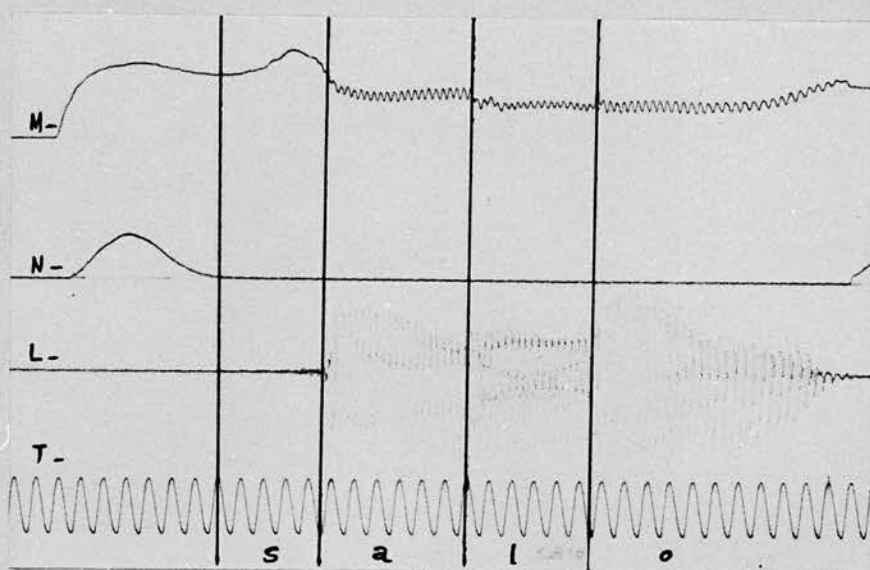
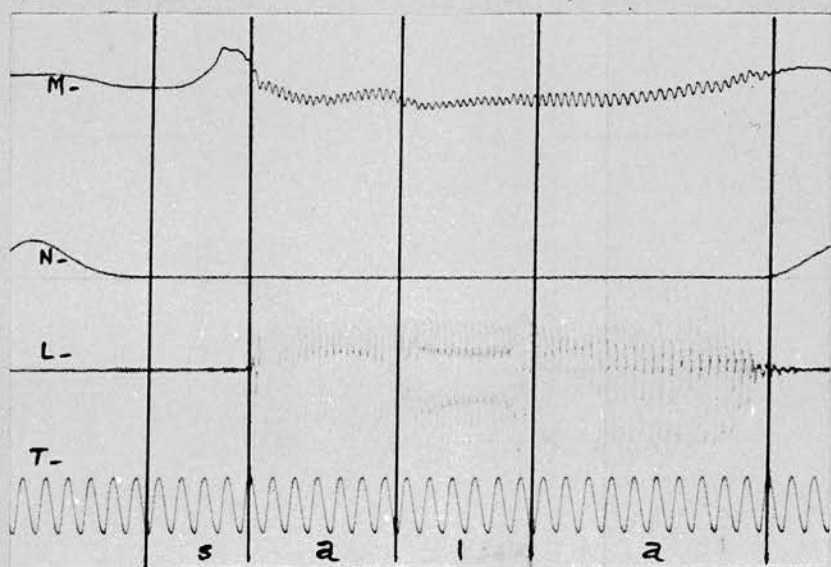
TABLE X: Showing duration of two vowels [ə] and [a] in the same phonetic environment.

More than 400 Kymograms were made on different occasions leaving a short interval, in order to check on the consistency with regard to vowel quantity. Measurements of about 100 examples of disyllabic words with 10 vowels in three different phonetic environments



Kgm.11 [achi] (white)

Kgm.12 [salo]  
(a sprout)Kgm.13 [sala]  
(years)

Kgm.14 [achi]  
(offered)Kgm.15 [salo]  
(brother-in-law)Kgm.16 [sala]  
(brothers-in-law)

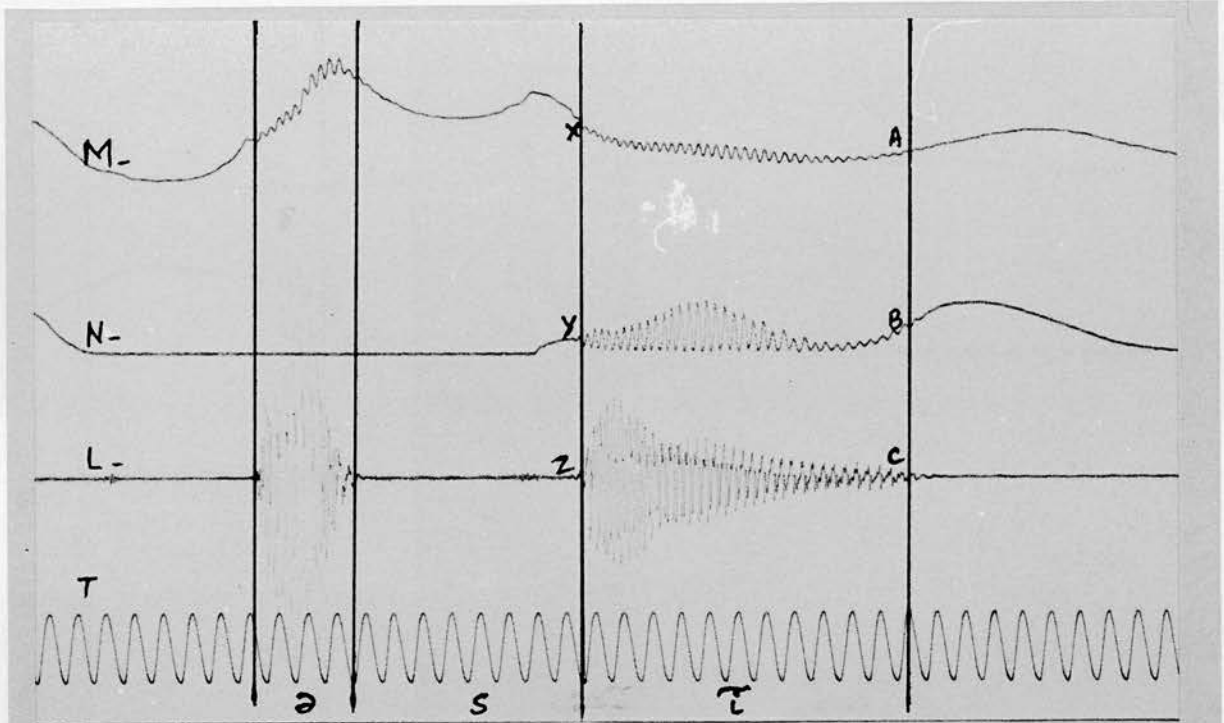
(word-initially, word-medially and word-finally) are given below:

vowel	WORD-INITIALLY					WORD-MEDIAALLY					WORD-FINALLY				
	SAMPLES			tot	aver	SAMPLES			tot	aver	SAMPLES			tot	aver
	1	2	3	al	age	1	2	3	al	age	1	2	3	al	age
i	16	15	-	31	16	18	18	18	54	18	20	21	19	60	20
ɪ	8	8	-	16	8	6	8	7	21	7	13	16	10	39	13
e	8	11	-	19	10	9	10	-	19	10	30	16	14	60	20
ɛ	17	-	-	17	17	21	22	16	59	20	35	24	26	85	28
ə	7	6	7	20	7	7	7	7	21	7	15	16	15	46	15
a	11	11	12	34	11	14	12	14	40	13	20	20	21	61	20
ɔ	11	12	-	23	12	16	17	17	50	17	23	24	24	71	24
o	18	13	18	49	16	14	12	12	38	13	20	21	19	60	20
ɒ	9	9	6	24	8	9	10	7	26	9	13	13	15	41	14
u	14	11	13	38	13	12	11	10	33	11	22	18	20	60	20

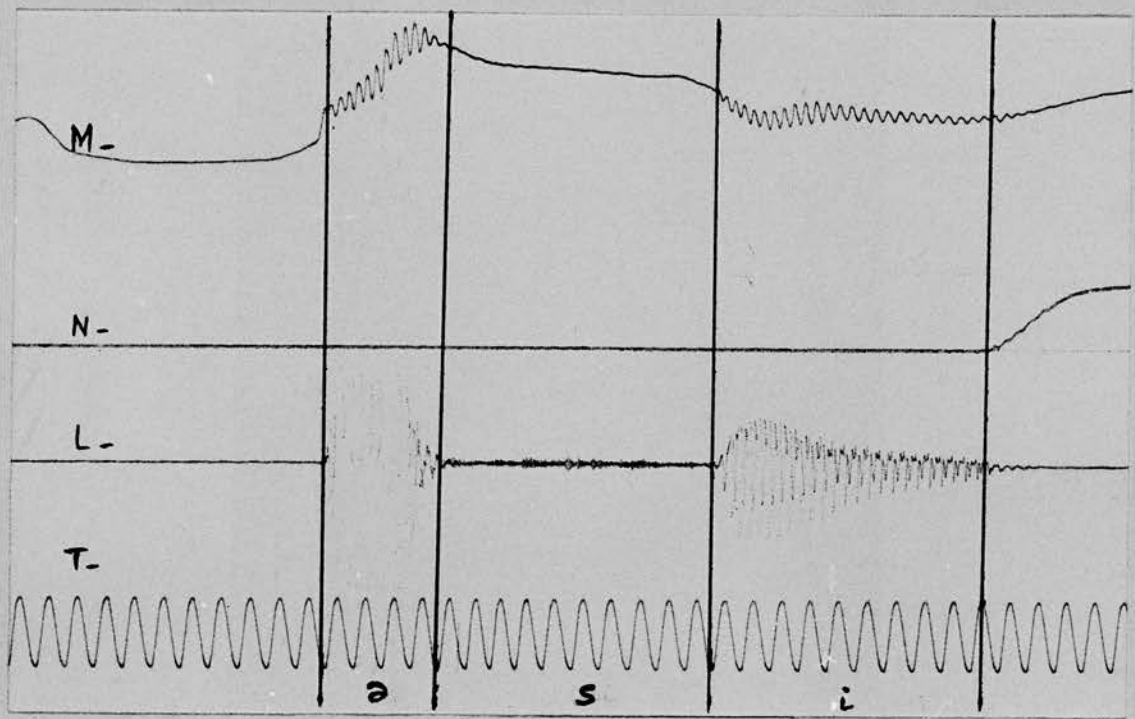
TABLE XI: Showing duration in cseconds of 10 vowels in Sindhi.

Kymographic measurements have shown conclusively that:

- i) the vowels of Sindhi tend to be longer when word-final in the open-syllable position than when word-initial or word-medial in closed syllable position.
- ii) the word-final vowels, which are always relatively long in the utterance final position are shortened in the



Kgm. 17 [əsi] (we)



Kgm. 18 [əsi] (eighty)

internal position, but even then their characteristic quality is maintained; and finally

- iii) the relative duration of a nasalised vowel tends to be slightly longer than the corresponding non-nasalised pure vowel, e.g.

[ə̃si]	(we)	23 csec	Kgm 17	(see page 144)
[ə̃si]	(eighty)	19 csec	Kgm 18	

Also

[ãdhi] (storm), [hũð] (otherwise),

[gə̃ũ] (cows) show relatively greater length than their corresponding non-nasalised pure vowels.

### 3.4 DETAILED DESCRIPTION AND DISTRIBUTION

For the description of vowels, the method adopted here is one of a comparison of my own Sindhi vowels with Daniel Jones's Cardinal vowel system as placed within the bi-parametric trapezoid chart. The acoustic data regarding vowel formants have been based on spectrographic findings discussed in section 3.2.

Sindhi has a system of 10 vowels. All vowels may occur word-initially, word-medially and word-finally. Kymographic measurements have conclusively shown that the vowels of Sindhi tend to be relatively longer when final than when word-initial or word-medial. All vowels in Sindhi are voiced; the action of the vocal cords will not be mentioned, therefore, in each individual case. The soft



palate is raised in the articulation of oral vowels discussed in this section. The phonetic feature of nasality with regard to vowels in Sindhi will be discussed in the next section 3.5.

### 3.4.1

[i] represents a close front unrounded pure/oral vowel in the articulation of which the front part of the tongue is raised towards the hard palate. It is slightly more open than the Cardinal vowel 1, and slightly retracted. The muscular tension is also much less than in the case of the Cardinal vowel 1. The lips are unrounded and the upper side rims of the tongue are in close contact with the upper molars. See pgm 15 of the word [pi] (drink) on p 113).

Of all the vowels that give palatograms, [i] has the most extensive wipe-off. It goes right up to the canine line on both sides. The area of wipe-off is widest near the third molar line; thus providing the narrowest air channel in the formation of this vowel sound.

The manner of its formation may formally be described as follows:

- i) height of the tongue: nearly close
- ii) part of tongue which is highest: centre of the 'front'
- iii) position of lips: unrounded (see Lgm 1 on page 109)
- iv) opening between the jaws: narrow

The tip of the tongue touches the lower teeth.

Its formant characteristics show an extreme low frequency F1 (300) and an extreme high F2 (2425). A low F1 represents a high/close vowel, and a high F2 is indicative of a front vowel.

### Distribution

- |                           |        |                            |
|---------------------------|--------|----------------------------|
| i) <u>Word-initially:</u> | [it̪]  | (diamond in playing cards) |
|                           | [is̪]  | (side stack of a cot)      |
| ii) <u>Word-medially:</u> | [sir̪] | (midstream)                |
|                           | [tir̪] | (an arrow)                 |
|                           | [cito] | (a tiger)                  |
| iii) <u>Word-finally:</u> | [esi]  | (upto that)                |
|                           | [iki]  | (odd)                      |
|                           | [ɛsi]  | (given to comforts)        |

### Other Allophones

Before flapped sounds [ɾ] and [r̪], the quality of the vowel sound [i] is slightly retroflexed owing to the curling up of the tip of the tongue (see 3.1.10).

Examples:

[p̪ir̪ho] (ring of rope)

### 3.4.2

[ɪ] symbolizes a front, unrounded vowel between close and half-close, in the articulation of which the front part of the tongue is raised to the hard palate, but it is nearly about two-thirds of the way between Cardinal vowels 1 & 2, and about half-way retracted from the front towards the central position. The lips are unrounded and the upper side rims of the tongue touch the upper molars.



The area of wipe-off which goes up to the second molar line is very much less than in the case of [i], thus providing a considerably wider air channel than in the case of [i] (see pgm 16, p113). The muscular tension is also considerably less.

The manner of its formation may formally be described as follows:

- i) height of the tongue : about one-third above half-close
- ii) part of the tongue  
which is highest: posterior portion of the front
- iii) position of lips: unrounded
- iv) opening between the jaws: narrow to medium

The tip of the tongue touches the lower teeth, but it varies sometimes, it is slightly withdrawn from them.

This vowel is marked by a low F1 380 (varying between 375-390) and a high F2 2075 (varying between 1950 and 2200). It may be observed that F1 is inversely related to the tongue-height. Since the vowel [ɪ] is about two-thirds lower than the Cardinal vowel 1, the F1 has correspondingly gone up. A much lower F2 indicates centralisation i.e. retraction towards the central position.

#### Distribution

- i) Word-initially: [ɪtə] (kick)  
[ɪki] (odd)
- ii) Word-medially: [pɪtə] (curse)  
[sɪrə] (brick)  
[nɪri] (throat)

- iii) Word-finally: [ɔrɪ] (a spice)  
 [pɪtɪ] (you curse)  
 [hundɪ] (power of sustenance)

#### Other Allophones

- i) Slightly centralised [ɪ] in word-final position, and  
 after  
 before sibilants.

#### Examples:

- a) Word-finally: [pɪtɪ] (you curse)  
 b) after  
 before sibilants: [sɪrə] (brick)  
 [zɪbənə] (tongue)  
 [ʃɪkərə] (hunting)

- ii) Slightly lowered [ɪ] when preceded by [h],

#### Examples:

- [hɪte] (here)  
 [bahɪ] (fire)

- iii) Retroflexed/retracted vowel quality before flaps,

Examples: [pɪrɔ̃] (a clandestine 'no')

### 3.4.3

[e] represents a nearly half-close, front, unrounded vowel. It is articulated with the front of the tongue raised to the hard

palate, about one-third lower than the Cardinal vowel 2, and slightly retracted. The lips are unrounded and the upper sides of the tongue are in loose contact with the upper molars. The wipe-off for [e] goes up to almost second molar line on the sides in the right. The air channel is wider than in the case of [ɪ]. See pgm 17 (p113).

