

# ACQUISITION OF FRICATIVES AND AFFRICATES IN HINDI

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**MASTER OF PHILOSOPHY**

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This may be placed before the examiners for evaluation for the award of the degree of MASTER OF PHILOSOPHY.

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**FOR MY DAUGHTER TANYA**

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Meenakshi Gupta  
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## TRANSCRIPTION

### VOWELS

	FRONT	CENTRAL	BACK
HIGH	I i		u U
MID	E e	A	o O
LOW		a	

### CONSONANTS

Pt. of Articulation	BI LABIAL	LABIO DENTAL	ALVEO LAR	PALETAL	VELAR
Manner of Articulation					
Stops	vl vd	p/ph b/bh	t/th d/dh		k/kh g/gh
Affricates	vl vd			č/čh j/jh	
Fricatives	vl vd	f v	s	š	
Nasals	m		n		
Laterals					
Trills			r̄	r	

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## INTRODUCTION

'The child provides the only opportunity that we have to observe language in its nascent state.' Karl Buhler-1935.

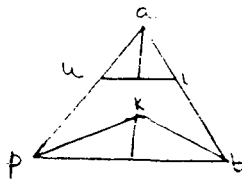
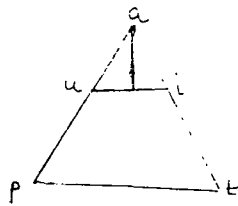
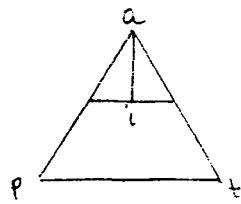
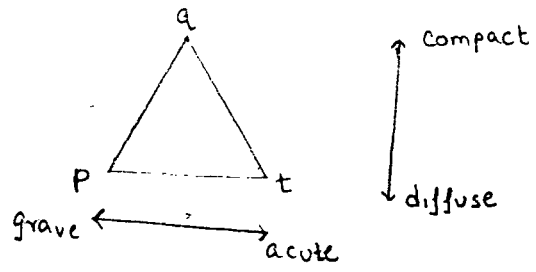
### 1.1 BACKGROUND

Child language has been the focus of linguists and psychologists for more than two decades now. Even earlier serious study of child language has been conducted for many years by non-linguists. But in the last two decades more and more linguists have joined others like psychologists, behavioral biologists and phoneticians in this kind of research. Child speech acquisition and development has come to be recognised as an important area of study for understanding the overall process of speech acquisition. Infant speech sounds are being studied on the assumption that their form might reveal important developmental aspects of speech. Several important questions may be studied in relation to vocalisations (the term as used by Kostič, refers to all kinds of utterances made by the infant or a young child) of the infants and young children. These include the classification of the vocalisations, the units of vocalisations, their relation to the units of the speech of the adults and stages of emergence of these units. What makes these studies difficult is the fact that the vocalisations change and develop even from one day to another. The progression of these vocalisations from one stage to the other is very fast and this makes their study

and classification very difficult. The normal child begins to produce noises and sounds right from the birth and slowly these cries and noises begin to acquire distinct phonetic shapes, and certain recurring patterns. Koštič (1971) also traced using spectrography the development of speech right from the first cry of the child. The spectographic study of the earliest developmental stages of speech by Koštič showed that the acoustic field of the first cry is very disorganised with expiration and inspiration intermingled and accompanied by noise. Immediately afterwards the expiration is separated from the inspiration and starts carrying the phonetic current. Within seven days the acoustic structure of the cry changes and the formant structures starts separating from the noise patterns. These formant structures later develop to be distinguished into vowels and the noise patterns acquire the structures of the consonants. The speech organs gradually become more stable. This starts showing within the first fifteen days of the child's life. At the end of the fifteen days one can find that the formant structures have become absolutely free of the noise patterns and are also distinct from the combinations of the formant structures and the noise patterns, which is the characteristic property of sonorants. This proves that acquisition of speech involves constructs that are functional very early in the life of the infant.

Thus to understand acquisition of speech it is very important to provide precise descriptions of the beginnings of the speech. In his 1941 study Jakobson<sub>4</sub> said that the development of speech producing skills in children may be viewed as occurring in a sequence of stages each of which is relatable to its preceding stage in a coherent way. This orderly progression seems to have certain universal aspects, universal not in the sense of "absolute prediction" but in the sense of "statistical probability". His theory of 'Phonological Development' says that the development of a phonetic system is the result of filling up of gaps between the two extreme sounds [p] and [a]. The process of development is differentiation. [p] is a consonant produced at the front region of the mouth. It is unvoiced and has a near total absence of acoustic energy. [a] is a vowel formed at the back of the mouth, is voiced and has the maximum of the acoustic energy. Thus [a] contrasts with [p] in every aspect. While [p] is the "optimal consonant" [a] is the "optimal vowel". In order to establish a phonemic system the space between [a] and [p] must be divided. The differentiation of the space between /a/ and /p/ is the result of successively introducing distinctive features. Jakobson summarises this process in terms of a series of vowel and consonant triangles which are reproduced below.

Jakobson further said that the phonemes that are relatively rare among the languages of the world are among the last phonemes to be acquired by the children exposed to these languages. In general rare phonemes embody more



JAKOBSON'S VOWEL AND CONSONANT TRIANGLES (1941)

distinctions of more subtle type than do the phonemes of wider distributions and these are acquired later. A natural order of acquisition and distribution therefore results from the latent but the universal structure of the distinctive features. For example, [Ø] in English is one of the last phonemes to be acquired. For the same reason most of the fricatives are acquired late as they involve more distinctions than the stops. The fundamental opposition between stops and vowels naturally precedes the opposition between the stops and the fricatives, according to Jakobson. ✓

The actual facts of this developmental course are yet to be obtained although several models of this development have been proposed based on the hypothesis that the distinction is from the least marked segment (in terms of features) to progressively more marked ones. Despite the fact that this developmental course has not been carefully analysed and that very little research has been reported on this, some data has been collected in various languages.

A study by R.E. Eblen<sup>5</sup> supported the position that children learning the phonologies of a particular language may produce forms exemplifying examples of general developmental processes across the languages. The study showed that in spite of individual variations, in general children acquire stops before fricatives and that stops act as substitutes for fricatives. This also corresponds with the developmental order of phonemes as given by Jakobson.<sup>6</sup>

A study by Paula Menyuk, also showed that the fricatives are the last sounds to be acquired as they embody more distinctions than the stops.

Some other studies on the acquisition of fricatives and affricates have also shown that these are the most difficult sounds for English speaking children to acquire (Ferguson, 1973), These are the last sounds to be acquired by older, normal children (Templin, 1957) and are the most difficult sounds to be acquired by children with articulatory delay (Morley, 1957).

A study by David Ingram, also showed that young children do acquire fricatives and affricates in a certain predictable order and stages along with certain substitutes that are more likely than others. He also emphasised that the individual differences are substantial though within certain limits.

## 1.2 SCOPE OF THE PRESENT STUDY

In Hindi fricatives and affricates are an important part of the consonant system. It has been noticed that these sounds are generally acquired later than other consonants though there are no specific studies that can be mentioned here. These sounds are also found to be generally more difficult to learn or acquire for :

1. foreign students learning Hindi when their mother tongue does not make phonemic distinctions within fricatives and affricates. These sounds also create problems for students whose mother tongue does not contrast between these sounds

and other stops.

2. children with speech problems : Speech and language problems as reported in various speech therapy clinics are of various kinds, ranging from dysarthria i.e. inability of motor reflexes to cope with the needs on one extreme and simple substitution & stammering on the other extreme. Aphasics of various kinds also exhibit certain patterns of speech and /or language loss and its subsequent reacquisition. Without going into the specific details of each of these groups, one may say that generally speaking these cases also show a greater difficulty in handling / acquiring fricatives as compared to other classes of speech like stops, nasals or laterals, liquids, glides and vowels.

Such children have more of difficulty in acquiring these sounds than others. The present work deals with the acquisition of six fricatives and affricates namely- /č/, /j/ /s/, /š/, /f/ and /v/ in normal children from Hindi speaking regions. The questions dealt with are;

1. What is the order of acquisition of these sounds, if indeed there is any order ?
2. What are main substitutes used for these sounds ?
3. What are the kinds and extent of individual variations that the children show in acquiring these sounds ?
4. Is the acquisition gradual or abrupt ?
5. Does the phonological position of the test sound in the test word (initial, medial or final) affect the production of the test sound ?



6. Does the method of elicitation i.e. spontaneous elicitation or elicitation by imitation affect the production ?

7. Is there any difference in the production of the test sound when the test word is produced alone and when it is produced in a sentence ?

Each one of these questions and many others related to these, arising during the course of this study were examined closely while analysing the data in chapters 4 and 5. Before discussing the procedural steps and methodology it is imperative to look at each one of the six sounds in question closely. The following chapter deals with a descriptive framework of fricatives in general followed by a detailed description of each one of these six sounds selected for the present study. The third chapter contains, apart from the methodological details, a description of the sample, the target groups and a discussion on the rationale behind the choice of the sample.

### 1.3 REFERENCES

1. Buhler, K. as referred in  
Deng F.C.C                      1984                      The Child's Acquisition of  
Sound patterns-Can it be Really  
Studied as Child Phonology-  
Language Sciences - Vol. 6, No. 1  
pp.107-127.
2. Kostic R.                      1971                      Speech and the Hearing Impaired  
child -pp-23-31-Publishers-Indian  
Statistical Institute of Calcutta
3. Jakobson, R. as referred in  
Mc Neill D.                      1970                      The Aquisition of Language- The  
Study of Developmental  
Psycholinguistics- pp.130-141 -  
Harper and Raw Publishers New York
4. Eblen R.E.                      1982                      A Study of Acquisition of Fricatives  
by Three Year Old Children Learning  
Mexican Spanish'-Language & speech  
Vol. 25, Part 3, pp201-220
5. Jakobson, R. as referred in  
Eblen R.E.                      ibid
6. Menyuk P.                      1968                      Role of Distinctive Features in  
Children's Acquisition of Language-  
Journal of Speech and Hearing  
Research-Vol.11 pp.138-46
7. Ferguson, C.A. as referred in  
Ingram D.                      1979                      Phonological Development:Production-  
P. Fletcher and M. Garman (eds)-  
Language Acquisition-pp.                      -CUE
8. Templin, M. as referred in  
Ingram D.                      ibid
9. Morley, M. as referred in  
Ingram D.                      ibid
10. Ingram, D.                      ibid

## CHAPTER 2

### FRICATIVES

#### 2.1 DESCRIPTIVE FRAMEWORK

Fricative sounds are those sounds in which a turbulent airstream is produced within the vocal tract. Chomsky & Halle, (1968) distinguished oral and nasal stops from fricatives by means of the feature continuant and fricatives from other continuant sounds like vowels and semi-vowels by features consonantal and lateral. Later Ladefoged<sub>2</sub>(1971) defined fricatives as those speech sounds which are produced by "a close approximation of two articulators so that the airstream is partially obstructed and a turbulent airstream is produced". This is now accepted as the conventional definition.

The gesture controlling the constriction in many fricatives has a greater degree of articulatory precision than that required in stops and nasals. Making the articulatory gesture for a stop simply involves moving one articulator so that it is held against another. It does not make much difference to the sound if the target position, which is the upper surface of the vocal tract, is a little higher or lower, so that the closure is formed tightly or gently. A stop closure will produce more or less the same sound as long as it is complete. The sound will be complete irrespective of whether it is a firm or a light articulatory contact. On the other hand, in a fricative a

variation as small as 1m.m. in the vocal tract will make a considerable difference. There has to be a very precisely shaped channel for a turbulent airstream to be produced. Moreover in a stop closure even the strength of the closure does not have to be constant throughout the gesture. On the other hand in many fricatives, especially in the sibilants, an exactly defined shape of the vocal tract has to be held for a noticeable period of time. This makes them more difficult to be produced than fricatives.

Fricative sounds may be the result of the turbulence generated at the constriction itself or it may be due to the high velocity jet of air formed at a narrow constriction going on to strike the edge of some obstruction like the teeth. These produce the sibilant and non-sibilant fricatives respectively.

