PHONEMIC INVENTORY OF PUNJABI

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ABSTRACT

Punjabi belongs to Indo-Aryan family. In this paper its phonemic inventory is discussed. Dialect spoken in Lahore region is considered. Documented inventories were considered as basis of the analysis and then further experiments are conducted for investigation of status of the phonemes particular to the dialect.

1. INTRODUCTION

Punjabi is an intercontinental language. Its speakers are spread all over the world. The natives of the Punjab region of India and Pakistan speak this language.

Punjabi is a member of the Indo-Aryan language family (See Appendix A) [6]. Punjabi in India is more open to Sanskrit and traditional sources whereas Punjabi in Pakistan is influenced by Perso-Arabic Sources [7].

Punjabi language has a number of regional dialects that are spoken in both India as well as in Pakistan. The main dialects of Punjabi in India are Majhi, Doabi, Malwai and Puwadhi. The regional dialects like Pothohari, Lehandi & Multani are spoken in Pakistan [7]. The dialects of different areas have been observed to have distinct differences in their phonemic inventories.

In India the Punjabi is written in Gurmukhi script as far as in Pakistan it is written in Perso-Arabic Script. Gurmukhi is considered more suitable script for writing Punjabi as it was devised to write Punjabi by a Sikh Guru Angad [13].

2. LITERATURE REVIEW & PROBLEM STATEMENT

The phonemic inventory of Punjabi is discussed in many books, but most of the work is done on the dialects spoken in Eastern Punjab. Due to difference of religious backgrounds, Punjabi spoken in Eastern Punjab is more influenced by Sanskrit where as Punjabi spoken in Western Punjab is influenced by Persian and Arabic. This difference causes some changes in the phonemic inventory of Western Punjab. Dialects spoken in Western Punjab also differ in their phonemic system.

This paper presents the phonemic inventory of the Punjabi dialect spoken in Lahore and its surroundings.

After collecting phonemic inventory from different sources, my aim was to verify them for my dialect.

One of the problems was to check for the existence of [ɲ], a palatal nasal. There were references to the existence of a palatal nasal /ɲ/ in various inventories of Punjabi (Colin, 1991), [7], but these did not mention the dialect or considered Majhi dialact (spoken in Amritsar) as the standard. Gurmukhi orthography [8] also shows that there is a distinguished palatal nasal in Punjabi, particularly in context of palatal affricate /ʤ/ and diphthong /ɪa/, nasal sound is written differently as compared to other contexts [9], [10].

For example, in /ʤə̃nʤ/ and /nɪaɲi/, ਞ is used for nasal occurring in /ʤ/ or /ɪa/context. Whereas for alveolar nasal ਨ is used [9], [10].

All the sources claimed three short vowels in Punjabi (Colin, 1991), [7]. But it was observed that quality of /ɪ/ and /ʊ/ short vowels changes with stress. It seems that they are converted to short form of vowels /e/ and /o/ respectively. This phenomenon may increase number of short vowels to five. The second problem was to examine the existence and phonemic status of these two new vowels.

Other controversial consonants were /ɳ/ and /ɭ/. Their phonetic characteristics had to be examined to check whether these are retroflex lateral and retroflex nasal or flaps.

Punjabi is a tonal language (Colin, 1991), [7]. Tonal languages employ patterns of pitch variation to distinguish between different meanings of word that have the same pattern of consonants and vowels. Tone features in tone languages are segmental and phonemic in function (Pickett, 1999). One of the problems was to observe the tonal patterns occurring in Punjabi, which cause lexical differences in words.

3. METHODOLOGY

For confirmation of phonemic existence of sounds I used parallel distributions of those sounds. I tried to find minimal pairs for all the sounds that might be allophonic to each other.
See Appendix B for a list of all the investigated pairs and the ones that were found to be minimal.

To investigate the phonetic characteristics of sounds /ɳ/ and /ɭ/, I took minimal pairs of /l/ and /n/ with their retroflex variations. Pairs used for this study were as follows:

[mə̃n]	[mə̃ɳ]
[kana]	[kaɳa]
[və̃l]	[və̃ɭ]
[kʰə̃l]	[kʰə̃ɭ]

To verify existence of palatal nasal, I choose four words in _dʒ and _ɪa context. The words were chosen from a Gurmukhi Dictionary [9], [10] since Gurmukhi script is phonemically more directly linked to spoken Punjabi than Urdu script. The words used for this analysis are as follows:

/dʒə̃ndʒ/	marriage party
/mə̃ndʒi/	bed
/nɪani/	girl
/d̪ʰə̃nɪa/	parsley like garnish

Their acoustic properties were analyzed to distinguish alveolar nasal from palatal nasal. Vowel transitions while entering into the nasal and at the release were observed.