The manner of its formation may be formally described as follows:

- i) height of tongue: slightly below the half-close position
- ii) part of the tongue which is highest: the front
- iii) position of lips: unrounded
- iv) opening between the jaws: medium

The tip of the tongue touches the lower teeth in the present writer's speech.

[e] is characterized by a slightly higher F1 (460) and a slightly lower F2 (2200) than in the case of other two front vowels, described earlier.

#### Distribution

- i) Word-initially: [eko] (unity)  
[esi] (upto that)
- ii) Word-medially: [bɛlo] (forest)  
[petu] (a glutton)  
[serə] (two pounds of weight)

iii) <u>Word-finally:</u>	[te]	(on)
	[pɪte]	(one may curse)
	[hunde]	(having means)

Other Allophones:

Retroflexed/retracted variety before flaps;

e.g.

[perɔ] (a candy)

### 3.4.4

[ɛ] represents a front, unrounded vowel which is about half-way between half-open and open. The tongue is low in the mouth and occupies a position which is roughly intermediate between the positions for the Cardinal vowels 3 and 4 and rather retracted. The lips are unrounded, and the sides of the tongue are in loose contact with the last two upper molars. The wip<sup>e</sup>off does not go beyond the second molar line. As a result, the air channel is widest in the articulation of the vowel sound [ɛ]. See Pgm 18 (p 113).

The manner of its formation may be formally described as follows:

- i) height of the tongue: between half-open and open
- ii) part of the tongue which is highest : the front
- iii) position of lips : unrounded
- iv) opening between jaws : medium

The tip of the tongue occasionally touches the lower teeth, sometimes is withdrawn from it.

The acoustic characteristics of the vowel [ɛ] include high F1 (700) and a high F2 varying between 1750 and 1800. A high F1 is indicative of the low tongue-height, and a middle high F2 is indicative of the retraction, rather centralisation. It is further more retracted than vowel [ɪ] which was characterized by a higher F2 (2075) than in the case of [ɛ]. Thus one can obviously conclude that F2 is an indication of tongue advancement.

In some speakers, there is a tendency to diphthongize the vowel [ɛ] which is realised as a monophthong in the present author's speech.

#### Distribution

- |                           |         |                     |
|---------------------------|---------|---------------------|
| i) <u>Word-initially:</u> | [ɛsi]   | (given to comforts) |
| ii) <u>Word-medially:</u> | [kɛdi]  | (a prisoner)        |
|                           | [sɛrə]  | (walk)              |
|                           | [bɛtə]  | (a poem)            |
| iii) <u>Word-finally:</u> | [tɛ]    | (decision)          |
|                           | [sɛ]    | (a thing)           |
|                           | [hundɛ] | (you might have it) |

Other Allophones: Retroflexed/retracted variety before flaps;

Examples:

[ʋɛrɔ] (revenge)

## 3.4.5

[ə] symbolizes a half-open, central unrounded vowel. It is articulated with the middle part of the tongue, very slightly retracted from the central position towards the back. The tongue is almost raised to the half-open position. The lips are neutral or unrounded. This vowel gives no palatogram. See pgm 19 (p 114).

The manner of its formation may be formally described as follows:

- i) height of the tongue: almost half-open
- ii) part of the tongue which is highest: the central
- iii) position of the lips: unrounded
- iv) opening between the jaws: medium

The tip of the tongue touches the gum of the lower teeth.

Because of the neutral nature of the vowel [ə], F1, F2 and F3 show about equal distances from each other. See sgms 9 & 10 (p 125).

#### Distribution

- i) Word-initially: [əto] (flour)  
[əsi] (eighty)  
[əcə] (come in)
- ii) Word-medially: [təro] (bottom)  
[təɾə] (get away)  
[pətə] (a belt)
- iii) Word-finally: [hʌndə] (availability)  
[sɪrə] (a brick)  
[səɾə] (funeral procession)

#### Other Allophones

- i) Retroflexed/retracted variety before flaps; e.g.,  
[pəɾo] (a lady's undergarment)  
[pəɾho] (you: read)
- ii) Slightly raised [ɛ̃] in word-final position, e.g.  
[sɪt̃ɔ] (a line)

## 3.4.6

[a] represents an open vowel with the tongue held very low down in the mouth. It ranges between a retracted low front vowel (closest to Cardinal vowel 4) with unrounded lips, and a fronted low back vowel (closest to Cardinal vowel 5) with a great deal of separation between the jaws. This vowel sound does not give any palatogram. See pgm 20,p114. The marking medium has remained absolutely intact, indicating that there is no contact between the sides of the tongue and the upper molars.

The manner of its formation may be formally described as follows:

- i) height of the tongue : fully open
- ii) part of the tongue which is highest : retracted front (central)
- iii) position of the lips : unrounded
- iv) opening between the jaws : wide

The tip of the tongue is usually withdrawn from the lower teeth.

The acoustic formant chart shows that the vowel [a] is marked by the highest F1 (800) which is indicative of the lowest tongue/vowel height, i.e. a fully open vowel produced with considerable opening of the oral cavity. Because of this large cavity size, the F1 and F2 are adjacent to each other, almost to the extent that they look interlocked. A comparison of the formant frequencies shows that [a] has a higher F1 and a lower F2 than [ε], for example.

Distribution

- i) Word-initially: [alo] (wet)  
                           [ano] (1/20 of a rupee)  
                           [ato] (anxious)
- ii) Word-medially: [salo] (brother-in-law)  
                           [pano] (a spanner)  
                           [kalɔ] (god of death)
- iii) Word-finally: [aia] (wet) pl.  
                           [pɔ̃ta] (belts)  
                           [hunda] (they might be)

Other Allophones: Retracted variety of [a] before flaps,  
 [ɾ] and [ɽ] and a retroflex nasal [ŋ].

Examples: [laro] (a slope)  
 [pharɔ] (a wound)  
 [karho] (decoction)  
 [manhu] (a human being)

## 3.4.7

[ɔ̃] represents a half-open, back, rounded vowel. It is articulated with the back part of the tongue, almost approaching the half-open position. The lips are slightly rounded without being pushed forward (see Lgm 7, p109). There is no contact between the upper side



rims of the tongue and the upper molars as can be seen from the pgm 21 (p 114) of the word [pɔ] (lie down). There is no suggestion of any wipe-off anywhere.

The manner of its formation may be formally described as follows:

- i) height of the tongue : nearly half-open
- ii) part of the tongue which is highest : the back
- iii) position of lips : rounded
- iv) opening between the jaws : medium

The tip of the tongue is usually slightly retracted from the lower teeth.

This vowel is characterized by low frequency components because of its very inherent low frequency nature. A comparison of formant frequencies of the vowel [ɔ] (F1 575, F2-F1 625) with that of [a] (F1 800, F2-F1 800) shows that [ɔ] has a lower F1 (575) indicating that this vowel is much closer than [a], and a shorter distance (F2-F1) indicative of its being a back vowel.

In some speakers, there is a tendency to diphthongize the vowel [ɔ], but it is realised as a monophthong in the present author's speech.

#### Distribution

- i) Word-initially: [ɔkho] (difficult)
- [ɔri] (a spice)
- [ɔlo] (emergency)

ii) <u>Word-medially:</u>	[sɔlo]	(simple, easy)
	[xɔfɔ]	(fear)
	[nɔdɔ]	(obstinate)
iii) <u>Word-finally:</u>	[tɔ]	(a blast)
	[cəʋəndɔ]	(you might say)
	[hundɔ]	(you might be)

Other Allophones: Retracted variety of [ɔ] when followed by flaps, .e.g.

[kɔro] (strong mustard seed oil)

#### 3.4.8

[o] symbolizes a half-close, back, rounded vowel. It is articulated with the back part of the tongue, slightly advanced, and approaching almost the half-close position for the Cardinal vowel 7. The lips are rounded without any prominent protrusion. This vowel sound does not give any palatogram, indicating lack of contact of the sides of the tongue with the upper molars.

The manner of its formation may be formally described as follows:

- i) height of the tongue : almost half-close
- ii) part of the tongue which is highest : slightly advanced back
- iii) position of lips : rounded
- iv) opening between the jaws : medium

The tip of the tongue is retracted from the lower teeth.

It may be noted in general that the first and second formants are very low in the articulation of back vowels. This back vowel [o] is marked by a low F1 ranging between 450 and 490 (Mean 470), and a low F2 ranging between 900 and 1050. The distance between F2-F1 was noted to be 505 frequencies which is clearly indicative of a back vowel.

Distribution:

i) <u>Word-initially:</u>	[ozarɔ]	(a tool)
	[orɔ]	(the after-birth)
	[olo]	(a parapet wall)
ii) <u>Word-medially:</u>	[polo]	(hollow)
	[potɔ]	(a grandson)
	[godɔ]	(a knee)
iii) <u>Word-finally:</u>	[hundo]	(he might be)
	[sɔlo]	(a sprout)
	[βelo]	(forest)

Other Allophones: Retracted variety before flaps; e.g.

[porho] (an old man)

### 3.4.9

[ɔ] represents a back, rounded vowel, which is about half-way between half-close and close. It is articulated with the back

of the tongue, very much advanced towards the central position. The tongue-height assumed for the vowel is about half-way between half-close and close position. The lips are rounded fairly closely (see Lgm 9, p 109). There is no contact between the sides of the tongue and the upper molars in the articulation of the vowel, and therefore the vowel gives no palatogram.

The manner of the formation may be formally described as follows:

- i) height of the tongue : between half-close and close
- ii) part of the tongue which is highest : the fore part of the back  
slightly centralised
- iii) position of lips : close lip-rounding
- iv) opening between the jaws : medium

The tip of the tongue is usually somewhat retracted from the lower teeth.

The vowel [ə] is characterized by a low F1 and F2. A low F1 is an indication of a high vowel, and a low F2 indicates that it is a back vowel. It may be noted that the distance between second and the first formant frequency (F2-F1) in the articulation of this vowel is much higher than that of [o] because of further tongue advancement towards the central position. Thus there is a good correlation between the degree of backness and the distance between the first two formants (F2-F1).

Distribution:

- i) Word-initially: [əsə] (the sunlight)

	[ʊnð]	(the wool)
	[ʊlu]	(an owl)
ii) <u>Word medially:</u>	[sʊrʊ]	(a tune)
	[gʊdʊ]	(a doll)
	[pʊrʊ]	(lids)
iii) <u>Word-finally:</u>	[pʊtʊ]	(a son)
	[pʊtʊ]	(floor)
	[petʊ]	(stomach)

Other Allophones:

i) Retracted variety before flaps; e.g.,

[mʊro] (you turn)

ii) Slightly centralised [ʊ] in word-final position;  
e.g.

[sʊrʊ] (a funeral procession)

### 3.4.10

[u] denotes a close, back, rounded vowel. The tongue height approaches almost fully close position but is slightly opener than the Cardinal vowel 8, and the tongue is more forward than the Cardinal vowel 8. The lips are maximally rounded leaving the smallest labial aperture (see Lgm, p 109). There is little or no contact between the upper side rims of the tongue and the fourth-molar. (See pgm 24, p 114 ).

The manner of its formation may be formally described as follows:

- i) height of the tongue : nearly close
- ii) part of the tongue which is highest: the back
- iii) position of lips: close lip-rounding
- iv) opening between the jaws: narrow

The tip of the tongue is generally somewhat retracted from the lower teeth.

The acoustic correlates of [u] show a low F1 340 (ranging between 325 and 350) and a low F2 (750), indicating that the tongue is at the highest position and is farthest back in the mouth.

It may be pointed out that the value of F2 is the lowest in the articulation of this vowel [u], showing that the tongue is farthest back in the mouth. One can undoubtedly say that the articulatory descriptions of vowels are related to the formant frequencies. The F1 is inversely related to the tongue/vowel height, and there is a good relationship between the tongue advancement and the distance between the two formants (F2-F1), i.e., they are far apart in front vowels, and close together in back vowels.

#### Distribution

i) <u>Word-initially:</u>	[uco]	(high)
	[undho]	(topsy turvy)
	[udo]	(discoloured)

ii) <u>Word-medially:</u>	[khub̌]	(plenty)
	[sudo]	(straight forward)
	[hunď]	(availability)
iii) <u>Word-finally:</u>	[babu]	(a clerk)
	[ɔ̌lu]	(an owl)
	[petu]	(a glutton)

Other Allophones: Retroflexed/retracted variety before flaps;  
e.g.

[kuro] (filth)

### 3.5 NASALITY

In the articulation of vowel sounds, described so far, the soft palate is raised and the nasal passage is completely blocked off. As a result, no air can pass through the nasal cavity. This closure of nasal passage is called 'velic closure'. If however, there is no velic closure, and the soft palate is lowered, the air can escape through both the nose and the mouth. The vowel sounds articulated with the lowered soft palate are termed 'nasalised' vowels. Nasalisation is symbolized by the diacritic tilde placed over the vowel symbol, e.g. [ĩ] [ďəhĩ] (tenth).

Nasalised vowels are common in the languages of the world. Like many other modern Indo-Aryan languages, there are a few instances in Sindhi when nasalisation is distinctive, i.e. it



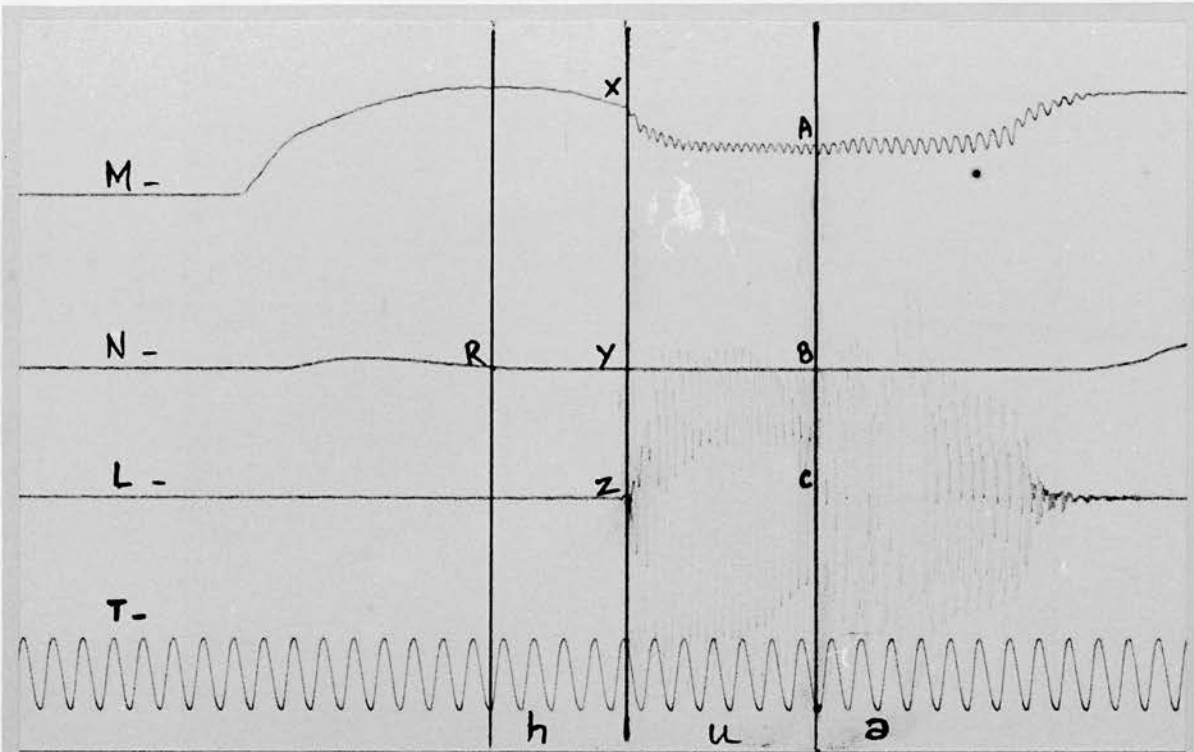
it is capable of distinguishing semantically one word from another. The following minimal pairs will illustrate it:

[əsi]	(eighty)	[əsĩ]	(we)
[huə]	(she)	[huə̃]	(otherwise)
[poe]	(having threaded)	[poẽ]	(the latter one)
[adhi]	(half-a-rupee)	[adhĩ]	(storm)