Fricatives contrast just like other consonants in features like voicing, aspiration etc. but sibilance is one classificatory feature restricted to fricatives and affricates. Ladefoged, (1971) defined Sibilance as an "acoustic property referring to a noise spectrum with a comparatively strong energy at high frequencies." In many cases, sibilant or non-sibilant fricatives can be produced at the same place of articulation. The articulatory difference probably involves the profile of the tongue, rather than the position of the narrowest constriction. It is treated as an independent contrastive property of the fricatives. Of course sibilant or non-sibilant distinction

is only actually contrastive for sounds which are articulated with the forward position of the tongue.

Though in his 1971 study, Ladefoged, noted that the main distinction lies in the fact that the sibilants have a 'comparatively large amount of energy in the higher frequencies,' later in UCLA papers, Ladefoged and Ian Maddison (1986) stressed that this kind of distinction will have problems in avoiding classification of the palatal (non-obstacle) fricatives along with sibilants as both have large amount of energy in the high frequency regions. A more appropriate division, according to them would be based on the articulatory distinction of 'whether friction is generated by downstream obstacle or not.'

The Sibilant fricatives found in Hindi, and, discussed in this work are ;

- 1./s/ as in /seb/ (apple)
- 2./š/ as in /šer/ (lion)

The other fricatives discussed here are

a. Labio-dental fricatives in the Non-Central region;;

- 1./f/ as in /ful/ (flower)

{In Hindi now /ph/ and /f/ have become allophonic. Due to the Arabic, English and Persian influence words like /phul/ are now pronounced as -/ful/ by a large majority of Hindi speakers.}

- 2./v/ as in /veršha/ (rain)

This has an allophonic variant /w/ as in kAuwa (crow). However, the orthographic symbol remains the same for the two.

b. Palatal fricatives in the Non-Central region:

1. /č/ as in /čaku/ (knife)

2. /j/ as in /juta/ (shoe)

All these fricatives are freely found in all three phonological positions i.e. word initial, word medial and word final positions.

The following section deals with individual discussions on these six sounds. In Hindi only some impressionistic studies on these sounds are available. No detailed instrumental, acoustic or aerodynamic measurements of these sounds are available. Due to this reason the descriptions given by Kostič and Mitter<sub>6</sub> have been depended upon. In addition to the descriptions of the general articulatory processes involved in the production of these sounds they also give some measurements of acoustic energies involved in the production of these sounds.

## 2.2 SIBILANTS

### 2.2.1 /s/

This is a voiceless unaspirated fricative in Hindi Its graphemic form is 'स'. It is found in all three phonological positions as in the following words;

s- /sabun/- ( साबुन ) - soap  
-s- /pESE/ - ( पैसे ) - money  
-s / pers/ - ( पर्स ) - wallet

While /s/ is produced the vocal chords are not in action making it a voiceless fricative. The jaw angle for this sound is closed and is closer than for normal breathing. The lips are either in neutral position or are slightly stretched and the palate completely prevents the air from escaping through the nasal cavity. The tip of the tongue is firmly pressed towards the gum of the lower teeth, the body of the tongue is curved forming a hollow cavity in the centre. The mid part of the tongue is raised towards the alveolar ridge forming a narrow passage through which the airstream rushes out. The whole cavity being very narrow, a hissing sound is produced during the process due to the friction created by the airstreams it passes through the cavity. The acoustic field of this sound is located between 4000 Hz and 8000 Hz.

### 2.2.2 /š̌/

This is a Voiceless, aspirated fricative in Hindi. Its graphemic form is 'श'. It is found in all the three phonological positions as in the following words;

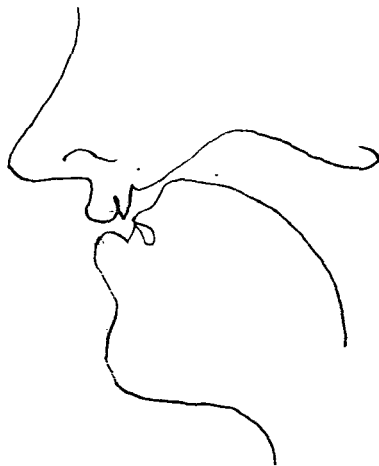
s- /ser/ - ( शेर ) - lion  
-s- /mesin/ - ( मशीन ) - machine  
-s /bres/ - ( ब्रश ) - brush

This has an allophonic variant /ṣ̌̌/ as in viṣ̌̌ (special). For the present study, both are treated alike, as free variants in non-contrastive distributions.

When /š̌/ is produced the vocal cords are not in action making it a voiceless fricative. While the action of the articulators is the same as for the sound /s/ their position is different. The lips are either neutral or are protruded, thus making the labiodental cavity a little higher than for /s/. The configuration of the tongue is also the same but the whole of the tongue is pulled back and the distance between the front part of the tongue and the lips is more than that for /s/. The front mouth is therefore larger for /š̌/ than for /s/.

The acoustic field of /š̌/ is also lower on the spectrum than for /s/. It lies between 2500 Hz. and 4500 Hz.





ARTICULATORY CONFIGURATION FOR S



ARTICULATORY CONFIGURATION FOR Z

## 2.3 LABIO- DENTAL FRICATIVES;

### 2.3.1 /f/

This is a voiceless fricative. Its graphemic form is 'फ'. It is found in all three phonological positions as in the following words;

f- /ful/ - ( फूल ) - flower  
-f- /tofi/- ( टोफी ) - sweets  
f- /serf/- ( सर्फ ) - surf

As can be seen from the above examples this fricative is largely confined to loan words from English, Arabian and Persian. These words have now become part of the Hindi vocabulary. The Hindi bilabial /ph/ has also become allophonic with /f/ as seen in words like [fir, ful, safal] etc. which were earlier pronounced as [phir, phul, saphal]. In certain styles, primarily literary and formal, however, the two continue to be distinct. The words like phir, saphal, phul are not pronounced with such substitutes.

During its production the inner side of the lower lip touches the edge of the upper teeth so that the airstream makes a friction while forcing itself through this loose contact.

During the pronunciation of /f/ the tongue is in a neutral position and it may tend to take the position of the following vowel. The soft palate is raised and the airstream is prevented from passing through the nasal cavity. The vocal cords are silent making it a voiceless consonant.

The acoustic field of the sound ranges from 4000 Hz. to 7000 Hz.

### 2.3.2 /v/

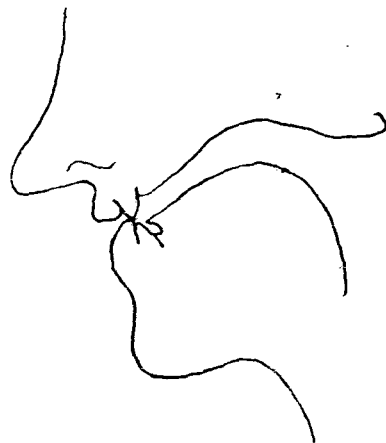
This is a voiced unaspirated labio-dental fricative in Hindi. Its graphemic form is 'व'. It is found in all the three phonological positions as in the following words;

v- /versha/ - ( वर्षा ) - rain  
-v- /chaval/ - ( चावल ) - rice  
-v /nav/ - ( नाव ) - boat

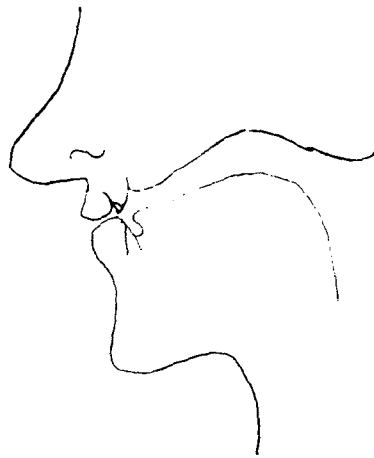
This has an allophonic variant /w/ as in kAuwa (crow) in Hindi. The orthographic symbol for both remains the same.

During the production of this sound the vocal chords are in action and so it is a voiced consonant. The inner side of the lower lip is in contact with the edge of the upper teeth creating an obstruction to the airstream resulting in generation of friction at this point.

The acoustic field of /v/ is from 4000 Hz. to 7000 Hz. or 8000 Hz.



ARTICULATORY CONFIGURATION FOR f



ARTICULATORY CONFIGURATION FOR v



## 2.4 PALATAL AFFRICATES

### 2.4.1 /č/

This is a voiceless, unaspirated affricate in Hindi. Its graphemic form is 'च'. It is found in all three phonological positions in the word as in the following words;

č- /čavAl/ - ( चावल ) - rice  
-č- /bAčča/ - ( बच्चा ) - child  
-č /pānč/ - ( पाँच ) - five

During the production of /č/ the vocal chords are not in action making it a voiceless phoneme. The soft palate is raised preventing the airstream from escaping through the nasal cavities. The tip and the blade of the tongue are stretched over the inner part of the front teeth from their edges to the alveolar ridge. The area of contact is closer than for the plosive /t/ i.e a larger part of the tip and the edges of the tongue are involved in the contact. The lips are slightly stretched. During the production of the sound the front barrier causes the airstream to form the onset of friction while forcing its way through the fissure. This results in a burst like acoustic energy.

The acoustic energy is concentrated in the region from 2500 Hz. to 5000 Hz. and a second region from 200 Hz. to 500 Hz.

#### 2.4.2 /j/

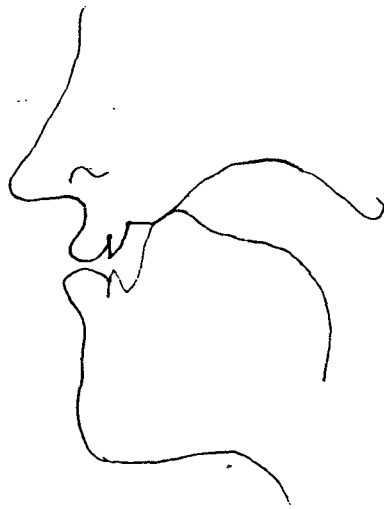
This is a voiced , unaspirated , palatal affricate in Hindi. It is the voiced counterpart of the voiceless palatal affricate /č/. Its graphemic form is 'ज'. It is found in all the three phonological positions as shown in the following examples;

j- /juta/ - ( जुता ) - shoe  
-j- /moja/ - ( मोजा ) - socks  
j- /frij/ - ( फ्रिज ) - fridge

During the production of /j/ the vocal chords are set in vibrations making it a voiced affricate. The soft palate is raised preventing the air from escaping through the nasal cavity. The front part of the tongue is in contact with the edge of the upper front teeth and the post-dental areas. A small cavity is formed just behind the front teeth and the quality of the affricate depends on this cavity.

The acoustic energy is concentrated in the region from 2500 Hz. to 5000 Hz.

/č/ & /j/ both contrast with respective aspirated counterparts /čh/ & /jh/ in Hindi like other stop consonants. Some examples of these are /čAl/ and /čhAl/, /jAlna/ and /jhAlna/.



ARTICULATORY CONFIGURATION FOR  $tʃ$



ARTICULATORY CONFIGURATION FOR  $j$

## 2.5 REFERENCES

1. Chomsky N. & M. Halle 1968 Sound Patterns in English- New York - Harper & Row
2. Ladefoged P. 1971 A Course in Phonetics- Harcourt Brace Jovanovich Publishers. (pp 9-10)
3. Ladefoged, P (1971) - ibid - pp92
4. Ladefoged, P (1971) - ibid - pp 9-10
5. Ladefoged P. and Ian Maddieson 1986 Fricatives (in) Some of the Sounds of The Worlds Languages (Preliminary Version) - in UCLA Working Papers in Phonetics- Vol.64 pp. 57-95 - Deptt. of Linguistics UCLA
6. Kostic R., A. Mitter and K.G.Rastogi 1975 A Short Outline of Hindi Phonetics -Publishers- Indian Statistical Institute of Calcutta



## CHAPTER 3

### METHODOLOGY & PROCEDURAL STEPS

#### 3.1 Data Elicitation

##### a) Selecting the sample group:

The subjects were children in the age group 1.6 years to 6.0 years. Though it is difficult to delineate clear-cut stages of development in speech (and language) learning, still, by 1.5 years, many children begin to exhibit use of single words. As John B. Carrol observes, "the first active voluntary use of vocal language approximating words in adult language is usually found at the end of the first year. From then, the child gradually develops his speech abilities and towards the end of the second year, there is a rapid growth in vocabulary." Due to this reason, the minimum age of the subjects was taken as 1.5 years, by which time the child is generally able to see the pictures, identify common objects, recognise lexical item representing the same. The words may or may not be pronounced correctly but in most cases, the child's differences have a distinctive resemblance with words in his native language. Again, as Carrol says, "the child gradually becomes capable of distinguishing the more frequently occurring phonetics of the language but does not attain full mastery in this respect until the age of 4 - 6 years or even later ... By the age of six, the average child has mastered nearly all phonetic distinctions of the language." Keeping this in mind, the upper age limit was kept at 6 years.