Since the distinguishing acoustic features were not found sufficiently documented [11], [12], an additional experiment was conducted to verify them.

It was documented that /ɲ/ can be distinguished by the feature [+compact] [11] i.e. the power of the signal is located in the middle, which implies that F2 is closer to F1 [12]. To verify this, a vowel with high F2 (ɛ) was selected, and another with low F2 (u) was selected. The contexts /Cɛ/ and /Cu/ were then recorded (C denoting a Consonant), where C was [n] and [ɲ], and the rate of transition of the F2s was observed. It was expected that in /Cu/ context, rate of transition of F2 will be greater for /n/ than /ɲ/. In /Cɛ/ context higher rate of transition for /ɲ/ is expected.

To check the existence of shorter form of vowels /o/ and /e/ some pairs of words containing /ɪ/ and /ʊ/ were taken. One of which is suspected to have change in vowel quality resulting in change to /o/ or /e/. Words used for this experiment are as follows:

/gɪtʰ/	/gɪtʰan/
/pʰɪr/	/pʰɪrki]
/tʃil/	/tʃɪlɳa]
/sʊr/	/sʊrili/
/mur/	/muri/

Words listed in first column are expected to have change in vowel.

To observe the tonal structure of Punjabi, some words containing different tones were recorded. Punjabi orthography in Urdu or Gurmukhi script does not show tones. It was observed that orthographically voiced aspirated stops are converted into corresponding voiceless stop with high tone on the syllable (Khan, 1997). Moreover, tones are observed on the words containing

/h/ in middle and end of the word in Urdu orthography. The word selection was made in accordance with these observations. For words selected for tonal analysis see Appendix C.

For all experiments, words were recorded five times in random sequence by five native speakers of Punjabi (Lahore accent).

4. RESULTS

While comparing spectrograms of /ɳ/ and /n/, a significant difference can be seen. In /ɳ/ there is very small duration of the closure period and falling F3, which shows it is a retroflex flap (Pickett, 1999). Another argument for considering it a flap is speaker cannot hold it while articulating /ɳ/. In the same way the spectrogram of /ɭ/ shows a slight retro flexion by falling F3. See Appendix D for spectrograms.

For the /ɲ/ experiment it was verified that the documented features were correct. F2 increase in /Cɛ/ context is more for /ɲ/ and its decrease in case of /Cu/ context is more for /n/. See Appendix E for spectrograms.

While observing formants of nasal with palatal consonant, it is observed that F2 is rising while entering in the nasal and coming downward at release. This shows that nasal in the palatal context does not get palatalized. See Appendices F.

For the short vowel experiment, the formants of the documented /ɪ/ and /ʊ/ in suspected words were found to be different as expected; their F2s were found to be decreasing and F1s were increasing. Their length of duration was also increasing. For the spectrograms see Appendices G. Even though the length of duration was increasing, they were not being changed into long vowels, since the long vowels were of even longer duration.

The minimal pairs
[ser] unit of measurement
[ser] (short e) head
prove that the long and short forms of [e] are phonemic, but the short form of [e] is allophonic with [ɪ].

And the minimal pairs
[pòr] morning / crumbs
[pòr] (with short [o]) to crumble
prove the same for the other set.

From the experiments on the tonal structure of Punjabi three tones high, mid and low were found. While producing these tones, there is no blockage of air in the mouth. They are pronounced concurrently with a syllable.

High tone is higher then the other two tones and the syllable with this tone is also shorter than those with other two tones.

Mid tone is considered to be an intermediate in pitch between the high and the low tones. The syllable is of an intermediate height. Low tone has been described as the lowest of the three tones. The pitch tends to fall. The syllable under this tone is longer in comparison with the other two. These three tones mark lexical contrast. Some examples are as follows:

/kòɾa/	horse
/koɾa/	whip
/kóɾa/	leper
/tʃà/	peep
/tʃa/	enthusiasm
/tʃá/	tea

See Appendix C for an example of tonal minimal pair.