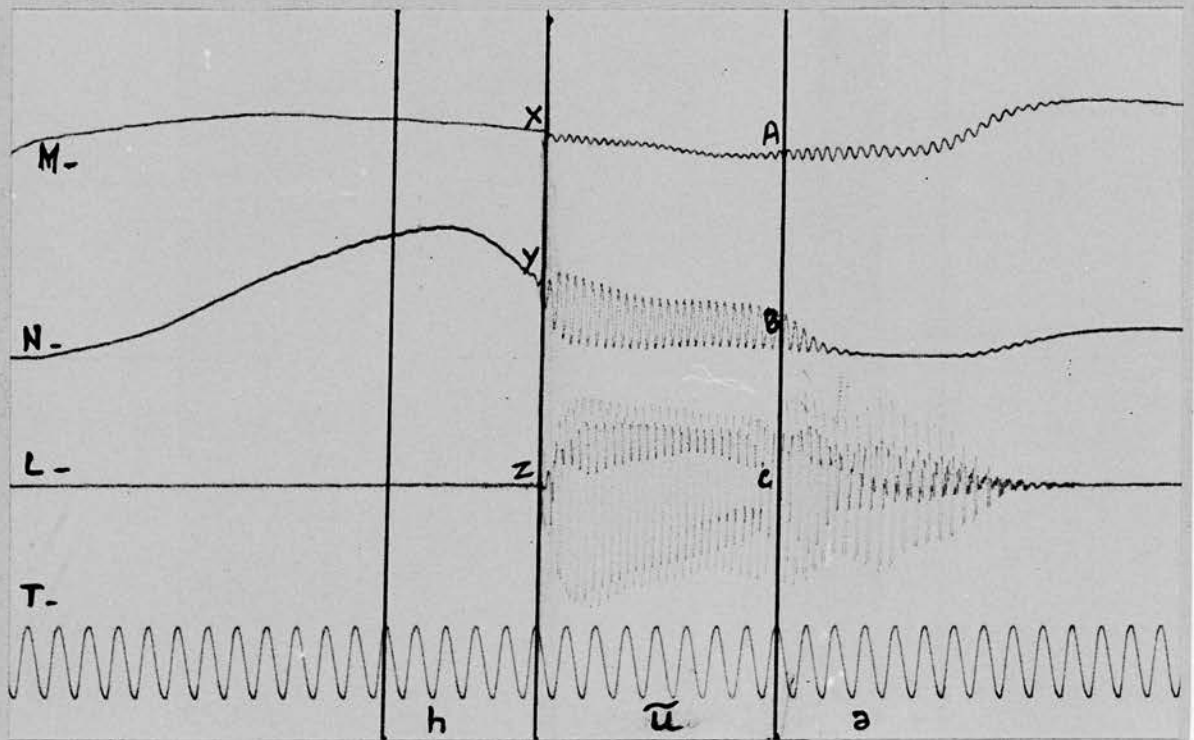
Kmograms 19 and 20 of the words [huə](she) and [huə̃] (otherwise) are reproduced on the next page.

Kgm 19 (p 165) - The delimited section Z-C on the L-tracing represents laryngeal waveforms and shows that the vocal cords vibrate during the articulation of the vowel sound [u]. Corresponding to this, the delimited section Y-B on the N-tracing is a straight line indicating a velic closure and that there is no airflow through the nasal cavity, i.e., the nasal cavity is blocked by raising the soft palate. Such a vowel is called an 'oral' vowel in the articulation of which, the air is let out only through the mouth as represented by the delimited section X-A on the M-tracing which is slightly higher than the zero line.

The delimited section Y-B on the N-tracing of the Kgm 20 (p 165) of the word [huə̃] (otherwise), however, clearly shows the presence of the strations of the waveforms, obviously suggesting that the air escapes also through the nose in the articulation of the vowel [ũ]. The corresponding section X-A on the M-tracing is also slightly higher than the zero line, thus proving that the vowel [ũ] in the word



Kgm.19 [huə] (she)



Kgm.20 [hūə] (otherwise)

[hu<sup>̃</sup>ə] (otherwise) is articulated with the combined resonances of the mouth and the nose together; hence the label 'nasalised' vowel.

The nasal tracing in the Kgm 18 (p 144) of the word [əsi] (eighty) again shows a straight line, whereas the delimited section Y-B on the N-tracing of the Kgm 17 (p 144) of the word [əsi<sup>̃</sup>] (we) evidently shows that the soft palate is lowered and the air is also let out through the nose in the articulation of the nasalised vowel [i<sup>̃</sup>] in [əsi<sup>̃</sup>] (we).

For the purposes of this thesis, nasalisation has been considered under the following two categories:

- i) 'Independent' nasalisation -, the nasalisation of vowels, without there being any nasal consonant in the neighbourhood as illustrated earlier in this section 3.5, is called 'independent' nasalisation.

The IPA symbol <sup>̃</sup> has been used to represent only the 'independent' nasalisation.

- ii) 'Dependent' nasalisation - A vowel in Sindhi tends to get nasalised when it either precedes or follows a nasal consonant. Nasalisation which is therefore on account of the proximity of a nasal consonant is called 'dependent' nasalisation.

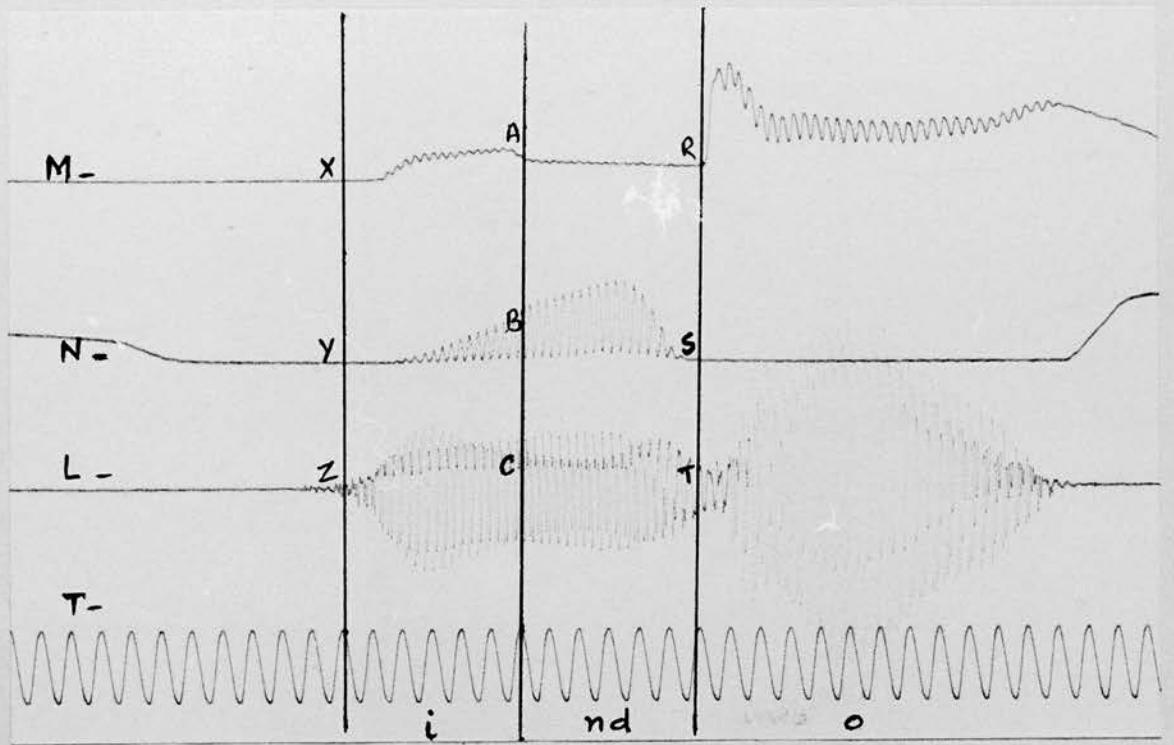
For example:

[indo]	(he will come)	Kgm 21
[mākhi]	(a fly)	Kgm 22

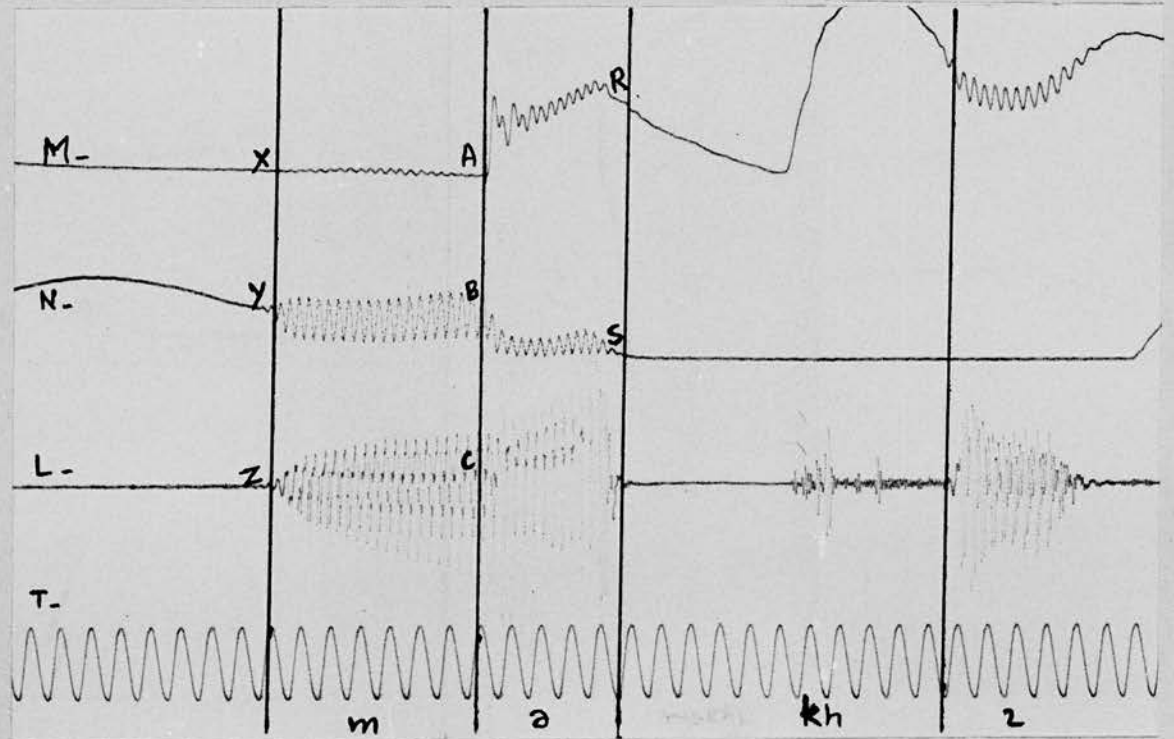
Dependent nasalisation may be either regressive as in the case of the nasalised vowel [i] in the word [indo] (he'll come) or 'progressive' as in the case of the vowel [ə] in the word [mðkhɫ] (a fly).

- a) Regressive Dependent Nasalisation - See Kgm 21 (p 168) of the word [indo] (he will come). The L-tracing shows the presence of laryngeal waveforms (i.e. the vocal fold activity) throughout the articulation of the word which indicates that all the sounds in the word are voiced. The delimited section A-R on the M-tracing is a straight line representing a closure in the mouth in the articulation of the nasal consonant [n] and the following stop sound [d]. The sharp vertical upward displacement at point R symbolizes the release of the closure. The section B-S on the N-tracing, corresponding to section A-R on the mouth tracing, shows that the air is let out through the nose by lowering the soft palate in the articulation of the nasal [n]. But the lowering down of the soft palate commences very much earlier than the actual articulation of the nasal [n] so much so that a part of the preceding vowel sound [i] also gets nasalised which is represented by the waveforms in the delimited section Y-B on the N-tracing.

Thus the nasal consonant [n] has the effect of nasalising the immediately preceding vowel [i]. This phenomenon is known as 'regressive' dependent nasalisation.



Kgm.21 [indo] (he will come)



Kgm.22 [mākhi] (a fly)

b) Progressive Dependent Nasalisation - Kgm 22 (p 168) of the word [m̄əkhɪ] (a fly) illustrates the phenomenon of progressive dependent nasalisation. The soft palate is lowered for the bi-labial nasal consonant [m] so as to allow the air to escape through the nasal cavity as shown in the section Y-B on the N-tracing. The corresponding section X-A on the M-tracing is a straight line indicating that the mouth passage is closed by the two lips and there is no airflow through the mouth in the articulation of the nasal consonant [m]. But before the soft palate takes the position for the following oral vowel sound [ə] to form a velic closure, some of the air escapes also through the nose as well as the mouth. As a result, the following vowel [ə] is nasalised which is amply represented by the presence of striations in the delimited section B-S on the N-tracing.

Thus the nasal consonant [m] has the effect of nasalising the immediately following vowel [ə]. Such a phenomenon is called 'progressive' dependent nasalisation.

More than one hundred kymograms (some of which are reproduced on the next few pages) were made on different occasions after short intervals, to examine this phenomenon in different phonetic environments. Kymographic findings have conclusively shown that:

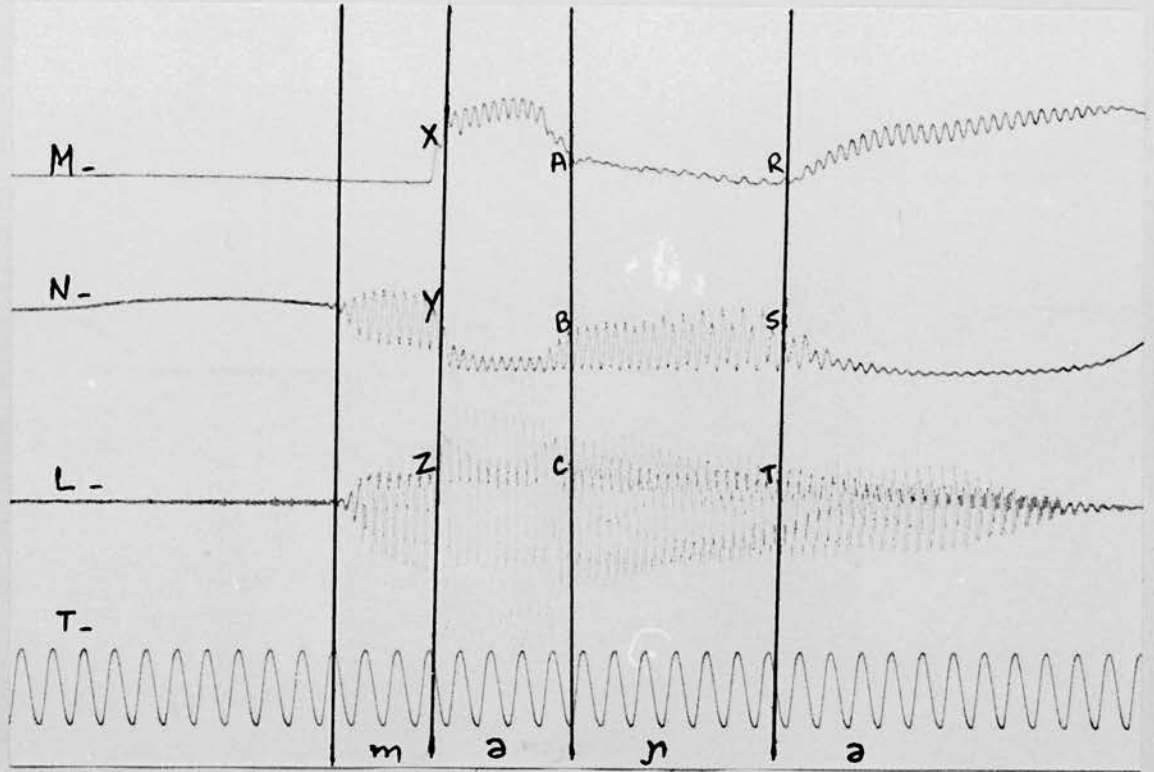
- i) In the words of the syllabic structure NV-NV, the vowel in the first syllable was noted to be heavily nasalised.

See Kgm 23 (p 171) of the word [mən̩ə] (marriage procession) and Kgm 24 (p 171) of the word [mən̩i] (a diamond). The presence of waveforms in section Y-B shows that the soft palate lowered for the articulation of the first nasal consonant remains lowered even during the articulation of the following vowel. It continues to remain lowered right up to the end so much so that the final vowel also gets nasalised, though not as much as the vowel in the first syllable.