Other studies in speech development by Templin, Ingram etc. have also conducted tests in nearly the same age group. In one study as reported in Carrol involving English and Spanish-speaking children, Templin conducted tests of sound discrimination and articulatory abilities with a sample of 240 children in the age group of 3 - 8 years. His results showed that by 6 years of age, most of the children could articulate most of the consonants. The only problematic sounds for the age, as indicated by the study, were /s/ /ʃh/ /th/ /z/ /zh/ /hw/ and /ch/. Considering these results and the fact that in the present study in Hindi, out of these sounds only /s/ and /ʃh/ are involved, the age group of 1.6 - 6 years has been taken.

All the 100 subjects were normal children without any kind of obvious mental or physical defect or evidence thereof. They all had normal speech. The effort was to choose children from the same socio-cultural, socio-linguistic and linguistic backgrounds so as to minimise the variations due to these factors. For this, they were all taken from primary, nursery or pre-nursery classes of schools in the same area. Very young children were taken directly from homes, again, from the same area. These children came from middle class or upper middle class. The fathers of most of these children had their own business and their mothers, if working, were again involved in businesses like running boutiques or tailoring shops. Most of the fathers were atleast graduates and only a few were postgraduates. Though

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many of these children belonged to Punjabi families, the languages that these children were largely exposed to were Hindi and English. None of the children spoke Punjabi either at home or in school. They attended English-medium schools and communicated with their friends and parents in Hindi. Words like /ʃuz/ /frɪj/ /faɪv/ etc. were very common in their daily linguistic environment. For this reason, many such words have been used for testing these subjects.

For ease in analysis, these subjects were divided into nine groups of 6 month intervals. During analysis, whenever needed, these groups were further narrowed and individual analysis of each subject in the group was done. These groups are as given below:-

<u>GROUP NO.</u>	<u>AGE GROUP</u>	<u>NO. OF SUBJECTS</u>	<u>BOYS</u>	<u>GIRLS</u>
1	1 yr 6 mths -- 2 yrs	5	2	3
2	2 yrs - 2 yrs 6 mths	6	3	3
3	2 yrs 6 mths - 3 yrs	11	5	6
4	3 yrs - 3 yrs 6 mths	14	7	7
5	3 yrs 6 mths - 4 yrs	7	4	3
6	4 yrs - 4 yrs 6 mths	18	10	8
7	4 yrs 6 mths - 5 yrs	14	7	7
8	5 yrs - 5 yrs 6 mths	14	7	7
9	5 yrs 6 mths - 6 yrs	11	7	4

Only 5 children could be tested from the age group 1, i.e., 1 year 6 months to 2 years, as children in this age group were too young to respond to the test and usually it proved difficult to get response or co-operation from them.

Though many more children were taken, the children who responded less than 70% of the time were not considered. This implies that to be selected for analysis, the child had

to give atleast four out of six responses for each sound

An effort was made to keep the number of boys and girls on par to eliminate the chances of any difference in the responses within a group due to difference in the gender.

### 3.1.2 Selecting\_the\_linguistic\_sample:

The test sounds in this study, as indicated earlier, are six Hindi fricatives /ç/ /j/ /s/ /š/ /f/ and /v/. Three test words were selected for each sound testing the sounds in initial, medial and final positions. For each word, a picture was selected from which the child could identify the word required. Though most of the words were from the Hindi language, some non-Hindi words were also taken. These words, though not originating from Hindi, still have assimilated into the linguistic repertoire of the Hindi speaker and are freely used by all Hindi speakers. These words include /jokAr/ /fri:j/ /sigret/ /pArs/ /brAš/ /faiv/ and /t0fi/. The children were more familiar with these words than with their Hindi equivalents.

In cases where there was some doubt about the ease with which the word could be identified from the picture, then more than one word for that sound was selected to facilitate elicitation. This was necessary as one of the methods of elicitation was 'spontaneous elicitation' by recognising the word from the picture alone

Though it was tried to take only bisyllabic words which would be easy for the children, particularly the younger

ones to produce, it proved impossible. Some monosyllabic words had to be included as only such words could be easily identified from the pictures alone.

The following table lists the stimuli used:

SOUND	INITIAL	POSITION MEDIAL	FINAL
-----	-----	-----	-----
č	čuri čiriya	báčča	páč
j	jokAr juta	gajAr	frIj
s	sigret sabUn	pEsE bIskIt	pArs
š	šiši šUz	cAšma	brAš
f	faIv frIj	tOfi	sArf bArAf
v	vIm vEn	tivi čavAl	nav faIv

### 3.1.3 Elicitation Techniques

The materials consisted of coloured pictures which were pasted on rectangular sheets, which were then put in a loose leaf binder. These pictures were so arranged that only one picture was visible at a time to avoid any kind of distraction. Such pictures were selected from which the word needed could be easily elicited from the child with minimum help or encouragement from the investigator.

In addition to lone words, the children were given sentences containing words. The sentence structure used was of the following design "ye \_\_\_\_\_ hai", where the blank represents the test word. The sentence structure being small and simple, was easy even for very young children to imitate.

Two methods of elicitation were used for collection of data. These were picture recognition for spontaneous elicitation and imitation. In picture recognition, the child was shown the picture and asked to speak out what he/she saw. For example, on being shown the picture of a bird (/cīriya/, the child was expected to say /cīriya/ as the correct response. The investigator produced the sentence 'ye \_\_\_\_\_ hai' (with the blank representing the test word) and the child was expected to imitate and repeat. This served a two-fold purpose. Firstly, it helped in checking whether imitation facilitates production. If imitation does facilitate production, then it was expected that the children would do better on 'imitation' than a 'spontaneous production'. Secondly, it also checked whether it is easier to produce a word separately (or alone) than in a sentence

Thus, each test sound was to be elicited a maximum of six times for each subject. Each test sound was, thus, produced two times, each phonological position, i.e, word initial, word medial and word final position.

Each subject was tested individually at the school or home being visited. The test was administered in a separate room whenever it was possible, but more often, the tests had to be carried out in a corner of the classroom itself or in the playground, due to non-availability of a separate empty room

Initially, it was planned to make audio recordings of each subject's responses. This proved to be difficult. Most of the time, the test sessions had to be conducted in the

classroom itself or in the open, in the presence of other children. In either case, not only was the noise level too high to allow clear recording, but also, the equipment attracted other children who gathered around and caused interference simply by being inquisitive about the equipment or by prompting the subject being tested. So, all sounds were recorded simultaneously, transcribing the test sounds phonetically using IPA.

Before administering the test, some time was spent with the child to establish rapport. During this period, the child was asked its name, class etc. Usually, it took about five minutes to establish rapport. After this, the child was asked to look at the picture book, one at a time. First, the child was asked to identify the picture for spontaneous response and then to repeat the sentence containing the test word after the investigator. If the child was unable to recognise the word by himself/herself, then some clues were given to help the child recognise the word and give the expected response. For example, for eliciting /tivi/ the child was asked what did he watch a movie on at home. If the child did not respond inspite of these efforts, then the experimentator moved on to the imitation technique. Most of the subjects caught on quickly. Each session took about 10 - 15 minutes depending upon the individual. In case a child did not respond most of the time, i.e, gave atleast four out of six responses for each sound, he/she was not selected for the final analysis.

### 3.1.4 Recording the Responses

Written records of each were made with transcription using IPA symbols. Charts for marking the responses were made out in advance and while administering the test, these were filled up with minimum effort. This helped not only in saving time but also helped the investigator to pay all attention to the responses of the subjects. The first three columns were meant to identify the subject and assign him to a class depending on his age. This was followed by the list of sounds with words in initial, medial and final position where responses could be marked for each of the two methods separately. A blank chart used for this purpose is reproduced below :

Name	No.		
Age			
Class			
c			
j			
s			
s			
f			
v	3		
v	3		



## 3.2 ANALYTICAL PROCEDURES

### 3.2.1 Classification and Tabulation

A group-wise analysis as well as analysis to show individual differences has been done. To start with, there are two charts. Chart 1 maps all responses of each subject. Chart 2 maps the substitutes and number of times each substitute was produced for each sound by each case. Tables 1 - 7 analyse the results of the nine groups in comparison to each other. Table 1 shows the selected response measure for the nine groups. This shows the number of subjects in each group, their numbering, number of responses obtained in each group, range of responses, and number of responses per subject per test sound. Table 2 presents the number and percentages of subjects in each age group to pass each of the six test sounds. As mentioned before too, a subject passes a sound if he/she gives at least four correct out of a total of six. Table 3 compares the percentage of correct production for the two methods of elicitation for each group.

Table 4 shows the number and percentages of each correct response in each of the three positions, i.e, initial, medial and final in each group for all the test sounds taken together. As against this, Table 5 shows the number and percentage of correct responses to all test sounds separately by imitation method only. Table 6 shows the number of subjects in each of the nine groups to acquire from none to six sounds. Table 7 shows the major

substitute their frequencies and percentages in the 100 subjects taken together.

Tables 8 to 18 contain individual data reflecting individual patterns and variations in responses. Table 8 shows the no. and ages of the children who have acquired all the test sounds while table 9 shows the subjects who have not acquired any of the six test sounds.

Table 10 contains the no. and age of subjects who have acquired all sounds except /š/. Table 11 shows the subjects who predominantly use stop substitutes for fricatives/affricates while table 12 shows subjects who substitute č/j for other fricatives.

Once a child acquires /s/ but not /š/, he tends to substitute /s/ for /š/. But there are individuals who do not follow the generalisation and these are shown in Table 13.

Tables 14, 15 and 16 help in outlining the general order of acquisition of these six sounds. Table 14 shows the subjects who acquire /s/ and /š/ before other sounds. Table 15 shows individuals who acquire /f/ and /v/ before others and Table 16 shows the individuals who acquire /č/ and /j/ before the other sounds. Tables 17 and 18 show individuals who use /š/ for /s/ and some kind of distorted substitutes respectively.

### 3.2.2 Chi-Square Analysis

Chi-square analysis is used to see whether the frequencies of different variables are a matter of chance or whether there is any significant relationship between them. Chapter 5 deals with chi-square analysis of some of the results. This was done whenever there was any doubt about the relation between two variables in a Table.

In Tables II, III, IV & V we had to do the chi-square analysis to check the relationship between acquisition of a sound and age, between response and method of elicitation and between response and phonological position of the test sound.

### 3.3 REFERENCES

1. Carrol, J.B. 1961 Language Development in Children -  
in Sol Saporta, ed -  
"Psycholinguistics- A book of  
Reading" - pp 331-342-Holt,  
Rinehart & winston, New York

## CHAPTER 4

### PRESENTATION AND DISCUSSION OF DATA

This section contains two charts which contain the complete data. Chart 1 shows the responses of all the 100 children, while Chart 2 contains all the substitutes, with number of times they are produced by all the children. These have been included here and not separately in Appendix as these have to be referred to again and again while analysing and discussing the data. Tables I - VII contain data showing general patterns while Tables VIII - XVII contain data reflecting individual variations.

All these are discussed in brief here, and again in detail in Chapter VI.

## 4.1 Data Charts Showing Data of all the 100 Subjects

### 4.1.1

Chart 1 shows all the six responses for each of the test sounds, produced in each position and each method by each one of the 100 subjects.

The responses by each child for every test sound in each position i.e. initial, medial and final have been noted. Also, the responses for the two methods of elicitation have been separately noted. This kind of separation is needed for further analysis to see whether the position of the sound in a word affects production. It is also needed to see whether the method of elicitation i.e. spontaneous elicitation or production by imitation affects production. Further, it will also show whether the production is affected by the fact that the word is spoken in isolation or in a sentence.