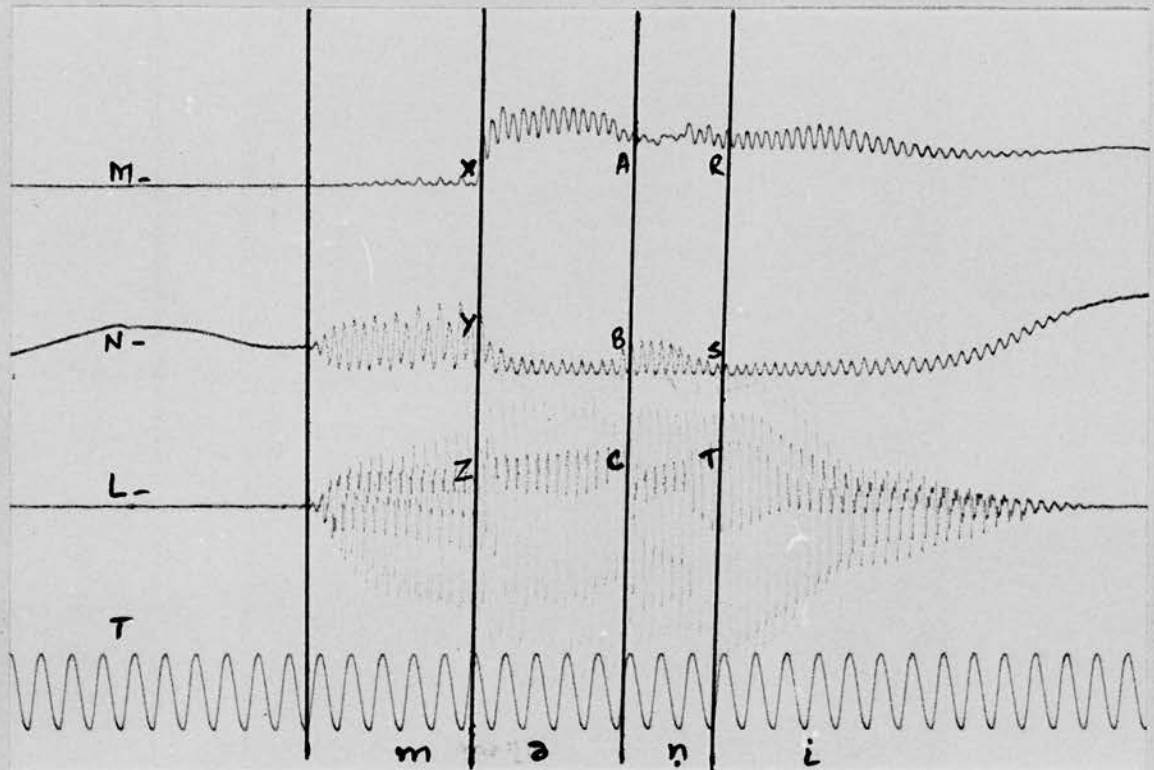
- ii) In the words like [indo] (he will come) (see Kgm 21, (p 168) and [undho] (somersault) of the syllabic structure VN-CV, it was noted that the vowel with a nasal consonant after it, in the first syllable, was nasalised (see Kgm 25, p172 )

However, the vowel with a nasal consonant after it, but preceded by a consonant (other than a nasal consonant) in the first syllable (i.e. of the syllabic structure CVN-CV) was noted to have no nasalisation as illustrated in the Kgm 26 (p 172) of the word [pən̩do] (a priest). The N-tracing shows a straight line up to point B when the soft palate is lowered for the articulation of the nasal consonant [n̩] and the air is let out through the nasal cavity as reflected in the waveforms shown in the section B-S. The straight line in the delimited section Y-B on the N-tracing clearly indicates that there is absolutely no suggestion of any nasalisation in the articulation of the



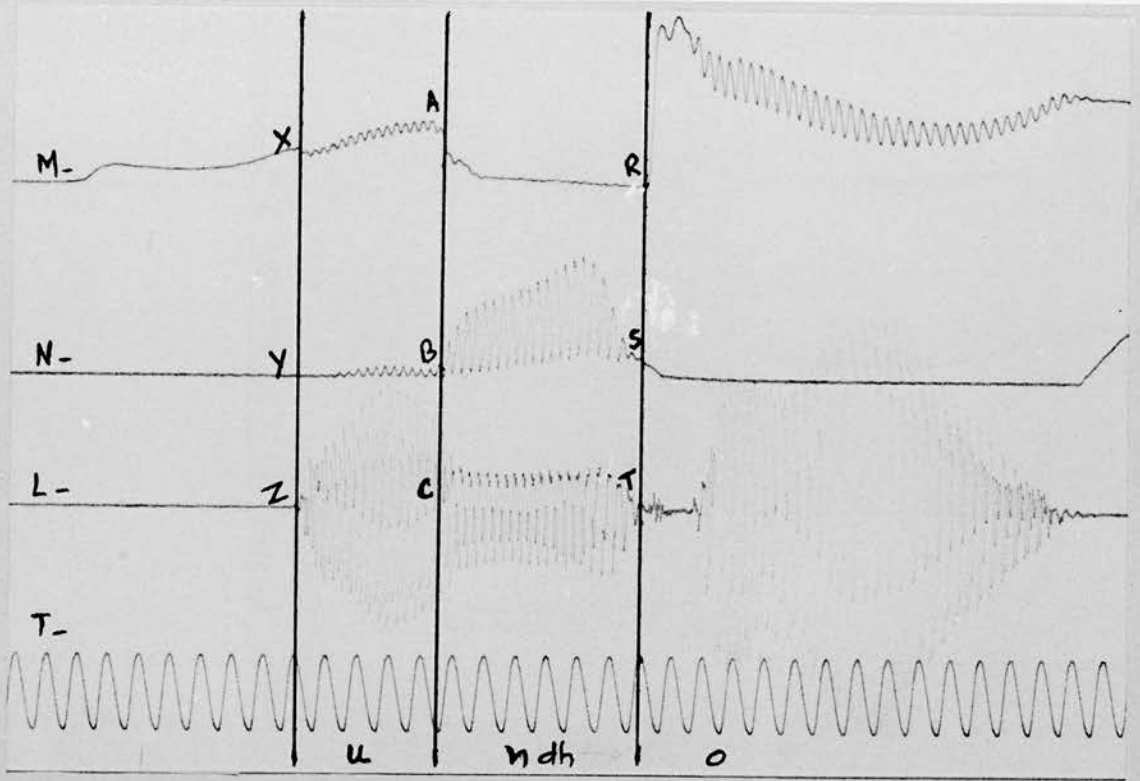


Kgm.23 [mɔ:pə]  
(a marriage procession)

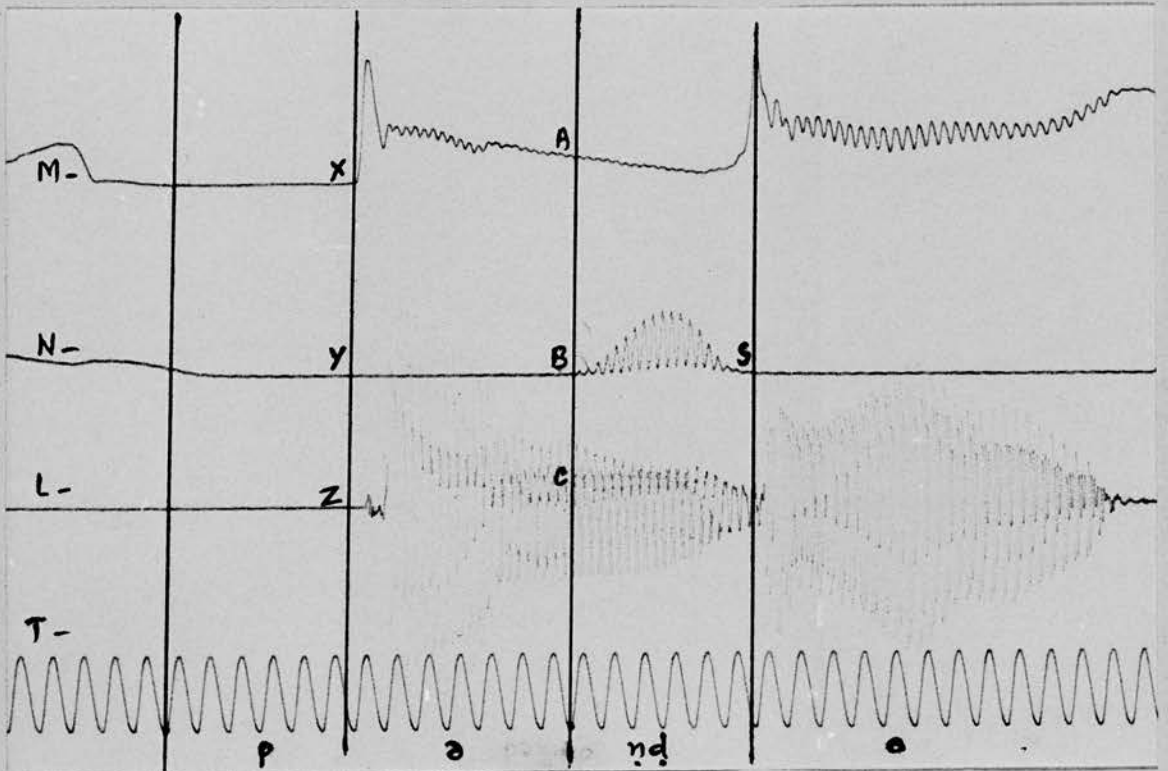


Kgm.24 [mɔ:ni]  
(a diamond)





Kgm.25 [undho]  
(somersault)

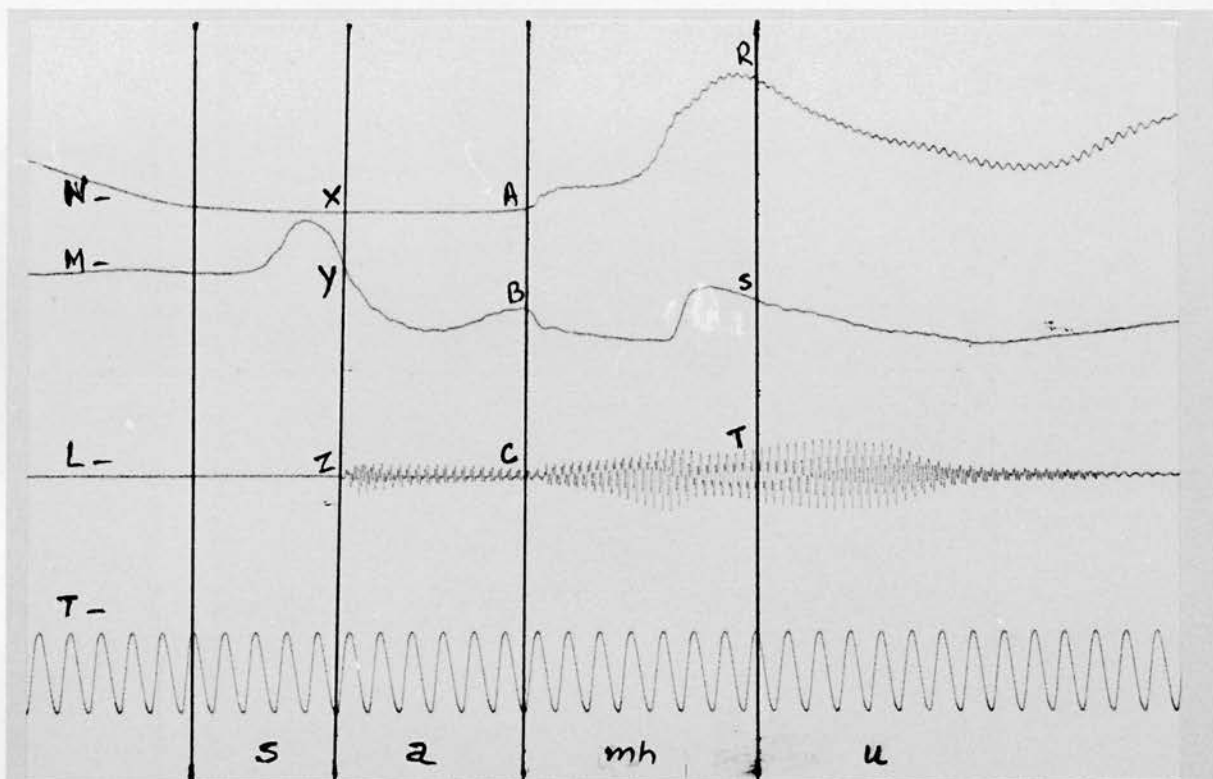


Kgm.26 [pando]  
( a priest)

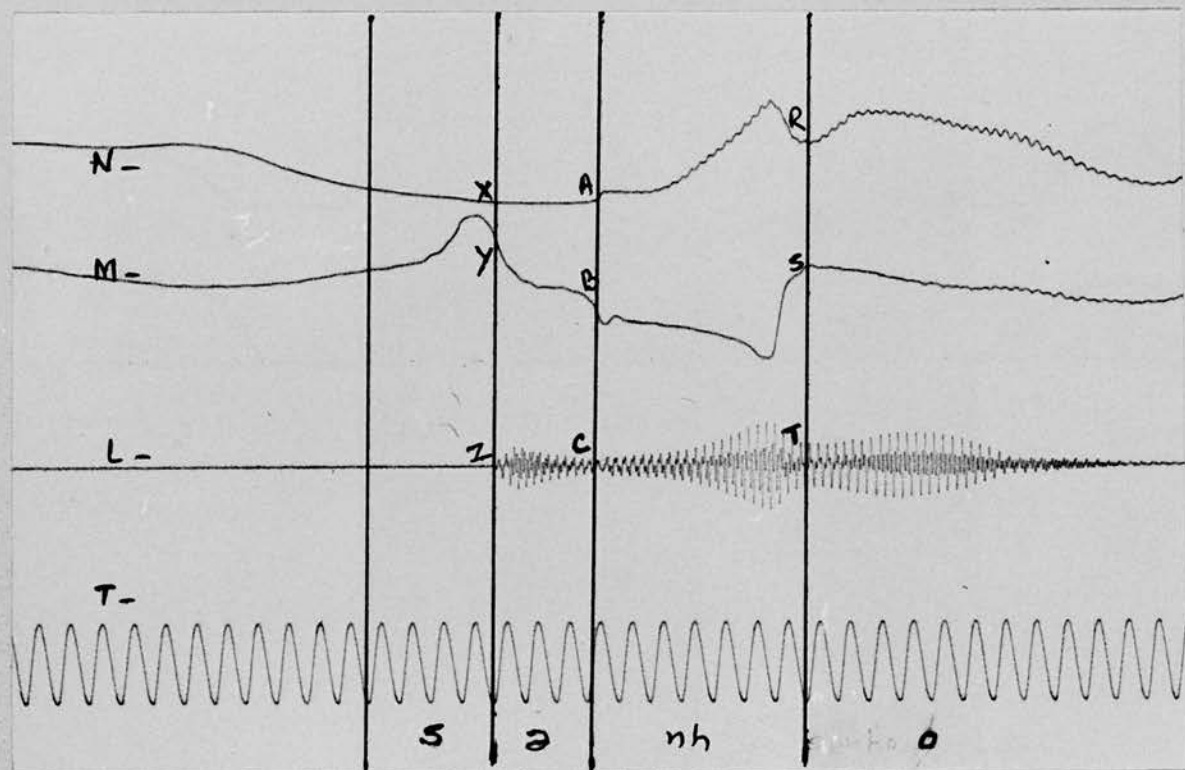
of the vowel [ə] in the first syllable in this phonetic environment.

- iii) The murmured nasals were noted to behave like their nasal counterparts, i.e. they also have the same effect of the following vowels as illustrated by Kgms 27 and 28 (p174) of the words [samhu] (in front of) and [sanho] (thin) respectively.

The nasal tracing upto point A in both the Kymograms under discussion is a straight line showing a velic closure. The soft palate that is lowered at point A on the N-tracing for the articulation of the murmured nasals [mh] and [nh] continues to remain in that position right up to the end of the two words and does not come to zero line even during the articulation of the following vowel sounds [a] in Kgm 27 and [ə] in Kgm 28. Thus the murmured nasals were noted to nasalise their following vowels.



Kgm.27 [samhu]  
(in front of)



Kgm.28 [sə nho]  
(thin)

## CHAPTER FOUR: THE SYLLABLE AND ITS STRUCTURE IN SINDHI

### 4.1 THE SYLLABLE

We have so far discussed aerodynamic, articulatory and acoustic features that characterize the speech sounds - consonants and vowels - in Sindhi. Together, they form the syllables. The concept of a unit higher than that of the sound segment has always existed ever since the ancient times. Though the syllable has proved to be a useful phonetic concept - this has been amply illustrated by the history of writing, it has always presented to phoneticians a challenge, perhaps a difficult task, to attempt a scientifically valid definition of the notion. Although everybody finds syllables to be comparatively easy units to identify, almost nobody can define them. In the words of Abercrombie (1967, p 34), 'the syllable would appear to be an intuitively recognisable unit even for primitive peoples'. It is an entity that could perhaps be taken for granted, and yet no phonetician has succeeded so far in giving an exhaustive and adequate description of the syllable.

Basically, there are two types of theories which attempt to define the notion of the syllable. Firstly, the 'sonority' theory of the syllable goes back to Jespersen and de Saussure who define the syllable in terms of properties of sounds. Other phoneticians have tried to define the syllable in articulatory terms - 'a puff of air from the chest'. (Stetson 1945). According to this theory, propounded by one of the American psychologists, Stetson, every syllable is initiated by a chest pulse. 'This theory is probably the best in so

far as it accounts for most of the facts....', remarks Abercrombie (1967:34). But unfortunately, subsequent direct instrumental investigations of the activity of the muscles themselves have failed to confirm Stetson's 'chest-pulse' theory. (See Ladefoged 1958, pp 1-14, Draper et al 1960). No physiological theory of the syllable, so far developed, seems to be adequately well-founded instrumentally to be acceptable as definitive and exhaustive.

However, the syllable has been used as the basic unit in the description of languages. 'Although there is no single muscular gesture marking each syllable (Ladefoged 1958,1967), we may still be able to define a physiological unit of this kind which will account for the timing and coordination of the articulatory movements. There is evidence (Kozhevnikov and Chistovich 1965; Ladefoged 1957; Lindblom 1968) that speakers organise the sequences of complex muscular events that make up utterances in terms of a hierarchy of units, one of which is of the size of a syllable; and it is certainly true that speakers usually know how many syllables there are in an utterance. We will therefore assume that a neurophysiological definition is possible, even if we cannot at the moment state it in any way'. (Ladefoged 1971:81)

Following Ladefoged, syllables have been considered here as abstract <sup>units</sup> in the mental activity of the speaker. The support for this view comes from various sources - the errors, the slips of the tongue etc.... (Fromkin 1965, 1973). Psycholinguists such as Osgood (1957) and others have presented a persuasive body of

evidence to argue that the minimal unit of speech encoding is the syllable. In fact, a syllable is the minimal utterance, and nothing less than a syllable can be pronounced.

It seems that as yet no totally satisfactory articulatory description/definition of syllable boundaries is available. The instrumental means have not proved to be any help either, to isolate or establish the syllable as a positive phonetic phenomenon. The syllable division, in this study, has therefore been based on the author's own intuition and kinaesthetic sensations and proprioceptive impressions. A syllable thus is an intuitively delimited entity in the connected speech.

#### 4.2 STRUCTURE OF A SYLLABLE

A syllable in Sindhi is comprised of three phases (Abercrombie 1967):

- i) the releasing phase,
- ii) the nucleus and
- iii) the arresting phase.

Each phase has a definitive place in the syllable structure. The element in the nucleus phase which is the central factor of a syllable is represented by a vowel sound symbolized as V; the elements in the 'releasing' and 'arresting' phases are characterised by consonant sounds symbolized as C. The elements in phases i) and iii) are marginal, these are rather optional components;

whereas every syllable in Sindhi necessarily contains a nucleus. Traditionally, consonants are defined as the 'body' of the language and vowels are its 'soul'. Thus all syllables in Sindhi, if we include the borrowed words of Persian, Sanskrit and English origin, have a vowel-nucleus with or without releasing or arresting consonants. Following is the basic phonetic structure of the syllable patterns in Sindhi:

	<u>Type of Syllable</u>	<u>Examples</u>
i)	V	[a] (come) [ɛ̃] (and)
ii)	VC	[om] (om)
iii)	CV	[po] (afterwards) [pi] (drink!)
iv)	CVC	[xɔ̃s] (happy) [xɔ̃f] (fear)

Syllables belonging to categories i) and iii) without a final consonant are referred to as 'open' syllables, those belonging to categories ii) and iv) will be, hereinafter, referred to as 'closed' syllables. These are four simple syllable patterns. But the complex syllable patterns arise when several C elements occur at the marginal places (i.e. the releasing and arresting components of the syllable). Such a phenomenon is known as consonant clusters, which is a sequence of consonant sounds embedded in one and the same syllable. Syllable patterns in Sindhi contain consonant clusters,



but of not more than three consonants. The maximum number of consonant elements constituting a releasing component in Sindhi is found to be 3. The maximum number of consonant elements constituting an arresting component is found to be 2. A generalised formula for the syllable structure in Sindhi would therefore be

(C) (C) (C) V (C) (C)

which could be further simplified and symbolized as

Co-3 V Co-2

#### 4.3 PATTERNS OF SYLLABLE STRUCTURE IN SINDHI

The phonotactic patterns have been based, as far as possible, on monosyllabic utterances. But monosyllables in Sindhi are not always representative of all syllable patterns. So polysyllabic words have been considered to account for various consonant combinations. The following are the patterns of the syllable structure in monosyllabic and polysyllabic words in Sindhi:

##### 4.3.1 Monosyllabic Words

- |                |                 |
|----------------|-----------------|
| i) Structure V | [a]      (come) |
|                | [ɛ̃]      (and) |

- ii) Structure VC      There are no examples of monosyllabic words of structure VC in Sindhi except the one given on the next page.



	[om] (om)
iii) Structure CV	[hu] (he)
	[to] (you)
	[bθ] (two)
	[ma] (I)
iv) Structure CCV	[sru] (begin)
	[bja] (others)
	[thjo] (happened)
	[hjo] (was)
v) Structure CVC	There are no examples of mono-syllabic words of the structure CVC except in foreign loan words from Persian, English and other languages; e.g.
	[xɔf] (fear)
	[xɔs] (happy)
	[sɔx] (rude)
	[rat] (night)

All these words tend to be pronounced by the younger generation as disyllabic words of the structure CV.CV.

vi) Structure CVCC	[ʊəkt]	(time)
	[zəbt]	(confiscated)
	[cəst]	(active)
	[bənd]	(closed)

A young Sindhi speaker tends to add either [ə], [ɪ] or [ə] at the end so as to pronounce these as disyllabic words of the structure CVC.CV.

vii) Structure CCVCC	[trəŋk]	(trunk)
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#### 4.3.2 Polysyllabic Words

##### 4.3.2.1 Structure of the Word-initial Syllable in Poly..

The dot (.) denotes syllable boundary.

i) Structure V	[ə.cə]	(come here)
	[a.lə]	(wet)
	[ə.nə]	(wool)
	[a.nə]	(1/16th of a rupee)
ii) Structure VC	[əl.tə]	(topsy turvy)
	[as.te]	(slowly)
	[at.ma]	(soul)
	[əm.bə]	(mango)

iii) Structure VCC	[eks. kə̃r. sən]	(excursion)
	[egz. bi.sən]	(exhibition)
	[ɛhn. sa]	(non-violence)
	[ɪnʒ. ne.rə]	(engineer)

All these are borrowed words of foreign origin.

iv) Structure CV	[kə. kə]	(half-baked)
	[mə. n̩ə]	(marriage procession)
	[ka.no]	(straw)
	[ra.nə]	(a leader)

v) Structure CCV	[pra.ni]	(a human being)
	[n̩ja.ro]	(unique)
	[glɑ.sə]	(glass)
	[xʊ a.hɪʒə]	(desire)

vi) Structure CVC	[hɪdʒ.ki]	(hiccup)
	[kə̃m. bə]	(claws)
	[mə̃n. tə]	(obedience)
	[n̩ə̃n.d̩i]	(small)

vii) Structure CVCC	[mə̃rt. bə]	(respect)
	[bə̃ns. bət]	(regarding)
	[lɔ̃ŋg. n̩ ə]	(to be crossed)
	[kũn.d̩ri]	(pinch)

viii) Structure CCVC	[prar.thna]	(prayer)
	[brah.mə.n̄]	(brahmin)

#### 4.3.2.2 Structure of the Word-medial Syllable in Poly...

i) Structure .V.	[d̄i.ə. n̄]	(to give)
ii) Structure .CV.	[a.za.r̄]	(nuisance)
	[o.za.r̄]	(tool)
	[əŋ.gu.r̄]	(grapes)
	[meh.n̄. ti]	(hardworking)
iii) Structure .CCV.	[əŋ. gre.zi]	(English)
	[s̄r.sū .ti]	(Goddess of knowledge)
	[s̄r.ḡ̄a.si]	(dead)
iv) Structure .CVC.	The only example that comes to the author's mind is	
	[ūd̄. mā. pai]	(high handedness)

#### 4.3.2.3 Structure of the Word-final Syllable in Poly...

i) Structure of .V	[kha.o]	(you, please, eat)
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	[sɔ̃.i]	(needle)
	[ma.i]	(mother)
	[dhi.ə]	(daughter)
ii) Structure .CV	[ɑ.no]	(1/16th of a rupee)
	[ma. nɦu]	(a human being)
	[at. ma]	(soul)
	[a.he]	(is)
iii) Structure .CCV	[ma.mlo]	(problem)
	[əm. bri]	(unripe mango)
	[ka. flo]	(caravan)
	[su. khri]	(gift)
iv) Structure .CCCV	[ban. drjũ]	(monkeys)
	[nən. dɦrjũ]	(small)
	[əm. brjũ]	(unripe mango)
	[bin. drjũ]	(short statured)
v) Structure .CVC	[gə. raʃ]	(garage)
	[be. sək]	(certainly)
	[eks. kər. sən]	(excursion)
	[bə. raʃ]	(a dam over a bridge)

vi) Structure .CVCC	[bðr.ʊðkt]	(at the same time)
	[bɔ. lðnd]	(high)
	[mi. tɪŋg]	(meeting)
	[gɪr. hðst]	(married life)
vii) Structure .CCVCC	[bðr. xʊast]	(adjourned)

#### 4.4 DISTRIBUTION OF CONSONANT CLUSTERS

A sequence of consonant sounds may occur across the boundaries of words or within a word itself. Within a word, it may occur across the syllables or within a syllable itself. 'It is important not to confuse a consonant cluster with a sequence of consonants which extends over two syllables'. (Abercrombie 1967:76). Consonant clusters (i.e. a sequence of consonants within a syllable) within a word only will be considered here. The number of such consonants, as seen earlier in the generalised formula (p 179 ) is either two or three.

A releasing cluster of either two or three consonants can occur word-medially, and of only two in the word-initial position. Consonant clusters do not occur in the word-final position. Few examples of clusters of two consonants are found in the word-final position only in imported/loan words from

Persian, English, Sanskrit.... It may be pointed out that they form a very low frequency occurrence in Sindhi.

Following is a summary of the distribution of consonant clusters in Sindhi:

#### 4.4.1 Consonant Clusters in Absolute Initial Position

(i.e. word-initial-cum-syllable initial consonant clusters)

Clusters with [j], [r], [l] and [v] as second element occur in this position.

i) [j] as the second element of the cluster is most frequent:

[pjarɔ]	(love)
[thjo]	(happened)
[njaro]	(unique)
[d̪jari]	(Diwali)

ii) [r] as second element of the cluster occurs in few words borrowed from Sanskrit, Persian and English:

[brahm̪n̪ɔ]	(brahmin)
[praɳi]	(a human being)
[krodhi]	(angry man)

iii) [l] as second element of the cluster occurs only in very few imported words from English:

[klasə] (class)

[glasə] (glass)

iv) [ʊ] as second element of the cluster occurs only in one word of Persian origin:

[x<sub>ʊ</sub>ahɪsə] (desire)

#### 4.4.2 Consonant Clusters in Junction Syllable Initial Position

(i.e. Word medial-cum-syllable initial clusters)

Consonant clusters with [j, r, l, ʊ, m, n, ŋ, r] as second element occur in the junction initial position.

i) All consonants occur with [j] as second element of the cluster.

[ka.hjə] (attacked)

[mə.ɲjə] (accepted)

[chə.ɖjə] (you give up)

[lə.bhjə] (found it)

ii) [m, n, ŋ, r, l] as second element occur with different consonants:

[təɾ.ʃmə] (translation)

[prəɾ.thnə] (prayer)



[p̄r.ḡno]	(province)
[̄m.bri]	(unripe mango)
[su.khri]	(gift)
[ka.flo]	(caravan)

iii) [v] as second element of the cluster has been noticed only with [ḡ, s] in loan words of Sanskrit origin and with [x] in loan word of Persian origin:

[s̄r.ḡvasi]	(late, dead)
[s̄r. s̄v̄ti]	(goddess of knowledge)
[b̄r.x̄vast]	(adjourned)

iv) A cluster of 3 consonants in the junction initial position has been noticed in a few words:

[ban.drj̄]	(monkeys)
[̄m. brj̄]	(unripe mangoes)
[bin. drj̄]	(short statured)

It may be pointed out that in a cluster of 3 consonants, the first element is a voiced occlusive, the second element is [r] and the third element is always [j]. It may also be observed that all these examples are feminine plural. Thus a 3 consonants cluster has very limited occurrence.

#### 4.4.3 Consonant Clusters In Junction Syllable-final Position

(i.e. Word medial-cum-syllable final clusters)

i) Clusters such as [ks], [gz], [rt] occur in a few borrowed words from English and Persian.

[eks. kəɾ. sən]	(excursion)
[egz. bi. sən]	(exhibition)
[mɔrt. bə]	(respect)

ii) Homorganic Clusters:

[bəns. bət]	(regarding)
[lɔŋgh. nɔ]	(to be crossed)
[ɪnʃ. nɛrə]	(engineer)

iii) Consonant clusters with [h] as the first element and a nasal as second element occur in a few words:

[cuhn.dri]	(pinch)
[ɛhn.sa]	(non-violence)

#### 4.4.4 Consonant Clusters in Absolute Final Position

(i.e. Word-final clusters)

Consonant clusters such as [kt], [st], [nd], [bt], [ŋk], [ŋg] occur in a few loan words:

[bər.ʊəkt]	(readily)
[bəndo.bəst]	(arrangement)
[bʊ.lənd]	(high)
[zəbt]	(confiscated)
[trəŋk]	(trunk)
[mi.tiŋg]	(meeting)

As pointed out earlier, these clusters in word-final position form a low frequency occurrence. A young Sindhi speaker tends to add either [ə], [ɪ] or [ʊ] at the end of each word.

## CHAPTER FIVE: PROSODIC FEATURES IN SINDHI

### 5.1 PRELIMINARY REMARKS

As pointed out earlier in the introduction, none of the works dealing with phonetics and/or phonology of Sindhi has dealt with prosodic features of the language in any but a cursory fashion. There is no denying the fact that the segmental features have a major role to play in the formation of language-bearing patterns, and have therefore traditionally received the maximum attention of linguists. However, the prosodic features like stress, rhythm, pitch and intonation also have a significant role to play in the speech continuum. It is a pity that practically no attention has been paid to these features. As a result, very little is known about these features in the field of Sindhi phonetics. To the best of present author's knowledge, no account of Sindhi intonation by any linguist is available.

An attempt is, therefore, made here to present a preliminary but systematic study of the pitch patterns in Sindhi. Any more detailed and systematic treatment of the subject could very well become a doctoral thesis in its own right.

### 5.2 STRESS

Stress is defined as the degree of force with which a syllable is uttered, 'a gesture of the respiratory muscles', to use Ladefoged's (1967) apt expression. A syllable is produced by pushing more air out of the lungs, i.e. the speaker expends more energy

in the articulation of the stressed syllables. When there is an increase in the amount of air being pushed out of the lungs, there is, correspondingly, an increase in the loudness of the sound produced. The feature of loudness has been traditionally looked upon as the perceptual counterpart of this general phonetic phenomenon termed 'stress'.

In this connection, Abercrombie (1976:52) remarks: 'Loudness is a poor clue to the presence of stress on a syllable anyway, and is probably never the only one. In any case it cannot, at present, be measured satisfactorily'. Abercrombie therefore has excluded from his definition of stress articulatory and auditory symptoms.

For the purposes of this study, the rise in pitch is a much more important indication of the presence of stress. An increase in the flow of air out of the lungs causes a significant rise in the pitch. A stressed syllable is usually on a higher pitch.

The role which stress plays in language systems varies considerably from one language to another. For example, in languages like English, German and Russian, all polysyllabic words include at least one strong stress, and the position of the stressed syllable in polysyllabic words cannot be changed. Thus stress is the permanent property of the word. In such languages, a succession of these stressed syllables largely contributes to the rhythmic patterns in connected speech. Stress in English also has a grammatical function, e.g. variations in stress are used to distinguish between a noun (object) and a verb (object).