CHART 1

S.NO	c̣-c̣-c̣	j-j-j	s-s-s	š-š-š	f-f-f	v-v-v
1.	t t t t t t	d - d d d d	t t - t t t	t - t t t t	p p - p p p	b b - b b b
2.	t t - t t t	- d d d d d	t t t t t t	- t t t t t	p p p p p p	b b b b b b
3.	t t t t t t	d d d d d d	t t - t t t	t t - t t t	p p p p p p	b b b b b b
4.	t t t t t t	d - d d d d	t t t t t t	th th th th th th	p p p p p p	b b b b b b
5.	t t t t t t	d d d d d d	t t t t t t	t t t t t t	p p p p p p	b b b b b b
6.	t t t t t t	d d d d d d	t t t t t t	t t t t t t	p p p p p p	b b b b b b
7.	t t t t t t	d d d d d d	s s s s s s	s s s s s s	p p p p p p	b b b b b b
8.	t t t t t t	d d d d d d	s s s s s s	t t t t t t	f f f f f f	v v v v v v
9.	č č č č č č	j j j j j j	čh čh čh čh čh čh	čh čh čh čh čh čh	- - - f f -	v v v v v v
10.	t t t t t t	d d d d d d	s s s s s s	š š š š š š	f f f f f f	v v v v v v
11.	t t t t t t	d d d d d d	t th t t th t	th th th th th th	f f f f f f	v v v v v v
12.	t t t t t t	d d d d d d	s s s s s s	s s s s s s	f f f f f f	v v v v v v
13.	t t t t t t	d d d d d d	s s s s s s	t t t t t t	f f f f f f	v v v v v v
14.	t t t t t t	d d d d d d	s s s s s s	s š s s š s	f f f f f f	v v v v v v
15.	t t t t t t	d d d d d d	t t s t t s	t t t t t t	f f f f f f	v v v v v v
16.	t t t t t t	d d d d d d	s s s s s s	t t t t t t	f f f f f f	v v v v v v
17.	c c c c c c	d j d j j j	s s s s s s	t t t t t t	f f f f f f	v v v v v v

S.NO	č-č-č	j--j--j	s--s--s	š--š--š	f--f--f	v--v--v
18.	t t t t t t	d d d d d d	s s s s s s	s s s s s s	f f f f f f	v v v v v v
19.	c c c c c c	j j j j j j	č č č č č č	ch ch ch ch ch ch	f f f f f f	v v v v v v
20.	c c c c c c	j j j j j j	č č č č č č	c c c c c c	f f f f f f	v v v v v v
21.	c c c c c c	d d d d d d	č č č č č č	c c c c c c	f f f f f f	v v v v v v
22.	c c c c c c	d d d d d d	č č č č č č	č č č č č č	f f f f f f	v v v v v v
23.	c c c t c c	d j j d j j	t t t t t t	t t t š š š	f f f f f f	v v v v v v
24.	c c c c c c	- - j j j j	s s s s s s	š š š š š š	f f f f f f	v v v v v v
25.	c c c c c c	j j j j j j	s s s s s s	s s s s s s	f f f f f f	v v v v v v
26.	č c c c c c	j j j j j j	š š š š š š	š š š š š š	f f f f f f	b v v b v v
27.	c c c c c c	j j j j j j	s s s s s s	š š š š š š	f f f f f f	b b b b b b
28.	c c c c c c	d d d d d d	s s s s s s	th th th th th th	f f f f f f	v v v v v v
29.	t c t t t t	d d d d d d	s s s s s s	s s s s s s	f f f f f f	v v v v v v
30.	c t c c t c	j d j j d j	th th th th th th	th th th th th th	f f f f f f	v v v v v v
31.	c c c c c c	d d j d j j	s s s s s s	s s s s s s	f f f f f f	v v v v v v
32.	c c c c c c	j j j j j j	s s s s s s	š š š š š š	f f f f f f	v v v v v v
33.	c c c c c c	d d d d d d	s s s s s s	s s s s s s	f f f f f f	v v v v v v
34.	t t t t t t	d - d d - d	s s s s s s	s s s s s s	f f + f f +	v v v v v v



S.NO	č--č--č	j--j--j	s--s--s	š--š--š	f--f--f	v--v--v
35.	c c c c c c	j j j j j j	s s s s s s	š š š š š š	f f f f f f	v v v v v v
36.	t t t t t c	d d j d d j	s s s s s s	s s s s s s	p p p p p f	b b v b b v
37.	c c c c c c	j j j j j j	s s s s s s	š š š š š š	p p p p p p	v v b v v v
38.	c c c c c c	j j j j j j	s s s s s s	s s s s s s	f f f f f f	v v v v v v
39.	c c c c c c	j j j j j j	s s s s s s	š š š š š š	f f f f f f	v v v v v v
40.	c t c c c c	j d j j d j	s s s s s s	s s s s s s	f f f f f f	b b v b b v
41.	c c c c c c	j j j j j j	s s s s s s	s s s s s s	f f f f f f	v v v v v v
42.	c c c c c c	j j j j j j	s s s s s s	s s s s s s	f f f f f f	v v v v v v
43.	c c c c c c	d d d d d d	s s s s s s	š š š š š š	f f f f f f	v v v v v v
44.	c c c c c c	- j j - j j	s s - s s s	s s s s s s	f f - f f f	- v v v v v
45.	c c c c c c	j j j j j j	s s s s s s	š š š š š š	f f f f f f	v v v v v v
46.	c c c c c c	d d d d d d	s s s s s s	š š š š š š	f f f f f f	v v v v v v
47.	c c c c c c	j j j j j j	s s s s s s	š š š š š š	f f f f f f	v v v v v v
48.	c c c c c c	j j j j j j	s s s s s s	š š š š š š	f f f f f f	b b b b b b
49.	c c c c c c	j j j j j j	s s s s s s	š š š š š š	f f f f f f	v v v v v v
50.	c c c c c c	d d d d - d	s s s s s s	š š š š š š	f f f f f f	v v v v v v
51.	c c c c c c	c j j c j j	s s s s s s	t t c t t c	f f f f f f	v b b v b b

S.NO	ç--ç--ç	j--j--j	s--s--s	ş--ş--ş	f--f--f	v--v--v
52.	c c c c c c	j j j j j j	s s s s s s	ş ş ş ş ş ş	f f f f f f	v v v v v v
53.	c c c c c c	d j j d j j	s s s s s s	ş ş ş ş ş ş	f f f f f f	v v v v v v
54.	c c c c c c	d d - d d d	s s s s s s	s s s s s s	f f f f f f	v v v v v v
55.	t t t t t t	d d d d d d	t t t t s s	t t t s s s	f f f f f f	v v v v v v
56.	c c c c c c	j j j j j j	t t t t t t	ş ş ş ş ş ş	f f f f f f	v v v v v v
57.	c c c c c c	ç ç ç ç ç ç	t t t s s s	ş ş ş ş ş ş	p p p p p p	v v v v v v
58.	c c c c c c	ç ç ç ç ç ç	s s s s s s	ş ş ş ş ş ş	ph ph ph ph ph ph	v v v v v v
59.	c c c c c c	ç ç ç ç ç ç	s s s s s s	ş ş ş ş ş ş	f f f f f f	v v v v v v
60.	c c c c c c	ç ç ç ç ç ç	ç ç ç ç ç ç	ş ş ş ş ş ş	f f f f f f	v v v v v v
61.	c c c c c c	ç ç ç ç ç ç	s s s s s s	ş ş ş ş ş ş	f f f f f f	v v v v v v
62.	ç ç ç ç ç ç	ç ç ç ç ç ç	s s s s s s	ş ş ş ş ş ş	f f f f f f	v v v v v v
63.	ç ç ç ç ç ç	ç ç ç ç ç ç	s s s s s s	ş ş ş ş ş ş	f f f f f f	v v v v v v
64.	ç ç ç ç ç ç	ç ç ç ç ç ç	s s s s s s	ş ş ş ş ş ş	p p p p p p	v v v v v v
65.	ç ç ç ç ç ç	ç ç ç ç ç ç	s s s s s s	ş ş ş ş ş ş	f f f f f f	v v v v v v
66.	ç ç ç ç ç ç	ç ç ç ç ç ç	s s s s s s	ş ş ş ş ş ş	f f f f f f	v v v v v v
67.	ç ç ç ç ç ç	ç ç ç ç ç ç	s s s s s s	ş ş ş ş ş ş	f f f f f f	v v v v v v
68.	t t t t t t	d d d d d d	s s s s s s	ş ş ş ş ş ş	f f f f f f	v v v v v v



S.NO	c--c--c	j--j--j	s--s--s	ç--ç--ç	f--f--f	v--v--v
86.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	bl v v v v v
87.	t t t t t t	d <sub>2</sub> d <sub>2</sub> d <sub>2</sub> d <sub>2</sub> d <sub>2</sub> d <sub>2</sub>	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
88.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
89.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
90.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
91.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
92.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
93.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
94.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	ph v v v v v
95.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
96.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
97.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
98.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
99.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v
100.	c c c c c c	j j j j j j	s s s s s s	ç ç ç ç ç ç	f f f f f f	v v v v v v

All responses of all the 100 children

Chart 2 shows every test sound by each of the 100 subjects. The number of times a substitution is used (out of a maximum of six responses) by each subject is also indicated in the same column. Omissions, wherever noted, are also marked. Empty spaces in the chart indicate that all six responses were correct and there were no omissions.

CHART 2

S.NO	č	j	š	š	f	v
1	t 6	d 5	t 5	t 5	p 5	b 5
2	t 5	d 5	t 6	t 5	p 6	b 6
3	t 6	d 6	t 5	t 5	p 6	b 6
4	t 5	d 5	t 6	th 6	p 6	b 6
5	t 6	d 6	t 6	t 6	p 6	b 6
6	t 6	d 6	t 6	t 6	p 6	b 6
7	t 6	d 6	t 6	s 6	p 6	b 6
8	t 6	d 6	t 6	t 6		
9			čh 6	č/čh 6		
10	t 6	d 6		s 4		
11	t 6	d 6	t 6	th 6		
12	t 6	d 6		s 6		
13	t 6	d 6		t 6		
14	t 6	d 6		s 6		
15	t 6	d 6	t 4	t 6		
16	t 6	d 6		t 6		
17		d 2		t 6		
18	t 6	d 6		s 6		
19			č 6	čh 6		
20			č 6	č 6		
21			č 6	č 6		
22			č 6	č 6		
23	t 1	d 2	t 6	t 6		
24		- 2		s 2	- 1	- 1
25				č 6		r

S.NO	v	j	s	v	f	v
26			š 4	č 2		b 2
27				č 2		b 2
28		d 6		th 6		
29	t 6	d 6		s 6		
30	t 2	d 2	th 6	th 6		
31		d 3		s 6	=	
32				s 1		
33		d 6		s 6		
34	t 6	d 4 - 2		s 6		
35				s 6		
36	t 5	d 4				
37						
38				s 6		
39						
40	t 1	d 2		s 6		
41				s 6		
42				s 6		
43		d 6				b 6
44	- 1	- 1	- 1	s 6	- 1	
45				- 2		
46		d 6		t 1		
47						
48				č 2		b 6
49						
50		d 5		č 6		
51		č 2		t 4 č 2		b 4

S.NO	č	j	s	š	f	v
52						
53		d 2		s 2		
54		d 5 - 1		s 6		
55	t 6	d 6	t 4	t 4 s 2		
56						
57					- i	
58				s 6	ph 6	
59				s 6		
60			čh 6	čh 6		
61					p 1	
62						
63						
64				s 6	p 6	
65	t 1					
66				s 6		
67						
68	t 6	d 6		s 6		b 6
69					p 6	
70					p/ph 6	b 6
71				s 6		
72				s 6	p 4	
73						
74						
75						
76			č 4	č 4		
77	- 1				- 1	- 1



S.NO	č	j	s	š	f	v
78	t	6	d	6	s	6
79				s	6	
80				s	6	
81				s	2	b 4
82						
83				s	5	
84				s	5	
85				č	6	
86						bh 1
87	t	6	d2	6	s	6
88				s	6	
89				s	6	
90						
91				s	6	
92				š	1	
93				š	1	
94				š	5	
95				s	6	
96						
97				s	6	
98						
99						
100						

Substitutions and their numbers, as used by the 100 subjects, taking both methods of elicitation together.