Abercrombie (1976) has drawn a very useful distinction between 'stress' and 'accent', and he prefers to call stress at the lexical level (i.e. word-stress) 'accent'. He looks upon stress as a purely general phonetic term. He uses the term 'accent' 'not as a synonym of stress but in a very different way in a sense which is not general phonetic at all'. According to Abercrombie, accent has no auditory and physiological characteristics attached to it whatsoever; accent exists only at the lexical level'.

Following Abercrombie, the present author is of the opinion that Sindhi has stress, it does not have accent. Stress is not distinctive in Sindhi. All the syllables in a Sindhi word are about equally stressed. The only increase in stress that occurs in Sindhi comes on the last syllable of the phrase/tone group.

In Sindhi, stress is used simply to give special emphasis to a word or to point up a contrast of ideas or an implication. For example, if someone says:

[sita kafi piye thi]            (sita is having coffee)

the utterance implies that Sita is having coffee, the contrast being with the speaker's expectation that Sita usually does not have coffee. In the utterance

[ram@ x@t@ likhe tho]            (Rama is writing a letter)

the speaker obviously wants to emphasise that it is Rama (and not his sister) who is writing a letter.

### 5.3 RHYTHM

Every language has its own characteristic rhythm. 'Rhythm..

arises out of the periodic recurrence of some sort of movement producing an expectation that the regularity of succession will continue'. (Abercrombie 1967:96)

Basically, there are two types of rhythm:-

- i) Syllable-timed rhythm in which all the syllables are said with equal prominence and they occupy roughly the same length of time. Thus it is the syllables, rather than only stressed syllables that tend to recur at regular intervals.
- ii) Stress-timed rhythm in which there is a tendency for stressed syllables to recur at regular intervals, i.e. the time taken by each foot\* irrespective of the number of unstressed syllables, is roughly the same. Russian, English and other Germanic languages are well-known examples of languages with stress-timed rhythm.

Sindhi has a syllable-timed <sup>h</sup>rhythm. Unfortunately, no research work has been done in this area, as far as I know, by phoneticians in general. A scientific investigation of sentence rhythm in Sindhi will be a formidable undertaking; and anyway far beyond the scope of this thesis. A systematic study, based on empirical methods, of rhythmic features in Sindhi may perhaps be undertaken at a later date.

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\* A foot consists of a stressed syllable plus unstressed syllables upto the beginning of the next stressed syllable.

#### 5.4 INTONATION

Intonation is usually defined in terms of pitch variations or variations in fundamental frequency determined by the tension of the vocal cords. If the vocal cords are stretched, the pitch of the sound goes high. Pitch is the psycho-acoustic sensation of the fundamental frequency produced by the speed of the vibrations of the vocal cords. Fundamental frequency is the principal physical correlate of pitch, and it can be measured with the help of certain instruments, in terms of frequency values of the fundamental. The terms 'pitch' and 'fundamental frequency' are generally used interchangeably (i.e. as synonyms) by a great many people - one is an auditory sensation and the other is the physical property of the acoustic stimulus.

Robins (1964, p110) defines pitch 'as the acoustic result of the speed of the vibration of the vocal cords in the voiced parts of utterances'. It is 'a sensation, perceived by the listener and referable to a scale- as well as being related to the frequency with which the vocal cords of the speaker open and close during the utterance and which is measurable by instrumental techniques' (Carnochan 1964:399).

In ordinary speech, the pitch of the voice keeps continually changing. Variations of the fundamental frequency and thus of the pitch of the voice are termed 'speech melody' which is part of the spoken form of a language. This phenomenon of pitch-fluctuations (ie speech melody) is not confined to a particular group of languages only. It is a universal phenomenon found in the speech of all communities.



Many different kinds of information can be conveyed by speech melody. Basically, there are three main functions of speech melody: i) Speech melody (i.e. the fluctuations in the pitch of the voice) indicates the personal characteristics of the speaker, i.e. it functions as a bearer of affective indices. The pitch of the voice usually indicates the sex, age and a great deal of other non-linguistic information about the speaker's emotional state, whether he is calm or agitated, happy or sad and so on. These emotional messages are recognised and interpreted by listeners but there is a great deal of individual variation. A considerable body of work done in this field has inconclusively shown that the pitch changes conveying this sort of information are universal. Accordingly this function of speech melody is sometimes regarded as extra-linguistic and not a legitimate part of the language study. The other view is that intonation is one of the chief means by which a speaker conveys exactness and subtlety of meaning. Intonation is, therefore, crucial to the art of communication. A compliment with the wrong intonation is no compliment, and a polite request with wrong intonation is not polite at all. Thus 'the attitude - and emotional - signalling function of intonation is integral to language, and its description validly part of the task of the linguist'. (Brosnahan and Malmberg 1970:155). The present author subscribes to the latter view which he finds to be the more realistic one.

All languages use variations in pitch also to convey differences in meaning. The linguistic function of voice-pitch variations is

fundamentally of two kinds:

- ii) Variations in pitch are made use of to change the meaning of a word. For example, in Chinese, the consonant-vowel sequence [ma] pronounced with a high and level pitch means 'mother', but the same sequence pronounced with a high falling pitch means 'scold'. Pitch fluctuations that bring about the meaning of a word are called 'tones', and the languages using word tones are called tone languages. There are many Asian and African languages like Yoruba, Chinese, Punjabi, Japanese and Vietnamese in which contrasts of tone function at the phonological level, i.e. there are minimal pairs in which the single differentiating feature is that of tone. Thus one word in the language is distinguished from another simply because of the pitch fluctuation. The tone in such cases is part of the word's inherent phonetic structure.
- iii) Pitch variations have a grammatical or syntactic function. For example, the distinction between a statement and a question, between a question and a command and such sentence types can be signalled by pitch variations. The use of pitch for conveying syntactic information is called intonation.

Sindhi is an intonation language in which pitch variations (i.e. intonation) are likely to change the meaning of the sentence as a whole. The intonation of Sindhi is best analysed in terms of pitch movement, i.e. when the pitch of the voice rises, we have

a 'rising' intonation; when it falls, we have a 'falling' intonation. The syllable on which the pitch change takes place is called the 'tonic' syllable. The function of the tonic syllable is to identify the focal point of information in the message.

The following two sentences for example:

[əfə skul ↓uendo]      (he'll go to school today)  
 [əfə skul ↗uendo]      (will he go to school today?)

are exactly identical except for the fact that the first is uttered with a falling intonation and the second, with a rising intonation. The two sentences bring out the difference between a statement and a question with the help of intonation. The use of falling pitch movement to mark finality, statement and non-interrogative sentences occurs in by far the majority of languages; whereas the rising pitch is used conversely to mark incomplete utterances, questions and mid-sentence breaks to show that there is something still to come. Thus intonation has meanings which are super-imposed on the dictionary meaning of the words uttered and on the normal syntactic patterns of the language.

The description of intonation patterns in Sindhi is based on two views expressed as follows:

- i) '(The) communicative validity (of sentence utterances ) is signalled doubly - by the intonation and by the sentence pattern'. (Deneš 1960)

- ii) 'Intonation is a linguistic form in which information about the speaker's emotional attitude towards his subject matter (e.g. agreement, doubt, questioning) is encoded - an attitude not normally expressed in the phoneme sequences which convey the factual elements of information about the subject-matter'. (Deneš<sup>V</sup> and Milton-Williams 1962).

Intonation has thus both -affective and linguistic-functions.

Since we are interested in pitch as the basis for intonation system, we should be mainly concerned with measuring the fundamental frequency during voiced sounds of a speech sequence. It may however be pointed out that the absolute values of pitch in terms of actual number of vibrations per second are never linguistically important. In the description of the intonation system of a language, it is not the absolute pitch but rather the relative values of pitch that are significant. All prosodic features are usually stated in terms of their interrelationships with other items in the same utterances.

It must be realised that so far we have described intonation in terms of pitch variations or 'fundamental frequency' - the one is an auditory sensation, and the other is the physical property of an acoustic stimulus. But neither an acoustic nor auditory definition of intonation can be satisfactory because the concept of intonation is used in linguistic analysis, and therefore a def-

inition based on linguistic factors is required. An attempt will be made here to relate acoustic characteristics to intonation described in linguistic terms, i.e. in terms of information categories such as 'factual statements', 'questions', emphatic expressions, interjection, agreement with reservation, persuasion etc.....

#### 5.4.1 Instrumentation

In order to establish correlation between acoustic characteristics and intonation categories, the values of the fundamental frequency were obtained with the help of the trans-pitchmeter built by Børge Frøkjær-Jensen. The pitch was calibrated in 13 steps from 60 Hz to 300 Hz.

The present author spoke the list of words and sentences into an electro-aerometer used for airflow measurements. The airflow curve was found to be very useful for segmentation. The signal from the throat microphone was passed through the pitchmeter. The trans-pitchmeter and the aerometer were both connected to a 16-channel Mingograph (an ink-writer) as a recording device. The paper speed of the mingograph was 10 cm per second. Thus mingograms displaying time (channel 1), the outward airflow through the nose (channel 2) and the mouth (channel 3), speech waveform (audio-signal) (channel 4) and fundamental frequencies (channel 5) were made of a large number of sentences in order to analyse the intonation patterns in Sindhi.

Moreover, an additional microphone placed at the open end of the aerometer was connected to a tape recorder. The tape recording was used as a control of what was said, but the speech recorded sounded slightly distorted to be used for making narrow band spectrograms to counter-check the intonation contours.

#### 5.4.2 Descriptions of Intonation Patterns in Sindhi

Since it is not possible to make an exhaustive analysis of the intonation patterns of Sindhi in a limited study of this type, it is absolutely essential to outline the limitations of such a study. This study is mainly confined to single tone-group sentences only. The examples selected are short enough for the speaker to utter in one breath so as to constitute a single 'breath' or 'tone'-group.

##### Division of Utterance into Tone-groups

A tone-group is a breath-group and a breath-group is a sense-group. For example, the sentence

[koṭhi nāndhi ahe] (It's a small room)

is said to be one tone-group. It's a short utterance and is said with one breath. It is not possible to produce long utterances with a single breath; so we tend to chop the stream of speech into pieces. In other words, we tend to take pauses when we say long utterances. The choice of the place at which pauses are taken is indicated by numerous grammatical and punctuation clues. For example, the sentence

[ma cəjo masi, /pəɾə hu bədhei nətho]

(I told him but he just couldn't be bothered about it)

*would not usually*  
~~cannot possible~~

be said at one stretch. A speaker would tend to pause after [masi]. Thus the above sentence consists of two tone-groups divided by an oblique line. There is no syntactic unit exactly corresponding to a tone-group though the tone-group is usually co-extensive with the clause, i.e. it comprises one information span. While analysing the intonation patterns, it was assumed that the largest utterance would be a single breath utterance which is also called a 'simple' tone-group. An exhaustive study of 'complex' tone-groups indicating various combinations and possibilities of intonation contours is outside the scope of the present study.

### Locating the Nucleus

Each tone-group has a separate nucleus or the syllable on which a change of pitch direction begins. This syllable is called 'nuclear' or 'tonic' syllable. It marks the beginning of the pitch movement - 'falling', 'rising', or 'falling-rising'.

The location of the nucleus is extremely important. It is very often the word to which the speaker wishes to give special prominence. Thus the function of the tonic is to identify the focal point of information in the message unit. An unmarked, non-topicalised, neutral sort of sentence, usually, has the nucleus on the last lexical item. (See sentence 1). For example






1. [ram<sup>0</sup> xət<sup>0</sup> likhe tho] (Rama is writing a letter)
2. [ram<sup>0</sup> xət<sup>0</sup> likhe tho]
3. [ram<sup>0</sup> xət<sup>0</sup> likhe tho]

It may be pointed out that the nucleus in sentence 2 is shifted to [xət<sup>0</sup>] because the speaker wants to emphasize the fact that Rama hasn't gone out but he is busy writing a letter. In sentence 3 Rama is the nucleus because the speaker wishes to emphasize the fact that Rama is busy writing a letter, which may imply that it is not his wife or his sister but Rama himself who is busy..... Thus the marked topicalised utterance may have a nucleus on a topicalised word. Locating the nucleus is very important, and this largely depends, as seen, on what the speaker considers to be important - the focal point of information in a tone-group.

#### Choice of the Pitch Contour

Various pitch changes are possible on the nucleus/tonic syllable. The tonic syllable is characterized by one of the following three pitch contours.

1. Falling denoted by mark 
2. Rising denoted by mark 
3. Falling-Rising denoted by mark 

The pitch movement begins on the tonic syllable and continues on the following syllables till the end of the tone-group. There are no large falling or rising changes in pitch noticed on any of the syllable other than the tonic syllable in a tone-group.

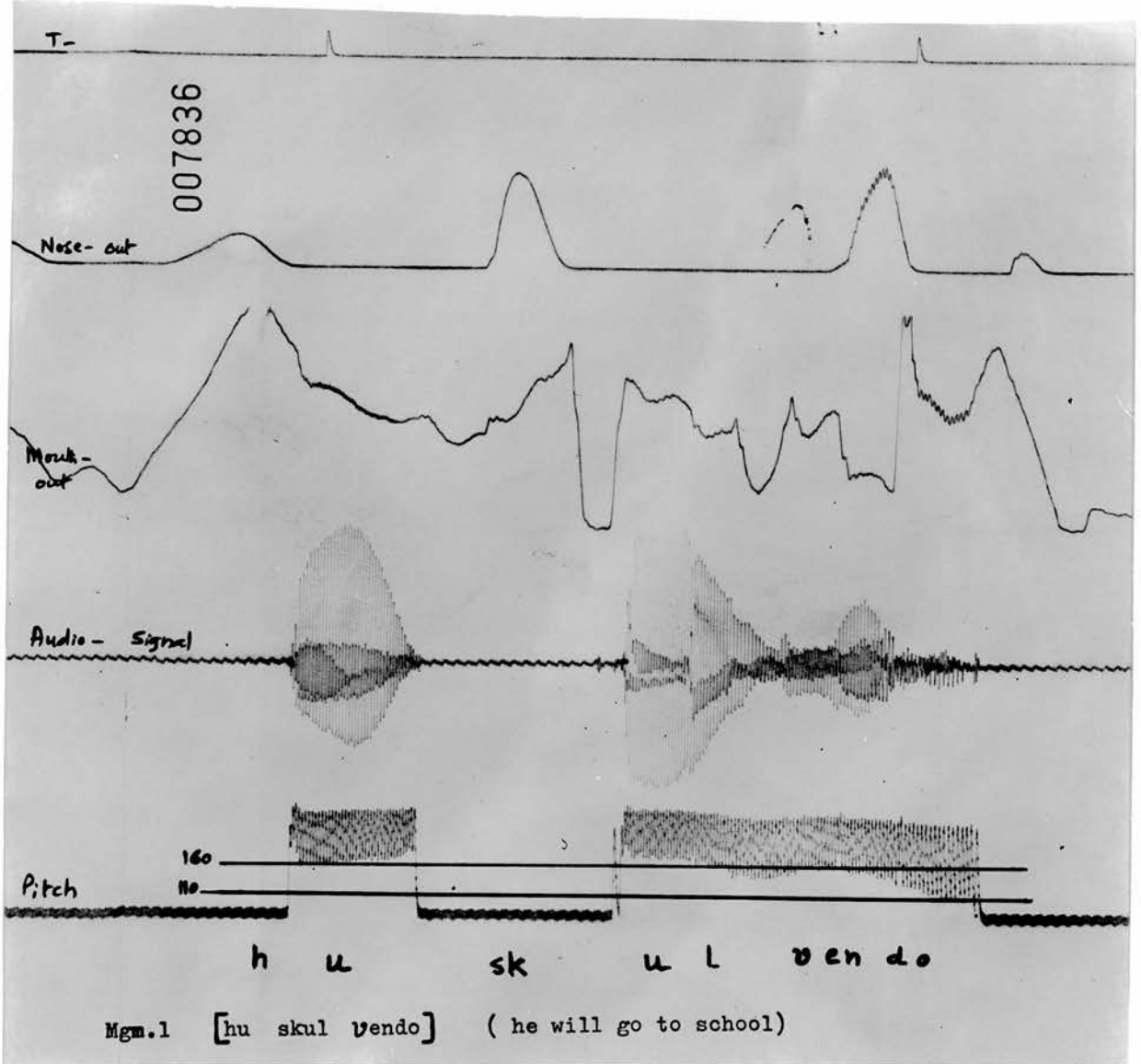


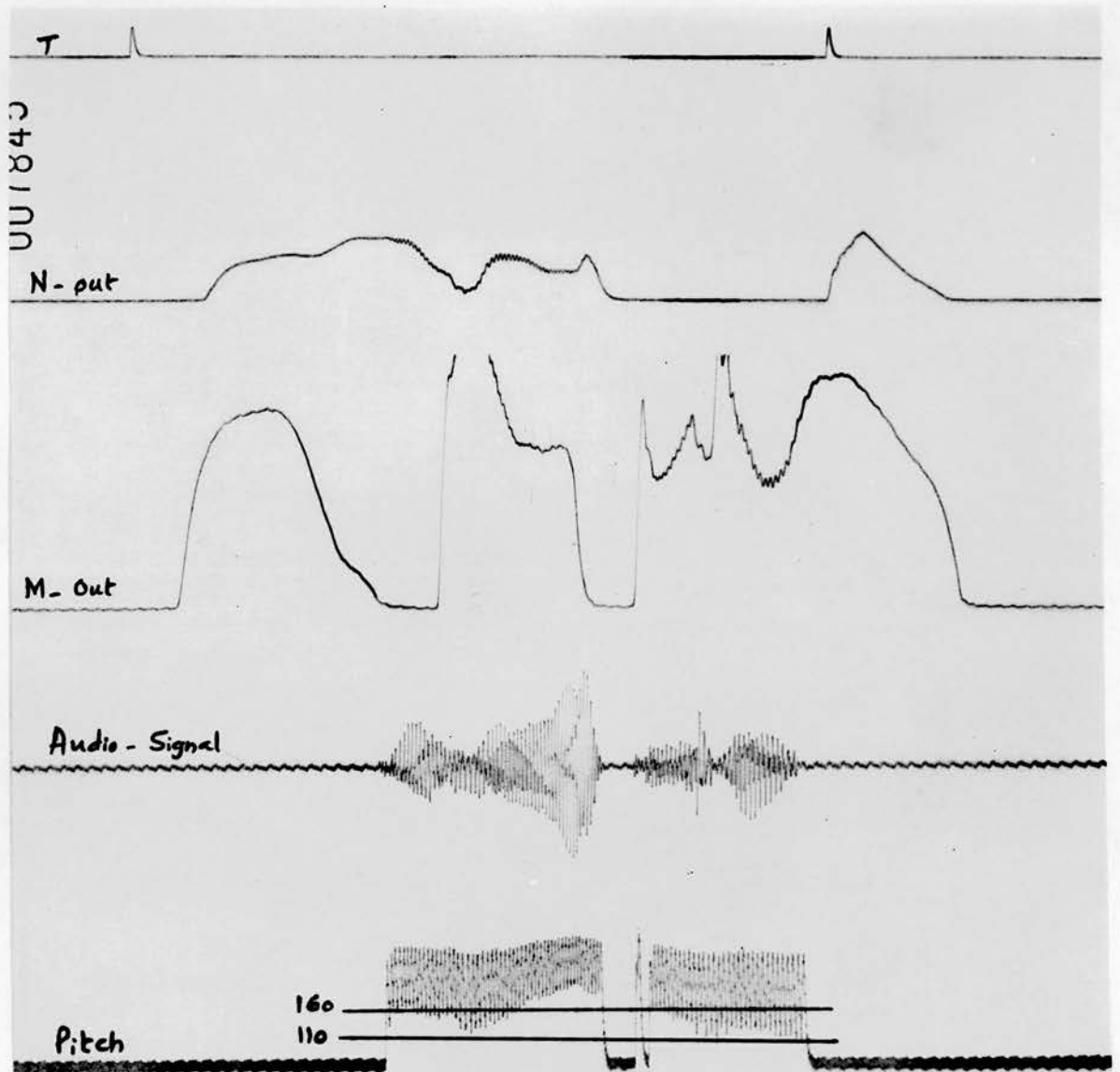
### Falling Intonation

The phonetic acoustic exponent of falling intonation is a narrow fall in pitch on the tonic syllable from mid to low between the range of 160-110 Hz. A narrow fall in pitch marks the finality of the utterance and is characteristic of 'cold' declarative statements, interrogative questions, exclamations etc... The word 'cold' denotes 'emotionally unmarked', 'neutral sort of', cool, calm, dispassionate and disinterested attitude of the speaker. A wider range of pitch variations was however observed in certain cases of emotionally marked utterances such as orders (see Mgm 4) implying assertiveness etc.....

Mgm. 1 (p 205 ) with simultaneous pitchmeter and the speech waveform recording shows variations in the pitch level of the syllables in the utterance [hu skul vendo] (he will go to school). The initial pitch level of 160 Hz may be ascribed to the first syllable. With a slight rise in the pitch level towards the middle of the utterance the pitch level then falls on the first syllable (i.e. tonic syllable) of the last lexical item [vendo] and terminates at 110 Hz.

Mgm. 2 (p206 ) of the utterance [ghəno pə̃rhi] (how much did you read?) shows the initial pitch level around 160 Hz clearly ascribable to the first syllable. The pitch level in the final word [pə̃rhi] begins to fall on the tonic syllable from 160 Hz and terminates at 110 Hz.





gha no pa rhi

Mgm.2 [gha<sup>h</sup>no pa<sup>h</sup>rhi] (how much did you read?)

Mgm. 3 (p 208) shows the initial pitch level at 180 Hz which may be attributed without any ambiguity to the first syllable of the utterance [ɔ̃thi] (get up). The falling pitch terminates at 110 Hz.

It may be pointed out that the wider range of the pitch movement (see Mgm 3) is usually characteristic of emotionally and attitudinally marked utterances; whereas a narrow range denotes emotionally unmarked, neutral sort of utterances. The intonation in all these examples may be simply described as falling and is illustrated in sentences of the following type. The tonic syllable is underlined and the values of the pitch measurements of the final word (which contains the tonic syllable) are stated in brackets against each example. The two numbers state the range of the pitch movements - the first number gives the point at which the pitch movement begins on the tonic syllable, the second gives the point at which the pitch level terminates.

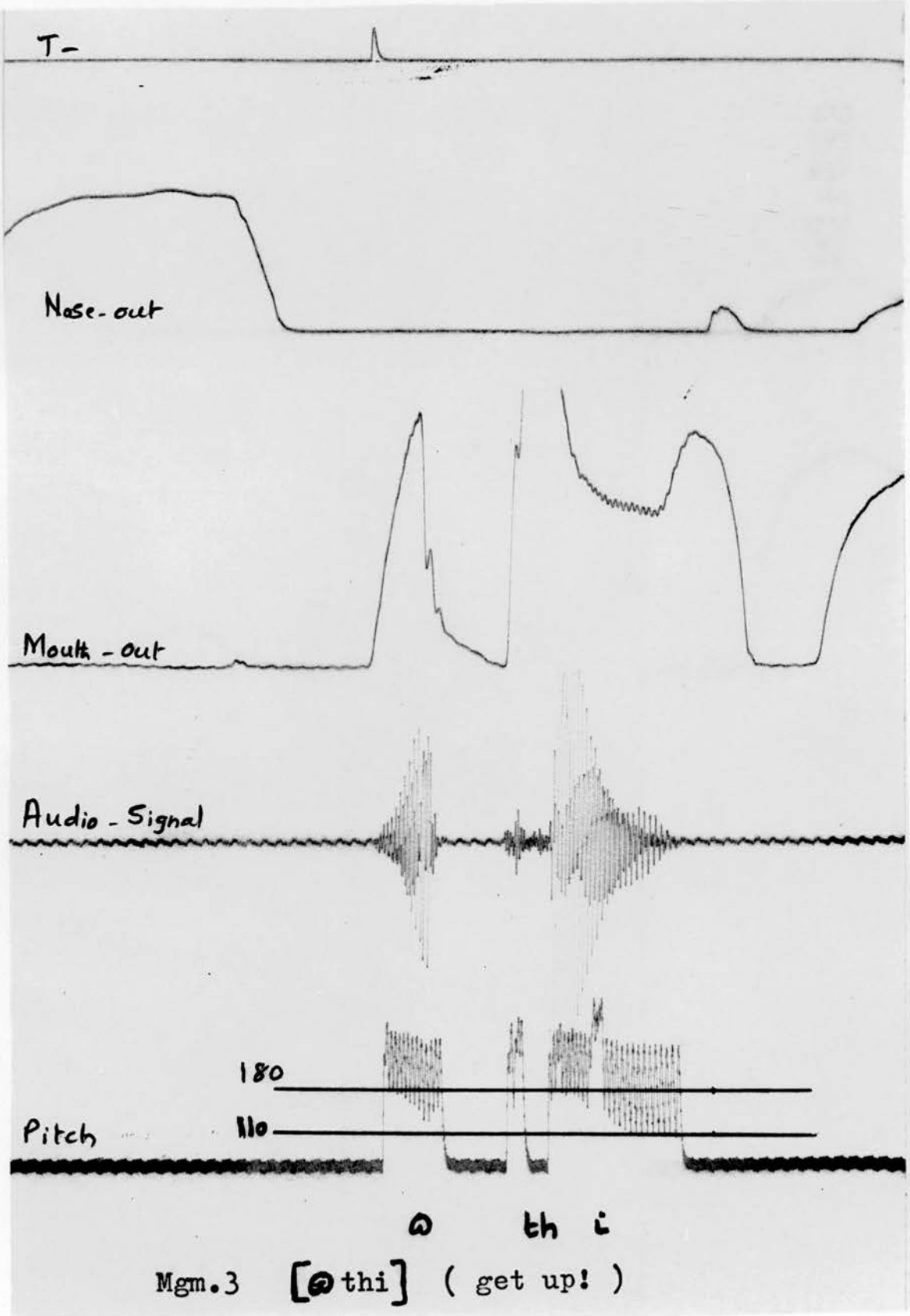
a) Factual Statements - complete and definite; e.g.

i) [hu skul uendo] (160-110 Hz)  
(he will go to school)

ii) [khirɔ̃ gə̃rɔ̃mɔ̃ ahe] (160-110 Hz)  
(milk is hot)

b) Questions which include 'interrogative words' such as [kɪthe] (where), [ghə̃no] (how much), [cha] (what) etc.

i) [kə̃lɪhə̃ cha khadho] (160-100 Hz)  
(What did you eat yesterday?)



- ii) [skul kithe ahe] (140-110 Hz)  
(Where is the school?)
- iii) [ghəno pərhi] (160-110 Hz)  
(How much did you read?)
- iv) [hi cha ahe] (160-110 Hz)  
(What's this?)

Questions that begin with interrogative words are usually intoned with a falling pitch movement in an unmarked situation.

c) Commands

- i) [dəri khəli] (160-100 Hz)  
(open the window!)
- ii) [mani khə] (160-110 Hz)  
(Have your meal!)
- iii) [həli vəṅə] (180-115 Hz)  
(go away!)
- iv) [əthi] (180-110 Hz)  
(get up!)

d) Exclamations

- i) [əmdo] (140-110 Hz)  
(It's excellent!)

- ii) [cəʒno] (150-110 Hz)  
(It's all right!)

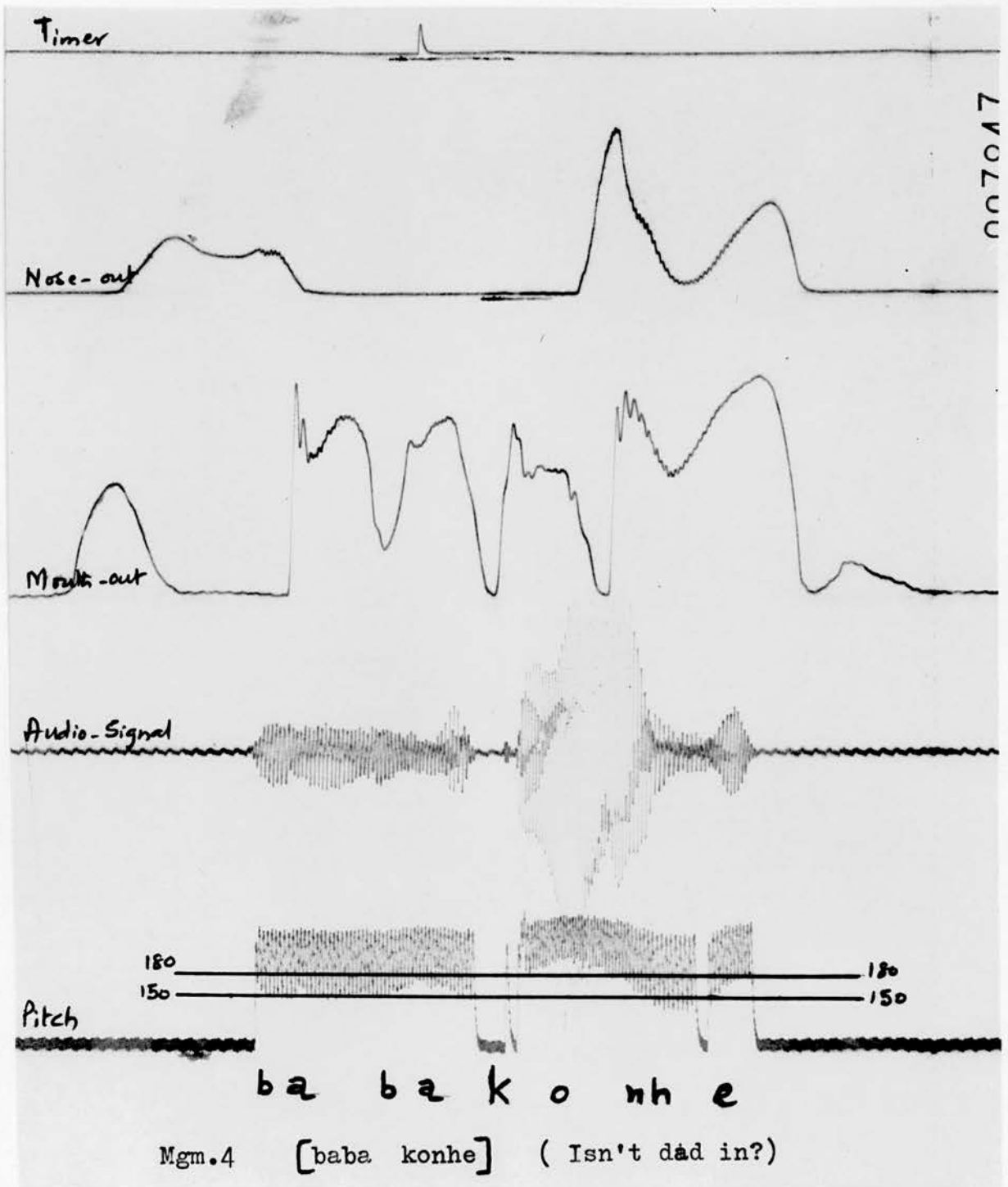
### Rising Intonation

The phonetic acoustic exponent of rising intonation is a rise in the pitch from low to mid between the range of 110-180 Hz on the tonic syllable. Utterances with this kind of pitch change include questions for which the most likely answers are either simple 'yes' or 'no', polite requests and counting. Repetition or echo-questions are noted to be characterized by a higher rise in the pitch movement to mark the emotions. such as shock, surprise etc..