#### 4.2 TABLES SHOWING GENERAL PATTERNS:-

TABLE I

#### SELECTED RESPONSE MEASURES FOR NINE GROUPS

AGE ----> RESPONSE MEASURES	6 MTHS TO 1Y 11M	2 YR TO 2Y 5M	2Y 6M TO 2Y 11M	3 YR TO 3Y 5M	3Y 6M TO 3Y 11M	4 YR TO 4Y 5M	4Y 6M TO 4Y 11M	5 YR TO 5Y 5M	5 6M TO 6 YR	TOTAL
NO. OF SUBS	5	6	11	14	7	18	14	14	11	100
SUB IDEN NOS	1-5	6-11	12-22	23-36	37-43	44-61	62-75	76-89	90-100	1-100
NO OF TOT RESP	168	216	396	495	252	631	504	500	396	3658
RANGE OF RESPONSE	31-36	36-36	36-36	32-36	36-36	32-36	36-36	33-36	36-36	31-36
MEAN NO- RES/SUBJ	33.60	36.0	36.0	35.35	36.0	35.05	36.0	35.71	36.0	36.58
MEAN NO- RES/AGE TEST SOU PER SUBJ	5.6	6.0	6.0	5.89	6.0	5.84	6.0	5.95	6.0	6.09

Though more than 100 children were tested, only those children who could give at least 4 out of 6 responses for each of the six sounds that have been considered. Subjects were numbered from 1 to 100 in increasing order of age for the purpose of individual analysis. They were divided into nine groups as earlier shown. 4 out of 6, i.e. 66.66 % was set up as a criterion of correct production for the child to be marked as having acquired that sound.

**TABLE II**  
**PERCENTAGE OF SUBJECTS WHO PASS A SOUND**

GROUP NO	1	2	3	4	5	6	7	8	9	TOTAL
SOUND :										
č	0/5 0%	1/6 16.66%	5/11 45.45%	11/14 78.57%	7/7 100%	17/18 94.44%	13/14 92.82%	12/14 88.88%	11/11 100%	77/100 77%
j	0/5 0%	1/6 16.66%	4/11 36.36%	8/14 57.14%	6/7 85.71%	14/18 77.77%	13/14 92.82%	12/14 88.88%	11/11 100%	69/100 69%
s	0/5 0%	2/6 33.33%	6/11 54.54%	11/14 78.57%	7/7 100%	16/18 88.88%	14/14 100%	13/14 100%	11/11 100%	80/100 80%
š	0/5 0%	1/6 16.66%	0/11 0%	4/14 28.57%	3/7 42.85%	10/18 55.55%	9/14 64.28%	4/14 28.88%	7/11 63.63%	38/100 38%
f	0/5 0%	4/6 66.66%	11/11 100%	12/14 85.71%	6/7 85.71%	17/18 94.44%	10/14 71.42%	14/14 100%	11/11 100%	85/100 85%
v	0.5 0%	4/6 66.66%	11/11 100%	12/14 85.71%	5/7 71.42%	16/18 88.88%	12/14 85.71%	13/14 92.82%	11/11 100%	84/100 84%

Table II presents the number and percentage of subjects of each age group to pass each of the six test sounds. As stated earlier, passing a sound means giving correct responses at least four out of six times, including both and imitated responses. The table shows that overall, /f/ is the sound produced correctly most of the time, i.e., 85% of the time. As opposed to this, /s/ was produced correctly the least no. of times, i.e., 38% of the time only. This indicates that among the six test sounds, /f/ was the easiest to produce, while /s/ was the hardest.

The table also shows that /f/ and /v/ were produced correctly 100% of the time by children as young as 2 yrs 6 months - 3 yrs. /s/ and /ç/ reached this stage only by 3

yrs 6 months - 4 yrs, /j/ by 5 yrs 6 mths - 6 yrs while /s/ was produced correctly by a maximum of only 64.28% and that too in the age group 4 yrs 6 mths to 5 yrs.

Interestingly, we also find that once having reached the position of 100% correct production, it is not necessary that even in the next age group, the results are 100% correct. Implications of this will be discussed later in Chapter 4.

A Chisquare analysis was done on this table. Separate analysis was done for each sound. This was done find out the correlation between the acquisition of the test sound and age of the test case. The chi-square analysis can also indicate if the dependence on age factor is statistically significant or not. Details of chi-square analysis are included in Chapter %.

TABLE III

Number and percentages of correct responses to the two methods of elicitation in each of the nine groups.

GROUP NO →	1	2	3	4	5	6	7	8	9
METHOD OF ELICITATION									
RECOGNITION (SPONTANEOUS)	0/30 0%	12/36 33.33%	36/72 50%	58/84 69.04%	34/42 80.95%	89/108 82.40%	70/84 83.33%	69/84 82%	63/66 91.36%
IMITATION	0/30 0%	12/36 33.33%	36/72 50%	62/84 73.80%	34/42 80.95%	90/108 83.33%	71/84 84.52%	69/84 82%	63/66 91.36%
	0	24	72	120	68	179	141	138	126

Table III compares the percentage of correct responses or productions for all the sounds taken together for the two methods of elicitation, i.e., spontaneous elicitation and elicitation by imitation. At least two, out of a total of three, correct responses for each test sound for each method of elicitation has been set as the criterion for selecting the response as a correct one.

The table shows that the percentage of correct responses for each method increases with increase in age, except in Group 8 where we see a slight fall in percentage. To check whether this fall is of any importance, a Chi-square analysis was done for both methods of elicitation. The analysis was to check whether the correct production is dependent or independent of the age group. The results show that the percentage of correct responses would increase with increase in age. These results are shown and discussed later.

When seen within a group, there is a difference in results in the two methods of elicitation in three groups, namely groups 4, 6 and 7. A Chisquare analysis was also done to check if this difference is statistically significant. The analysis shows that the production of all test sounds is independent of method of elicitation. These results are shown and discussed later. The results for the two methods of elicitation also hold for the difference in elicitation of test sounds in a word in isolation and the word taken in a sentence.

TABLE IV

Number and percentages of correct responses to all sound taken together in different phonological positions.

GROUP NO	1	2	3	4	5	6	7	8	9
POSITION									
INITIAL	0/58 0%	25/72 34.72%	75/94 79.79%	114/167 68.26%	68/84 80.95%	177/215 82.33%	140/168 83.33%	137/168 81.55%	124/132 93.94%
MEDIAL	0/57 0%	25/72 34.72%	74/94 78.72%	115/167 68.86%	65/84 77.38%	179/215 83.26%	141/168 83.92%	139/168 82.73%	123/132 93.18%
FINAL	0/58 0%	24/72 33.33%	77/94 81.91%	125/167 74.85%	70/84 83.33%	173/215 81.99%	140/168 83.33%	139/168 84.24%	124/132 93.94%

Table IV shows the number and percentage of correct responses for all the six test sounds taken together, in the three different positions, i.e, with the test sounds in the initial, medial and final positions, in each age group. For this analysis, the omissions, i.e, the 'no-response's have not been taken into account.

These results are further elaborated in Table V where responses for each test sound in each position are marked separately.

**TABLE V**  
**NO AND PERCENTAGES OF CORRECT RESPONSES TO EACH TEST WORD**

GROUP NO	1	2	3	4	5	6	7	8	9	TOTAL
SOUND :										
č-	0/5 0%	1/6 16.66%	5/11 45.45%	10/14 71.42%	7/7 100%	17/18 94.44%	12/14 85.71%	12/14 85.71%	11/11 100%	75/100 75%
-č-	0/5 0%	1/6 16.66%	5/11 45.45%	10/14 71.42%	7/7 100%	17/18 94.44%	12/14 85.71%	12/14 85.71%	11/11 100%	75/100 75%
-č	0/5 0%	1/6 16.66%	5/11 45.45%	12/14 85.71%	7/7 100%	17/18 94.44%	12/14 85.71%	12/14 85.71%	11/11 100%	77/100 77%
j-	0/5 0%	1/6 16.66%	4/11 36.36%	7/14 50%	6/7 85.71%	12/18 66.66%	12/14 85.71%	12/14 85.71%	11/11 100%	65/100 65%
-j-	0/5 0%	1/6 16.66%	5/11 45.45%	8/14 57.14%	5/7 71.42%	15/18 83.33%	12/14 85.71%	12/14 85.71%	11/11 100%	69/100 69%
-j	0/5 0%	1/6 16.66%	4/11 36.36%	10/14 71.42%	6/7 85.71%	14/18 77.77%	12/14 85.71%	12/14 85.71%	11/11 100%	70/100 70%
s-	0/5 0%	2/6 33.33%	6/11 54.54%	11/14 78.57%	7/7 100%	16/18 88.88%	14/14 100%	13/14 92.85	11/11 100%	79/100 79%
-s-	0/5 0%	2/6 33.33%	6/11 54.54%	11/14 78.57%	7/7 100%	17/18 94.44%	14/14 100%	13/14 92.85	11/11 100%	80/100 80%
-s	0/5 0%	2/6 33.33%	7/11 63.63	12/14 85.71%	7/7 100%	17/18 94.44%	14/14 100%	14/14 100%	11/11 100%	83/100 83%
š-	0/5 0%	1/6 16.66%	0/11 0%	5/14 35.71%	3/7 42.85	10/18 55.55%	14/14 100%	4/14 28.57	7/11 63.63	39/100 39%
-š-	0/5 0%	1/6 33.33%	1/11 9.09%	5/14 35.71%	3/7 42.85	10/18 55.55%	9/14 64.28	5/14 35.71	8/11 72.72	42/100 42%
-š	0/5 0%	1/6 16.66%	0/11 0%	5/14 35.71%	3/7 42.85%	8/18 44.44%	9/14 64.28%	6/14 42.85%	7/11 63.63%	39/100 39%
f-	0/5 0%	2/6 33.33%	11/11 100%	13/14 92.52%	5/7 71.42%	17/18 94.44%	11/14 78.51%	14/14 100%	11/11 100%	84/100 84%
-f-	0/5 0%	2/6 33.33%	11/11 100%	13/14 92.82%	5/7 71.42%	17/18 94.44%	11/14 78.57%	14/14 100%	11/11 100%	84/100 84%
-f	0/5 0%	2/6 33.33%	11/11 100%	13/14 92.82%	5/7 71.42%	17/18 94.44%	10/14 71.42%	14/14 100%	11/11 100%	83/100 83%
v-	0.5 0%	3/6 50%	11/11 100%	12/14 85.71%	6/7 85.71%	16/18 88.88%	11/14 78.57%	14/14 100%	11/11 100%	84/100 84%
-v-	0.5 0%	3/6 50%	11/11 100%	13/14 92.82%	7/7 100%	16/18 88.88%	11/14 78.57%	14/14 100%	11/11 100%	86/100 86%
-v	0.5 0%	4/6 66.66%	11/11 100%	12/14 85.71%	5/7 71.42%	16/18 88.88%	12/14 85.71%	13/14 92.82%	11/11 100%	84/100 84%



Table V shows the number and percentage of correct responses to each test sound, in each phonological position in each group. This table contains responses only by the imitation method. This is because during testing spontaneous elicitation, sometimes, the children responded to different words/pictures. For some sounds, more than one picture was selected in anticipation of any problem in recognising the given picture. But for imitation, all children were given the same words. This table helps in examining whether or not the word in which a sound appears affects production. It also checks whether the phonological position of the test sound in the test word affects its production. Chi-square analysis was done for each sound in each group wherever there was any difference in correct productions in the three positions. Then, an analysis was done on the total correct productions for each sound in each position, for all the groups taken together. The results show that the production of the test sound is independent of the test word, at least for this particular test. These results are discussed later.

TABLE VI

No. of subjects in each group to acquire from none to six sounds

GROUP NO	TOT NO OF SUB	0	1	2	3	4	5	6
1	5	5						
2	6	1	1	2		2		
3	11			1	5	4	1	
4	14				2	4	3	1
5	7				1	5		1
6	18			1		5	4	8
7	14			1		3	3	7
8	14				2	2	8	2
9	11						4	7
TOTAL	100	4	1	4	8	23	22	25

Table VI gives an idea of the acquisition of these sounds as a class. It presents the number of six sounds that reached the 66.66% criterion for subjects in each age group. Only by the age group 3 - 3.5yrs, we have one subject (out of ten) reaching that criterion on all sounds. Even in the last age group, i.e, 5.6 - 6 yrs, we have only 7 out of 11 subjects who have reached that criterion. The other four have acquired five out of the six sounds. The sound that has not been acquired is !s! as we have seen in Table II.