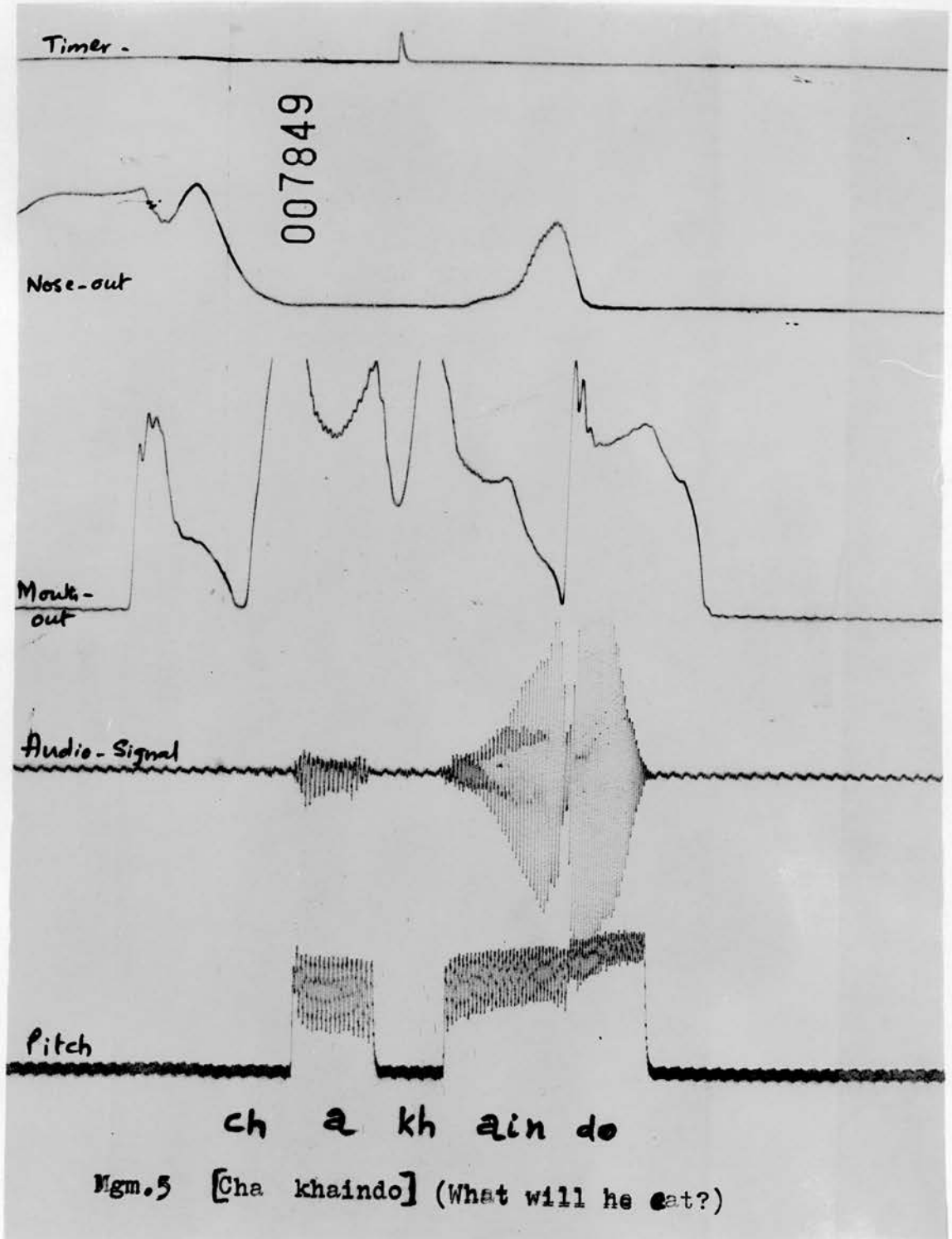
Mgm. 4 (p211) shows the variation in the pitch level of the syllables in the utterance [baba konhe] (Isn't Dad in?). The upward glide of pitch starts on the tonic syllable at 150 Hz and the termination is effected at 180 Hz.

This kind of narrow/non-high rise, which we might simply refer to as 'rising' is typical in questions requiring the answer 'yes' or 'no', and polite requests. It may be useful to distinguish between two kinds of rising intonation. There is another sub-type which has a larger upward pitch movement characteristic of surprise, irritating<sup>ed</sup> attitude....

Mgm. 5 (p 212) of the utterance [cha khaindo] (What will he eat?) illustrates the much larger upward pitch movement. The







pitch level on the tonic syllable begins to rise at 140 Hz. The rise is perceived to terminate at 250 Hz much higher than that on the tonic syllable in the utterance exemplified in the earlier type.

This sort of high-rising intonation is used when the speaker is under the influence of some emotion like great surprise or sudden shock. The whole clause is uttered at a fairly high tempo. It seems that the speaker finds it hard to believe in what has been said or has happened before. So he is eager to get confirmation or otherwise. Thus all the emotionally/attitudinally unmarked utterances like counting, polite requests, questions (yes-no type) are characterised by a low rise (i.e. a smaller upward pitch movement) on the tonic syllable; whereas wider pitch spans (a larger upward pitch movement) are characteristic of emotionally marked utterances to express surprise, irritation, implied criticism, echo questions. The intonation in all the sentences may be simply described as 'rising' and is illustrated in the sentences of the following types. The values of the pitch measurements are given in the bracket against each example.

a) Yes-no questions (seeking confirmation or denial)

i) [baba kohnhe] (150-180 Hz)  
(Isn't dad in?)

ii) [khir@ əthði] (120-140 Hz)  
(Do you have milk?)

- iii) [gh<sup>o</sup>m<sup>o</sup>nd<sup>o</sup> r<sup>o</sup>h<sup>o</sup>j<sup>o</sup>] (100-180 Hz)  
(Did he keep wandering?)
- iv) [mani khain<sup>o</sup>] (110-180 Hz)  
(Will he have his dinner?)

b) Repetition or Echo-questions

- i) [cha khain<sup>o</sup>] (140-250 Hz)  
(What will he eat?)

c) Counting

<sup>↗</sup> [b <sup>o</sup> ]	<sup>↗</sup> t <sup>o</sup> e	<sup>↗</sup> car <sup>o</sup> ,	<sup>↘</sup> p <sup>o</sup> h <sup>o</sup> ]
(two)	(three)	(four)	(five)
{160-180}	{150-180}	{140-170}	{200-120}

(The last one is usually said with a falling intonation to imply the finality of the utterance.)

d) Polite Requests

- i) [mani de] (120-160 Hz)  
(Please serve me dinner)
- ii) [p<sup>o</sup>t<sup>o</sup> d<sup>o</sup>ri kh<sup>o</sup>l<sup>o</sup>] (120-170 Hz)  
(Sonj<sup>o</sup>! please open the window)

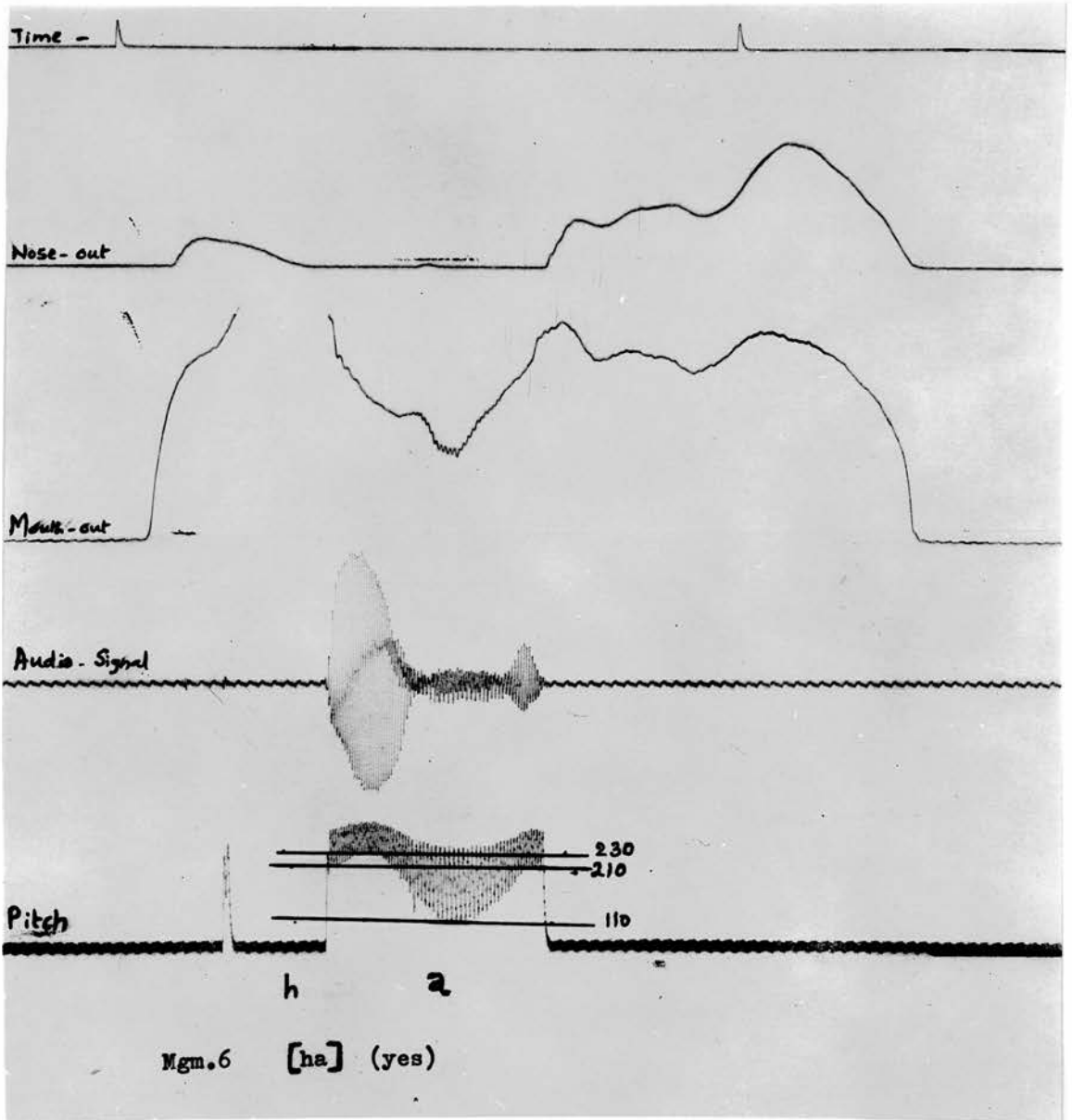
### Falling-Rising Intonation

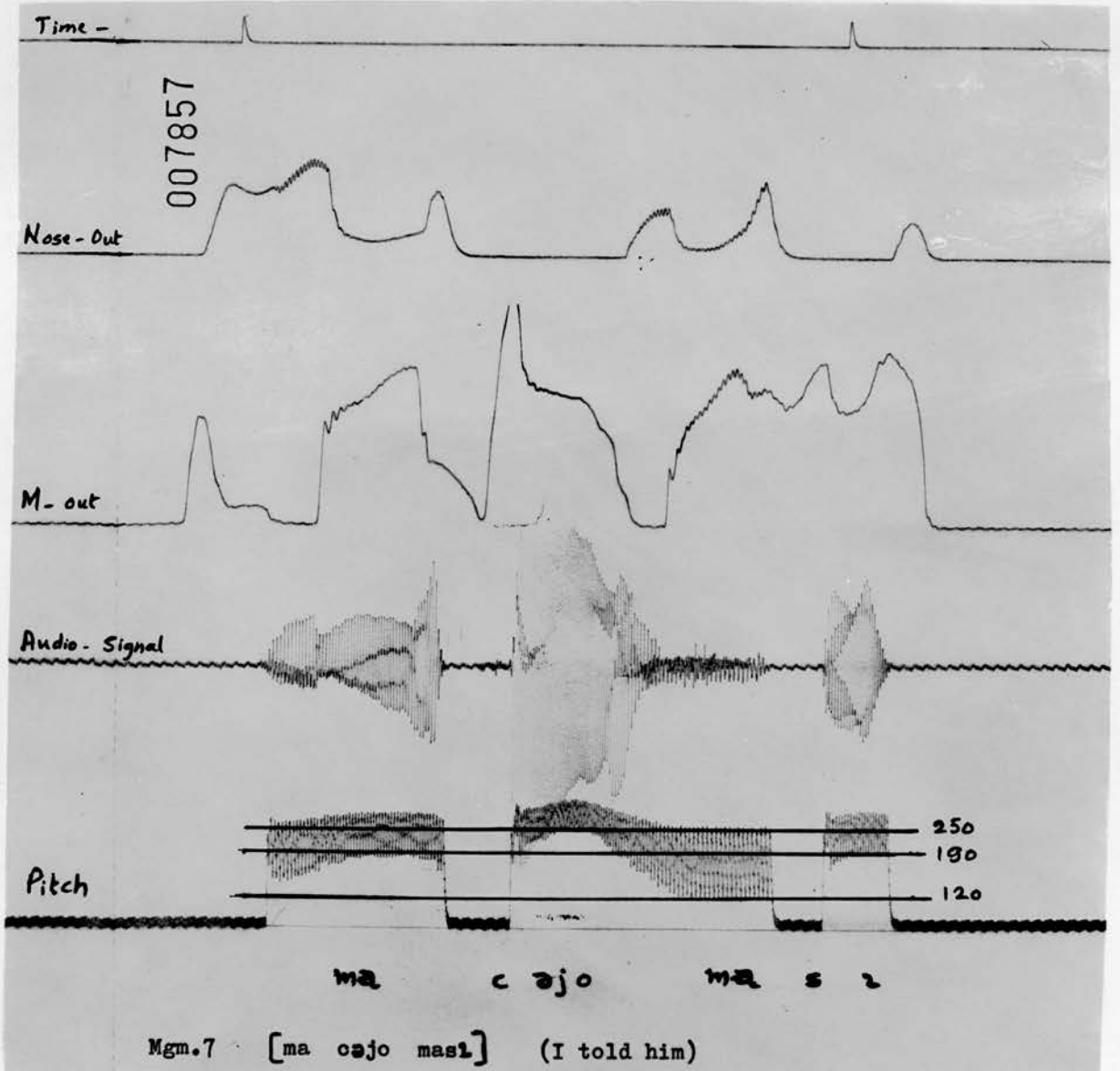
Both falling and rising intonations can occur in the same tonic syllable. This pitch movement is generally used in Sindhi to imply reservations, apprehension, special implications such as insults, unpleasant news, reassurances or doubts. Thus the falling-rising intonation marks the utterance emotionally as well as attitudinally; a lot is suggested rather than stated. It would seem that a speaker is making a statement or a comment but with some reservation. Therefore all the utterances with falling-rising intonation can be followed by [pəɾə] (but) and another clause.

Mgm 6 (p 116) shows the variations in the pitch level of the monosyllabic utterance [ha] (yes) characterized by 'falling-rising' intonation. The initial pitch starting at 210 Hz rises a little up to 230 Hz. A fall in the pitch level starts around 230 Hz and continues right up to 110 Hz, further followed at the end by a slight rise that terminates at 210 Hz. It may be observed that the starting of a fall in the pitch is preceded by a slight rise. Thus a falling-rising intonation is phonetically realised as (rising) falling-rising.

Mgm 7 (p 117) shows the spread of the falling pitch ascribable to the tonic syllable from 250 Hz to 120 Hz which is further followed by a rise in the pitch level up to 190 Hz in the utterance [ma cəjo masi] (I told him...).

The intonation in both these sentences may be simply described





as 'falling-rising' intonation and is illustrated in the following sentences.

- i) [ḍiːsə̃nə̃ ʃi ˌsə̃θi ahe] (225-110-180)  
 (She is pretty...), the implication being that she is not intelligent ...
- ii) [ghə̃rə̃ ˌsə̃θa ahini] (215-110-175)  
 (The houses are nice), the implication being that they are not perhaps centrally located etc....
- iii) [ma ˌcə̃jə̃ masi] (250-120-190)  
 (I told him), the implication being that 'but he couldn't care less'.

CONCLUSIONS

Results clearly show that Sindhi speakers do express intonation differences in a variety of acoustic dimensions. As can be seen from the above exposition, there are three basic simple intonational patterns in Sindhi. The following table shows the correlation between the acoustic characteristics and the information categories:

<u>Pitch Pattern</u>	<u>Range of the Fundamental frequency</u>	<u>Information Categories</u>
1. <u>Falling Intonation</u>		
a) Narrow fall	160-110 Hz	Emotionally unmarked factual statements.
b) Wide fall	180-110 Hz	Emphatic expressions, orders implying assertiveness
2. <u>Rising Intonation</u>		
a) Narrow rise	120-140 Hz 150-180 Hz 140-170 Hz	Emotionally unmarked Questions, counting, enumeration of things, polite requests.
b) High rise	140-250 Hz	Emotionally marked utterances like echo-questions, showing surprise, shock etc...
3. <u>Falling-Rising</u>		
	230-110-210 250-120-190	Emotionally/attitudinally marked utterances implying agreement with reservation, doubt etc.

TABLE XII: Showing correlation between acoustic characteristics and the information categories



The above mentioned data within the limited scope of this study are by no means adequate to enable one to draw any definite conclusions regarding the minute attitudinal shades characterised by various intonational differences. Some of the typical intonational contours used by a Sindhi speaker are illustrated here. There are numerous other ways in which intonational contours can be used to signal a speaker's attitude. Anyway, this is a preliminary study and the first attempt at making some valid statements on this important prosodic feature.

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