TABLE VII

TYPE & FREQUENCY OF SUBSTITUTION MADE BY ALL SUBJECTS

SOUND	SUBSTITUTION	NUMBER	TOTAL	FREQUENCY
v c	t	137	137	t - 100 %
j	d dz c	170 6 2	178	d - 95.5% dz - 3.37% c - 4.13%
s	t/th c/ch s	66 50 5	121	t/th - 54 % c/ch - 41 % s - 4 %
v s	s t/th c/ch	191 95 63	349	s - 55 % t/th - 27 % c/ch - 18 %
f	p/ph	93	93	t/th - 100%
v	b	87	87	b - 87 %

Table VII presents the type and frequency of substitution made by all subjects for the six test sounds. As the table reveals, certain substitutions are very common like /t/ for /c/, /d/ for /j/, /p/ for /f/ and /b/ for /v/. Substitution of /s/ for /s/ was very common, once /s/ has been acquired by the subject.

### 4.3 TABLES SHOWING INDIVIDUAL VARIATIONS

Tables viii to xviii contain data reflecting individual variations. The identification number and ages of each subject is given by its side. The sounds that are correctly acquired are highlighted. Sounds in parenthesis are those that were obtained two or less times. Though the data provided some universal patterns it also highlighted the individual variations. Some children showed some different pattern of acquisition of the sounds, and these tables show these differences.

The tables xiv xv and xvi show that /f/ and /v/ are acquired before /č/ and /j/ and these in turn are acquired before /s/ and /š/ in most of the cases. But there are exceptions to this general pattern. One child acquired /s/ and /š/ before having acquired /č/ and /j/. This was case number 10, age- 2 yrs 4 mths.) There was also one child who had acquired /č/, /j/, /s/ and /š/ before having acquired either /f/ or /v/. This was case number 70, whose age was 4 yrs 9 mths.

Another general pattern that was observed was that there is a preference for using stops as substitutes for the fricatives, if neither of the sound of a pair has been acquired (pairs mean /s/ and /š/, /č/ and /j/, /f/ and /v/). There were exceptions to this too. For example at times /č///čh/ is used as a substitute for /s/ and/ or /š/ e.g. case no. 10, age 2 yrs 4 mths, case 19 age 2 yrs 9 mths and others, given in Table XII.

Another important feature was that if one sound of a pair has been acquired but not the second than that sound acts as a substitute for the sound yet to be acquired. But some children do not follow this pattern and instead still use a stop or a fricative of a different class as the substitute. For example case number 76 has acquired /s/ but not /š/. This case uses /ç/ and not /s/ as the substitute for /š/. Other such cases are case numbers 16, 17, 28, 33, 43, 50, 51, 85, 94.

Another exception was that though in most cases /s/ is acquired before /š/ there is one case that acquired /š/ before /s/. This was case number 26, age- 3 yrs 2mths. Another interesting thing was that this was the only case to substitute /š/ for /s/.

Lastly, though most of the substitutes used are either stops or fricatives from the Hindi consonant system, there was one case that used a distorted or non-adult like pronunciation too. this was case number 87 age-5 yrs 4 mths, who used /dz/ for /j/.

These observations show that in spite of general patterns being present, there are individual variations too. For this reason it is not appropriate to compare a child's acquisition to a set pattern only without giving proper attention to the individual variations that might be present.

Table VIII

LIST OF CHILDREN WHO HAVE ACQUIRED ALL THE SIX SOUNDS

No.	Age	No.	Age	No.	Age
27	3yrs 2mths	32	3yrs 4mths	35	3yrs 5mths
39	3 8	45	4 1	47	4 1
49	4 2	52	4 2	53	4 2
56	4 4	57	4 4	61	4 4
62	4 6	63	4 6	65	4 6
67	4 7	74	4 10	75	4 11
77	5	82	5 1	86	5 2
89	5 5	90	5 6	92	5 9
93	5 9	96	6	98	6
99	6	100	6		

TABLE IX;

LIST OF CHILDREN WHO HAVE NOT ACQUIRED ANY OF THE SIX FRICATIVES;

NO.	AGE	NO.	AGE
1	1yrs 6mths	2	1yrs 7mths
3	1 8	4	1 8
5	1 11	6	2 11

TABLE X;

LIST OF CHILDREN WHO HAVE ACQUIRED ALL THE FRICATIVES EXCEPT /š/;

NO.	AGE	NO.	Age	No.	Age
17	2 yrs 8 mths	24	3yrs 0mths	25	3yrs 1mths
38	3 7	41	3 9	42	3 10
44	4	59	4 5	66	4 7
72	4 9	79	5	80	5 1
81	5 1	83	5 2	84	5 2
85	5 2	88	5 4	91	5 6
94	5 11	95	5 11	97	6

TABLE XI;

LIST OF CHILDREN WHO SUBSTITUTE STOPS FOR FRICATIVES;

NO.	AGE	NO.	AGE	NO.	AGE
1	1yrs 6mths	2	1yrs 7mths	3	1yrs 8mths
4	1 8	5	1 11	6	2 1
8	2 2	10	2 4	11	2 5
13	2 6	15	2 7	16	2 7
17	2 8	22	2 11	23	3
28	3 3	30	3 4	37	3 6
43	3 11	48	4 2	51	4 2
55	4 4	69	4 8	80	5 1

TABLE XII

LIST OF CHILDREN WHO SUBSTITUTE PALATAL AFFRICATES FOR OTHER FRICATIVES;

NO.	AGE	NO.	AGE	NO.	AGE
10	2yrs 4mths	19	2yrs 9mths	20	2yrs 10mths
21	2 11	48	4 2	50	4 2
60	4 5	76	5	85	5 2
94	5 9				

TABLE XIII

LIST OF CHILDREN WHO DO NOT USE /s/ FOR /š/ EVEN WHEN THEY HAVE ACQUIRED /s/ AND NOT /š/;

NO.	AGE	NO.	AGE	NO.	AGE
13	2yrs 6mths	16	2yrs 7mths	17	2yrs 8mths
28	3 3	50	4 2	51	4 3
85	5 2	94	5 11		

TABLE XIV;

LIST OF CHILDREN WHO HAVE ACQUIRED /s/ and /š/ BEFORE THE PALATAL AFFRICATES AND/OR THE LABIO DENTAL FRICATIVES:

NO.	AGE	SOUNDS					
		/c/	/j/	/s/	/š/	/f/	/v/
10	2yrs 4mths	t	d	s	s	f	v



TABLE XV;

LIST OF CHILDREN WHO HAVE ACQUIRED THE PALATAL AFFRICATES BEFORE THE LABIO-DENTAL FRICATIVES:

NO.	AGE	SOUNDS					
		/č̣/	/j/	/s/	/ṣ̌/	/f/	/v/
9	2yrs 2mths	c	j	c	c	ph (f)	v
70	4 9	c	j	s	s	ph	b

TABLE XVI:

LIST OF CHILDREN WHO SUBSTITUTE /s/ FOR /s/ :

NO.	AGE	SOUNDS					
		/č̣/	/j/	/s/	/ṣ̌/	/f/	/v/
26	3yrs 2mths	c	j	ṣ	ṣ	f	v

TABLE XVII;

LIST OF CHILDREN WHO USE A DISTORTED SOUND AS A SUBSTITUTE FOR ANY OF THE FRICATIVES UNDER STUDY:

NO.	AGE	SOUNDS					
		/č̣/	/j/	/s/	/ṣ̌/	/f/	/v/
87	5yrs 4mths	t	dz	s	ṣ	f	v

## CHAPTER 5

### CHI-SQUARE ANALYSIS

#### 5.1 Chi- Square test

To go beyond our intuitive feelings about the observed and expected frequencies we can use the chi-square analysis.

It enables researchers to ascertain whether the frequencies of different variables are a matter of chance or whether there is any significant relation between the variables. In this analysis we first propose a null hypothesis. The null hypothesis states a relation of independence between the variables under consideration. If the chi-square value is found to be significant or high than the null hypothesis is rejected. On the other hand if the chi-square value is small than the null-hypothesis is retained. This implies that there is not enough statistical evidence to reject the hypothesis. If the chi-square value is high than the null hypothesis may be rejected with a high level of confidence.

For deciding whether the value is high or not it is compared against the value of the selected level of significance. The level of significance is usually selected as .01 for research works and is the same for the present work too. A chi-square value is represented by  $\chi^2$ . It is a reliable means for testing the significance of association between two variables or attributes. This test can be applied to a contingency table with several classes. It is based on frequency and not on parameters like mean or standard

deviation. It is very useful for testing hypothesis. It is calculated by the following formula;

Sum total of all the :  
square of {f (observed)- f(expected)}/f (expected)

Chi square value thus obtained is compared with the tabulated values for the appropriate degree of freedom. Degree of freedom is calculated by;

$$\{ \text{total no. of columns} - 1 \} \times \{ \text{total no. of rows} - 1 \}$$

This value is then compared to the value for the selected level of significance. If it is less than the value for the selected level of significance then the null hypothesis is accepted and otherwise it is rejected.

## 5.2 STATEMENT OF HYPOTHESIS

We will first state all the hypotheses and then test their validity.

### 1. Hypothesis : Acquisition of a sound is independent of age:

1.1 Acquisition of /č/ is independent of the age.

1.2 Acquisition of /j/ is independent of the age.

1.3 Acquisition of /s/ is independent of the age .

1.4 Acquisition of /š/ is independent of the age.

1.5 Acquisition of /f/ is independent of the age.

1.6 Acquisition of /v/ is independent of the age.

2. Hypothesis: Production of a sound is independent of its phonological position:
- 2.1.1 Production of //j/ in group 3. is independent of its phonological position
- 2.1.2. Production of /s/ in group 3 is independent of its phonological position.
- 2.1.3. Production of /š/ in group 3. is independent of its phonological position.
- 2.1.4. Production of all fricatives (taken together ) is independent of their phonological positions.
- 2.2.1. Production of /č/ in group 4. is independent of its phonological position.
- 2.2.2. Production of /j/ in group 4. is independent of its phonological position.
- 2.2.3. Production of /š/ in group 4. is independent of its phonological position
- 2.2.4. Production of /v/ in group 4. is independent of its phonological position.
- 2.2.5 Production of all fricatives (taken together ) in group 4. is independent of their phonological positions.
- 2.3.1. Production of /j/ in group 5. is independent of its phonological position.
- 2.3.2. Production of /v/ in group 5. is independent of its phonological position.
- 2.3.3. Production of all the fricatives ( taken together) is independent of their phonological positions.
- 2.4.1. Production of /j/ in group 6. is independent of its phonological position
- 2.4.2. Production of /s/ in group 6. is independent of its phonological position
- 2.4.3. Production of /š/ in group 6. is independent of its phonological position.
- 2.4.4. Production of /v/ in group 6. is independent of its phonological position.
- 2.4.5. Production of all fricatives (taken together) in group 6. is independent of their phonological positions.

2.5.1. Production of /f/ in group 7. is independent of its phonological position.

2.5.2. Production of all the fricatives (taken together ) is independent of their phonological positions.

2.6.1 Production of /s/ in group 8. is independent of its phonological position.

2.6.2. Production of /š/ in group 8. is independent of its phonological position.

2.6.3. Production of all the fricatives ( taken together ) is independent of their phonological positions

2.7.1. Production of /š/ in group 9. is independent of its phonological position.

2.7.2. Production of all the fricatives ( taken together ) in group 9. is independent of their phonological positions.

3. Hypothesis : Production of a sound is independent of the method of elicitation;

3.1. Production of all the fricatives is independent of the method of elicitation in group 4.

3.2. Production of all the fricatives is independent of the method of elicitation in group 6.

3.3. Production of all the fricatives is independent of the method of elicitation in group 7.

3.4. Production of all the fricatives is independent of the method of elicitation in all the groups taken together.

4. Hypothesis : Ability to give correct responses by either method of elicitation is independent of age.

4.1 Ability to give correct responses by Recognition is independent of the age.

4.2 Ability to give correct responses by Imitation is independent of the age.

### 5.3 HYPOTHESIS TESTING

In this section we will test the validity of the hypothesis based on their chi-square values, on the basis of which the null hypothesis will be accepted or rejected.

#### 1. Hypothesis;

Acquisition of a sound is independent of age;

##### 1.1 Acquisition of /č/ is independent of the age.

RESULT: The chi-square value is 46.35. For a level of significance .01 this value is very high. Therefore there is no statistical evidence to show that the acquisition of /č/ is independent of the age. Hence the null hypothesis is rejected with a high level of confidence.

This implies that the acquisition of /č/ is dependent on the age.

##### 1.2 Acquisition of /j/ is independent of the age.

RESULT: The chi-square value is 38.17. For a level of significance .01 this value is very high. Therefore there is no statistical evidence to show that the acquisition of /j/ is independent of the age. Hence the null hypothesis is rejected with a high level of confidence.

This implies that the acquisition of /j/ is dependent on the age.

##### 1.3 Acquisition of /s/ is independent of the age .

RESULT: The chi-square value is 35.48. For a level of significance .01 this value is very high. Therefore there is no statistical evidence to show that the acquisition of /s/ is independent of the age. Hence the null hypothesis is rejected with a high level of confidence.

This implies that the acquisition of /s/ is dependent on the age.

##### 1.4 Acquisition of /š/ is independent of the age.

RESULT: The chi-square value is 21.63. For a level of significance .01 this value is very high. Therefore there is no statistical evidence to show that the acquisition of /š/ is independent of the age. Hence the null hypothesis is rejected with a high level of confidence.

This implies that the acquisition of /š/ is dependent on the age.

1.5 Acquisition of /f/ is independent of the age.

RESULT: The chi-square value is 39.51. For a level of significance .01 this value is very high. Therefore there is no statistical evidence to show that the acquisition of /f/ is independent of the age. Hence the null hypothesis is rejected with a high level of confidence.

This implies that the acquisition of /f/ is dependent on the age.

1.6 Acquisition of /v/ is independent of the age.

RESULT: The chi-square value is 34.27. For a level of significance .01 this value is very high. Therefore there is no statistical evidence to show that the acquisition of /v/ is independent of the age. Hence the null hypothesis is rejected with a high level of confidence.

This implies that the acquisition of /v/ is dependent on the age.

2. Hypothesis; Production of a sound is independent of its phonological position;

2.1.1 Production of //j/ in group 3. is independent of its phonological position

RESULT: The chi-square value is .25. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /j/ is independent of the phonological position in group 3.

2.1.2. Production of /š/ in group 3 is independent of its phonological position.

RESULT: The chi-square value is .24. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /š/ is independent of the phonological position in group 3.

2.1.3. Production of /š/ in group 3. is independent of its phonological position.

RESULT: The chi-square value is 2.024. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /š/ is independent of the phonological position in group 3.

2.1.4. Production of all fricatives (taken together) is independent of their phonological positions.

RESULT: The chi-square value is 14.66. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted.

This implies that the production of all fricatives (taken together) is independent of their phonological position in group 3.

2.2.1. Production of /č/ in group 4. is independent of its phonological position.

RESULT: The chi-square value is .842. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted.

This implies that the production of /č/ is independent of the phonological position in group 4.

2.2.2. Production of /j/ in group 4. is independent of its phonological position.

RESULT: The chi-square value is 1.38. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted.

This implies that the production of /j/ is independent of the phonological position in group 4.

2.2.3. Production of /š/ in group 4. is independent of its phonological position

RESULT: The chi-square value is .302. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted.

This implies that the production of /š/ is independent of the phonological position in group 4.

2.2.4. Production of /v/ in group 4. is independent of its phonological position.

RESULT: The chi-square value is 1.17. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted.

This implies that the production of /v/ is independent of the phonological position in group 4.



2.2.5 Production of all fricatives (taken together) in group 4. is independent of their phonological positions.

RESULT: The chi-square value is .4894. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of all the fricatives (taken together) is independent of the phonological position in group 4.

2.3.1. Production of /j/ in group 5. is independent of its phonological position.

RESULT: The chi-square value is .57. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /j/ is independent of the phonological position in group 5.

2.3.2. Production of /v/ in group 5. is independent of its phonological position.

RESULT: The chi-square value is 1.09. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /v/ is independent of the phonological position in group 5.

2.3.3. Production of all the fricatives ( taken together) is independent of their phonological positions.

RESULT: The chi-square value is .0946. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of all the fricatives (taken together) is independent of the phonological position in group 5.

2.4.1. Production of /j/ in group 6. is independent of its phonological position

RESULT: The chi-square value is 1.07. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /j/ is independent of the phonological position in group 6.

2.4.2. Production of /s/ in group 6. is independent of its phonological position

RESULT: The chi-square value is .54. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /s/ is independent of the phonological position in group 6.

2.4.3. Production of /s̥/ in group 6. is independent of its phonological position.

RESULT: The chi-square value is .58. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /s̥/ is independent of the phonological position in group 6.

2.4.4. Production of /v/ in group 6. is independent of its phonological position.

RESULT: The chi-square value is 9.58. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /v/ is independent of the phonological position in group 6.

2.4.5. Production of all fricatives (taken together) in group 6. is independent of their phonological positions.

RESULT: The chi-square value is 2.98. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of all the sounds taken together is independent of the phonological position in group 6.

2.5.1. Production of /f/ in group 7. is independent of its phonological position.

RESULT: The chi-square value is .25. For a level of significance .01 this value is very-small. Hence the null hypothesis is accepted. .

This implies that the production of /f/ is independent of the phonological position in group 7.

2.5.2. Production of all the fricatives (taken together ) is independent of their phonological positions.

RESULT: The chi-square value is .3747. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted....

This implies that the production of all the fricatives (taken together) is independent of the phonological position in group 7.

2.6.1 Production of /s/ in group 8. is independent of its phonological position.

RESULT: The chi-square value is .98. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /s/ is independent of the phonological position in group 8.

2.6.2. Production of /š/ in group 8. is independent of its phonological position.

RESULT: The chi-square value is .62. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /š/ is independent of the phonological position in group 8.

2.6.3. Production of all the fricatives ( taken together ) is independent of their phonological positions

RESULT: The chi-square value is .3747. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of all the fricatives (taken together) is independent of the phonological position in group 8.

2.7.1. Production of /š/ in group 9. is independent of its phonological position.

RESULT: The chi-square value is .229. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of /š/ is independent of the phonological position in group 9.

2.7.2. Production of all the fricatives ( taken together ) in group 9. is independent of their phonological positions.

RESULT: The chi-square value is .0779. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of all the sounds (taken together) is independent of the phonological position in group 9.

### 3. Hypothesis-

Production of a sound is independent of the method of elicitation;

3.1. Production of all the fricatives is independent of the method of elicitation in group 4.

RESULT: The chi-square value is .25. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of the test sounds is independent of the method of elicitation in group 3.

3.2. Production of all the fricatives is independent of the method of elicitation in group 6.

RESULT: The chi-square value is .25. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of the test sounds is independent of the method of elicitation in group 3.

3.3. Production of all the fricatives is independent of the method of elicitation in group 7.

RESULT: The chi-square value is .25. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of the test sounds is independent of the method of elicitation in group 3.

3.4. Production of all the fricatives is independent of the method of elicitation in all the groups taken together.

RESULT: The chi-square value is .25. For a level of significance .01 this value is very small. Hence the null hypothesis is accepted. .

This implies that the production of the test sounds is independent of the method of elicitation in group 3

4.1 Ability to give correct responses by Recognition is independent of the age

RESULT- The chi-square value is 141.951. For a level of significance .01 this value is too high. This implies that the null hypothesis may be rejected with a high level of confidence.

This means that the ability to give correct responses by recognition is dependent on the age of the child

4.2 Ability to give correct responses by Imitation is independent of the age

RESULT- The chi-square value is 151.27. For a level of significance .01 this value is too high. This implies that the null hypothesis may be rejected with a high level of confidence.

This means that the ability to give correct responses by imitation is dependent on the age of the child



## CHAPTER 6

### RESULTS AND DISCUSSIONS

As discussed in previous chapters, phonological universals in language acquisition have been a matter of interest for many years now. Though many studies in language acquisition have been conducted by psychologists, linguists, neurologists, audiologists and speech therapists, one of the most important works so far has been that of Roman Jakobson, (1941). His theory of phonological universals remains as the most well known theory so far about language universals. He emphasised that language producing skills may be viewed as occurring in a sequence of stages each of which is relatable to its preceding stage in a coherent way. He also said that the phonemes that involve more distinctions are relatively rare in the languages of the world and are also more difficult to be acquired by children exposed to such languages. For this reason one may hypothesise that fricatives are one of the difficult classes of sounds to be acquired. Many studies have been done in various languages to test this hypothesis. Paula Menyuk<sub>2</sub> showed that these are the most difficult sounds to be acquired by children learning English. Ferguson<sub>3</sub> (1973) showed that these are the last sounds to be acquired by normal children, while Templin<sub>4</sub> (1957) showed that these are the most difficult sounds for children with articulatory defects to acquire. R.E. Eblen<sub>5</sub> has also shown the same thing in children learning Mexican Spanish.

As no such study has been done in Hindi although the language has many fricatives this work was undertaken to gain some insight into acquisition of fricatives by Hindi speaking children. The work deals with the four fricatives and two affricates [ /č/ /j/ /s/ /š/ /f/ and /v/]. The main issues considered are the order of acquisition of these six sounds, common substitutes used for these sounds in general as well as any kind of individual variations that might be present. The other questions dealt with are whether the production of the test sound differs due to the difference in the phonological position, and the method of elicitation.

Each of these questions was dealt with in detail in this study. - We will deal with these questions one by one. The individual variations found are also shown and discussed along with the general patterns of acquisition.

The first important thing that was noticed was that /f/ was correctly produced by a child as early as 2yrs 6mths, while even by 6 yrs not every child could produce /š/ correctly. All other sounds were acquired by all the children of the last age group i.e. 5 yrs 6mths - 6 yrs. this particular age group (1 yrs. 6 mths - 6 yrs. ) was taken because J.B Carroll has observed that the first voluntary use of words is found by the end of the first year in most children, and , by the end of the six years most of the phonemes of the language the child is exposed to are mastered by her/him. Also as Carroll states, an articulatory test by Templin showed that the only sounds not mastered by



all of the 240 children tested by him were /s/ /š/ /th/ /z/ /zh/ /hw/ and /ch/ as out of these sounds the only sound considered in this study are /s/ and /š/ it was expected that by six years most of the children would have acquired all of the six sounds in question.

The results of our study follow those of the studies of Wellman et. al., (1931) and Templin (1957), that /f/ is one of the first fricatives to be acquired by children, and is acquired as early as 2 yrs. Our results also tally with Templin's results that /š/ is among one of the last sounds to be acquired by the children. The first child to have acquired /š/ was in the age group 3 yrs to 3 yrs 6 mths. The general order of acquisition followed by most of the children was- Labiodental fricatives- Palatal affricates - Sibilants. This means that any child who had acquired the sibilants had also in most of the cases acquired the other two classes of fricatives., and any child who had acquired the palatal affricates had also necessarily acquired the labiodental fricatives in most of the cases.

Though this was the general pattern , there were some exceptions to this too. We came across one case (no. 10 ) who had acquired /s/ and /š/ but not /č/ or /j/. There was also one case (No. 70 ) who had acquired /c/ and /j/ but not /f/ and /v/.

A chi-square analysis was done for all the sounds to see whether the acquisition of the sounds tested is dependent on

the age i.e. does the possibility of acquisition of the sounds increase with age. The result showed that the possibility of acquisition of the sounds does increase with age.

The study also showed that the acquisition of the sounds is gradual and not abrupt. These results are same as that of Ingram's study - the test made the child produce the same sound six times. The child had to produce a sound in all three positions i.e. word initial medial and final . Also two methods of elicitation were used- spontaneous picture recognition and sentence imitation. This meant that a child could produce a sound a maximum of six times. Moreover only those children were selected for the final analysis who gave atleast four responses for each sound. Thus each sound was elicited atleast four times by each child It was found that if the child had not already mastered the sound at the time of the test then her/his responses varied between correct and incorrect responses. This shows that the acquisition of a new sound is gradual and not abrupt. This emphasises the need to elicit a sound more than once for any kind of speech acquisition or articulatory tests.

As mentioned above two methods of elicitation were used .  
these were

1. Spontaneous picture recognition
2. Imitated sentence response.

This was done to test whether the method of elicitation affects the production of a test sound. Earlier studies have

shown different results. While Templin<sub>6</sub> and Ingram showed that imitation does not result in a better production, Faircloth and Faircloth<sub>11</sub> (1970) said that imitation does improve the production of the test sound. In the present study it was seen that there was a very slight difference in the responses by the two methods of responses, in some groups. To check whether this difference is of any significance or not a chi-square analysis was done on these results. The results indicate that the difference was not significant. This implies that in the present study no significant difference was noticed in the production of the test sound by two different methods of production.

The same results also apply to whether the production of the test sound in a word alone and with the word in a sentence affects production. This is so because imitated responses were of words in the sentences and the spontaneous picture recognition resulted in the production of the word alone. Thus the results show that the fact whether the test sound is produced in a word alone or with the word in a sentence does not affect its production.

It was also tested whether the phonological position of the test sound affects its production. For this the test sounds were tested in all the three phonological positions i.e. word initial medial and final. For this analysis only the responses of the production by imitation were considered. This was done because for spontaneous response sometimes different children responded to different pictures.

Wherever there was any doubt about the ease with which the children could respond to the test pictures, more than one picture was selected for that test sound so that the child would respond to atleast one of them without any help or encouragement from the investigator. For the imitated responses on the other hand every child produced the same test word.

In some cases some difference was noticed in the responses to the same test sound in different positions To test whether this difference was significant or not a chi- square analysis was done. The analysis was done on every sound in every group, wherever a difference was noticed in the responses in the different phonological positions. The results indicate that the phonological position does not significantly affect the production of the test sound in any of the groups. Chi-square analysis was also done on the results of all groups taken together, for each test sound. Even these results show that the phonological position of the test sound does not affect its production significantly.

As there was no particular position in case of any of the test sound which resulted in a better response for all the children , the difference in the responses to the test sounds in different phonological positions can be attributed to the fact that the acquisition of the sounds is gradual and not abrupt. Due to this the child gives some correct responses and some incorrect ones. For a test sound these results also show that different words will not necessarily

result in different responses provided the words are phonologically equally easy(or hard) and are also equally familiar to the child. If this later fact is not taken care of the results might differ. This will have to be further tested as for the present test care was taken to take only those words which were familiar to all the children and which were phonologically easy to produce even for very young children. This also implies that for articulation tests using a single test word care should be taken regarding the word selected. Also as the acquisition is gradual and not abrupt, the same word will have to be elicited more than once to get a correct picture of the acquisition of the test sound by the child being tested.

As emphasised by Jakobson (1941) children prefer to substitute stops for the fricatives. Also as shown by Ingram (1980) children show preference for certain substitutes. The most preferred substitutes for the six test sounds were;

SOUND	SUBSTITUTES	
	Vd.	Vl.
/ç/		/t/
/j/	/d/	
/s/		/t/ /c/
/š/		/s/ /t/ /c/
/f/		/p/
/v/	/b/	

As the table shows generally a voiceless sound substitutes for a voiceless fricative, and a voiced one for a voiced fricative. Another feature that can be seen is that though, as Jakobson said, children prefer to use stops as substitutes for the fricatives, but once /č/ has been acquired it was also very frequently, though not always, used as a substitute for /s/ and /š/.

It was noticed that usually /č/ was acquired before /j/, /f/ before /v/ and /s/ before /š/. But some individuals showed a contradiction. For example case no. 26 acquired /š/ before /s/, case no. 9 acquired /v/ before /f/

Also though /č/ substitutes for /j/ and /s/ for /š/ in most cases there were some contradictions to this too. Case no. 26, for example substitutes /š/ for /s/. This was the only case among the hundred children tested to use /š/ as a substitute for /s/. There was no example of substitution of /j/ for /č/ or /v/ for /f/. In this respect this was a very interesting exception.

One very interesting fact noticed was that every child has her/his own pace of learning. It cannot be said that by a particular age a particular sound will be necessarily acquired.

While some children acquire a sound at an early age others might acquire the same sound only later. For example though even by age group 2 yrs to 2 yrs 6 mths a child had acquired /f/ not every one in that age group or the later age groups, for that matter had acquired /f/

Thus the results show that inspite of the general patterns emerging during the analysis, some individual variations also come up. These contradict the general patterns emerging in the study as well as the general principles laid down by other language acquisition studies. These cannot be overlooked, and should be paid due attention. While children acquire the sounds according to some general principles like acquiring a labio dental fricative before a palatal affricate, some child might show a contradiction. Such individual variations may be seen not only in terms of the order of acquisition but also in terms of the substitutes used, as seen and discussed above. Such variations or contradictions do not negate the general hypothesis but instead underline the need to pay due attention and importance to such variations as might come up during such tests and studies or during administering articulation tests. The general patterns predict the order and process of acquisition of sounds not in terms of absolute predictability but only in terms of statistical probability.

## SUMMARY

1. Acquisition of sounds is gradual and not abrupt. The child's responses vary between correct and incorrect responses before s/he masters the sound.
2. Production of the test sound does not improve with imitation i.e. the other method of elicitation.
3. Production of the test sound does not vary depending upon the phonological position of the test sound, if all the words are phonologically equally easy or difficult and are equally familiar for the child.
4. Production pattern does not differ whether the test sound is produced in a word alone or the test word is produced in a sentence.
5. Certain substitutes are more common than the others. Most of the times children show a preference for the stops, as a substitute for the fricatives.
6. Usually a voiced sound substitutes a voiced fricative and a voiceless one for a voiceless fricative.
7. /č/ is usually acquired before /j/, /f/ before /v/ and /s/ before /š/.
8. In spite of certain general patterns being present in terms of the order and process of acquisition of sounds, individual variations also are present and should be paid due attention.



## REFERENCES

1. Jakobson R. as referred in  
 Mc Neill D. 1970 The Aquisition of Language- The  
 Study of Developmental  
 Psycholinguistics- pp.130-141 -  
 Harper and Raw Publishers New York
  
2. Menyuk P. 1968 Role of Distinctive Features in  
 Children's Acquisition of Language-  
 Journal of Speech and Hearing  
 Research-Vol.11 pp.138-46
  
3. Ferguson C.A. as referred in  
 Ingram D. 1979 Phonological Development :  
 Production-P. Fletcher and M.  
 Garman (eds)- Language Acquisition-  
 pp. -CUP
  
4. Templin as referred in  
 Ingram D. ibid
  
5. Eblen R.E. 1982 A Study of Acquisition of  
 Fricatives by Three Year Old  
 Children Learning Mexican Spanish'-  
 Language & speech Vol. 25, Part  
 3, pp201-220
  
6. Carrol J.B. 1961 Language Development in Children-in  
 Sol Saporta, ed. -  
 'Psycholinguistics-A book of  
 Readings' -pp.331-342-Holt, Rinehart  
 & Winston, New York
  
7. Wellman B. as referred in  
 Ingram I. ibid
  
8. Templin ibid
  
9. Ingram I. ibid
  
10. Templin ibid
  
11. Faircloth & Faircloth as referred in  
 Ingram D. ibid

## BIBLIOGRAPHY

1. Carrol J.B.                      1961      Language Development in Children-  
in Sol Saporta, ed. -'Psycholinguistics-A book of Readings' -pp.331-342-  
Holt,Rinehart & Winston,New York
2. Chomsky N. &                      1968      Sound Patterns in English- New York  
M. Halle                              - Harper & Row
3. Deng F.C.C                      1984      The Child's Acquisition of  
Sound patterns-Can it be Really  
Studied as Child Phonology-  
Language Sciences - Vol. 8, No. 1  
pp.107-127.
4. Eblen R.E.                      1982      A Study of Acquisition of Fricatives  
by Three Year Old Children Learning  
Mexican Spanish'-Language & speech  
Vol. 25, Part 3,pp201-220
5. Ferguson C.A.and                      1980      Words and Sounds In Early Language  
C.B.Farwell                              Acquisition- Language 51 p. 419-439
6. Horman.H                      1979      Psycholinguistics: An Introduction  
to Research and Theory - Springer  
Verlag New York
7. Ingram D. et. al                      1980      The Acquisition of word Initial  
Fricatives And Affricates in English  
by Children Between 2 yand 6 yrs.-  
Grace H. ,J.F. Kavanagh and  
C.A. Ferguson (eds.)-Child Phonology  
- Vol.1-pp169-92- Academic Press
8. Ingram D.                      1979      Phonological Development:Production-  
P. Fletcher and M. Garman (eds)-  
Language Acquisition-pp.              -CUP
9. Jakobson.R and                      1981      Phonemic Patterning -Sol Saporta (ed)  
M. Halle                              -Psycholinguistics- A Book of Readings  
- pp.346-48 - Holt, Rinehart and  
Winston Inc New York
10. Kennedy M.S.                      1963      The Perception of Speech- Thomas A  
Sebok(ed)- Current Trends In Linguis-  
tics Vol 12, pp2349-85- The Hague;  
Mouton
11. Kent R.D. ,                      1985      Vocalisations of one year olds-Journal  
Harold and Bauer                      of Child Language - Vol 12 pp. 491-525

12. Kostic R., A. Mitter  
and K.G. Rastogi 1975 A Short Outline of Hindi Phonetics  
-Publishers- Indian Statistical  
Institute of Calcutta
13. Kostic R. 1971 Speech and the Hearing Impaired child  
-pp 23-31-Publishers-Indian  
Statistical Institute of Calcutta
14. Ladefoged P. 1971 A Course in Phonetics- Harcourt Brace  
Jovanovich Publishers.
15. Ladefoged P. and  
Ian Maddieson 1986 Fricatives (in) Some of the Sounds of  
The Worlds Languages (Preliminary  
Version) - in UCLA Working Papers in  
Phonetics- Vol.64 pp. 57-95 -  
Deptt. of Linguistics UCLA
16. Leopald W.F. 1961 Patterning in Childrens Language  
Learning- in Sol Saporta (ed)-  
Psycholinguistics - A Book of  
Readings-pp. 350-358-Holt, Rinehart  
and Winston Inc. , New York
17. Liberman P. and  
S.E. Blumstein 1988 Speech Physiology Speech perception  
and Acoustic Phonetics- CUP
18. Lenneberg E.H. 1971 Speech as a Motor Skill with Special  
Reference to Non Aphasic Disorders  
Bellugi and Brown (eds)- Aquisition  
of Language-University of Chicago Press
19. Mc Neill D. 1970 The Aquisition of Language- The  
Study of Developmental  
Psycholinguistics- pp.133-141  
harper and Row Publishers New York
20. Menyuk P. 1988 Role of Distinctive Features in  
Children's Acquisition of Language-  
Journal of Speech and Hearing  
Research-Vol.11 pp.138-46
21. Menyuk P., Lise  
Mann ,R. Silber 1979 Early Strategies for the  
Perception and Production of Words  
and Sounds-P. Fletcher and M.  
Garman (eds) -Language Acquisition-  
pp. 49-70 -CUP
22. K. S. Venkataraman A. 1977 The First Two Years of Speech in The  
Acquisition of English Phonology-  
UCLA Working Papers in Phonetics-  
Vol.46 pp.426-41.

23. Oller, D.K. and R.E. Eilers 1982 Similarity in Babbling in Spanish and English learning Babies- Journal of Child Language-Vol. 9 pp.
24. Oller, D.K. 1980 The Emergence of Speech in Infancy- Grace H., J.F. Kavanagh and C.A. Ferguson (eds)- Child Phonology Vol. 1 pp 93-112- Academic Press
25. Srivastava, G.P. 1974 A Childs acquisition of Hindi consonants - Indian Linguistics Vol. 35 pp.112-18
26. Stark, R.E. 1979 Prespeech Segmental Feature Development - P. Fletcher and M. Garman (eds)- Language Acquisition- pp 149-60 -CUP
27. Stark, R.E. 1980 Stages of Speech Development in the First Year of Life- Grace H. J.F. Kavanagh and C.A. Ferguson (eds) - Child Phonology, Vol. 1 -pp. 73-92- Academic Press
28. Straight, H.S. 1980 Auditory Versus Articulatory Processes and Their Development in Children- Grace H., J.F. Kavanagh and C.A. Ferguson (eds)- Child Phonology Vol. 1 pp.- Academic Press