The conclusion drawn from the results of the experiments stated above are as follows.
Punjabi system of sounds involves five distinctive tongue positions: labial, dental, retroflex, palatal and velar. The retroflex position varies from person to person and may involve curling back of the tongue to make the contact with the underside of the tip, or merely retraction.

TABLE 1 Consonant of Punjabi

	Bilabial	Labiodental	Dental	Alveolar	Retroflex	Palatal	Velar	Glotal
Plosive	p		t̪		ʈ	tʃ	k	
	pʰ		t̪ʰ		ʈʰ	tʃʰ	kʰ	
	b		d̪		ɖ	dʒ	g	
Nasal	m			n	ɳ		ŋ	
Fricative		f		s		ʃ	χ	h
		v		z			ɤ	
Trill				r				
Flap					ɾ			
Approxi-mate				l	ɭ	j		

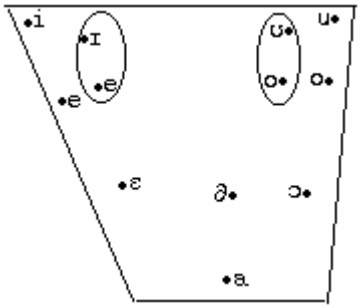

FIGURE 1 Vowels of Punjabi

Voiceless series of stops is /p, t̪, ʈ, k/. Their corresponding voiced phonemes are /b, d̪, ɖ, g/.

There is a palatal affricate /tʃ/ and its voiced version is /dʒ/. All voiceless stops and affricates also have aspirated version.

Voiced aspirates series is absent in Punjabi. Absence of the voiced aspirates is compensated by the presence of tone. Voiced aspirates exist in written script, but in speech, word initially they are replaced by corresponding voiceless stop and presence of high tone; whereas, in the middle and end of words the voicing feature remains and a tone is added.

There are four nasals observed; bilabial, alveolar, retroflex and velar: /m, n, ɳ, ŋ/. /ɳ/ is a nasal flap[ɾ̃]. Punjabi includes one trill /r/, a tap /ɾ/ and a retroflex flapped lateral /ɭ/.

Fricatives include labiodental, alveolar and palatal places: /f, s, ʃ/. Their corresponding voiced version is /v, z/. Voiced fricative does not exist at palatal place. Velar fricatives /χ, ɤ/ exist due to Persian and Arabic influence. Most of the Punjabi speakers recognize them. These have become part of Punjabi language due to borrowed words form Arabic and Persian, which are frequently used in Islamic books written in Punjabi. But some people replace them with native sounds /g/ and /kʰ/ respectively. Glottal fricative [h] exists in Punjabi. It occurs frequently in written script but is only pronounced word-initially, otherwise it is manifested as a tone (high or low).

Approximates /l, j/ are also in phonemic inventory of Punjabi. Complete consonant inventory is given in the Table 1.

Ten vowels are included in the Punjabi vowel system. Three of them are short vowels /ɪ, ʊ, ə/, whereas seven are long out of which /i, e, ɛ/ are front vowels and /u, o, ɔ, a/ are back vowels. Complete vowel inventory is given in Figure 1. Encircled vowels are allophonic to each other. To determine relative position of the vowels,

formants of all recorded words are considered.

5. DISCUSSION

With reference to the phoneme /ɭ/, it was found that two of test subjects could not recognize the difference between the minimal pairs listed in Appendix B. This could have been due to the variation of the dialect found even in Lahore only, or due to the influence of other dialects and also Urdu. It was not expected that such a small variation would affect the results, otherwise more test subjects would have been chosen.

In the documented inventories of Punjabi, either [ʋ] or [w] were used. I have used [ʋ] because I have observed that when Punjabi speakers learn English they pronounce all words with /ʋ/ or /w/ as a [ʋ] and have to be taught specifically how to pronounce a [w] but I have not investigated this acoustically.

6. REFERENCES

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[8] http://www.omniglot.com/writing/devanagari.htm

[9] http://www.gurmukhi.org

[10] http://www.punjabonline.com/servlets/library.dictionary?Action=Punjabi

[11] http://www.uoregon.edu/~guion/411notes/phon.htm

[12] http://www.phon.ucl.ac.uk/home/johnm/sid/sidc.htm

[13] http://www.sikhs.org/gurmukhi.htm

7. APPENDIX A

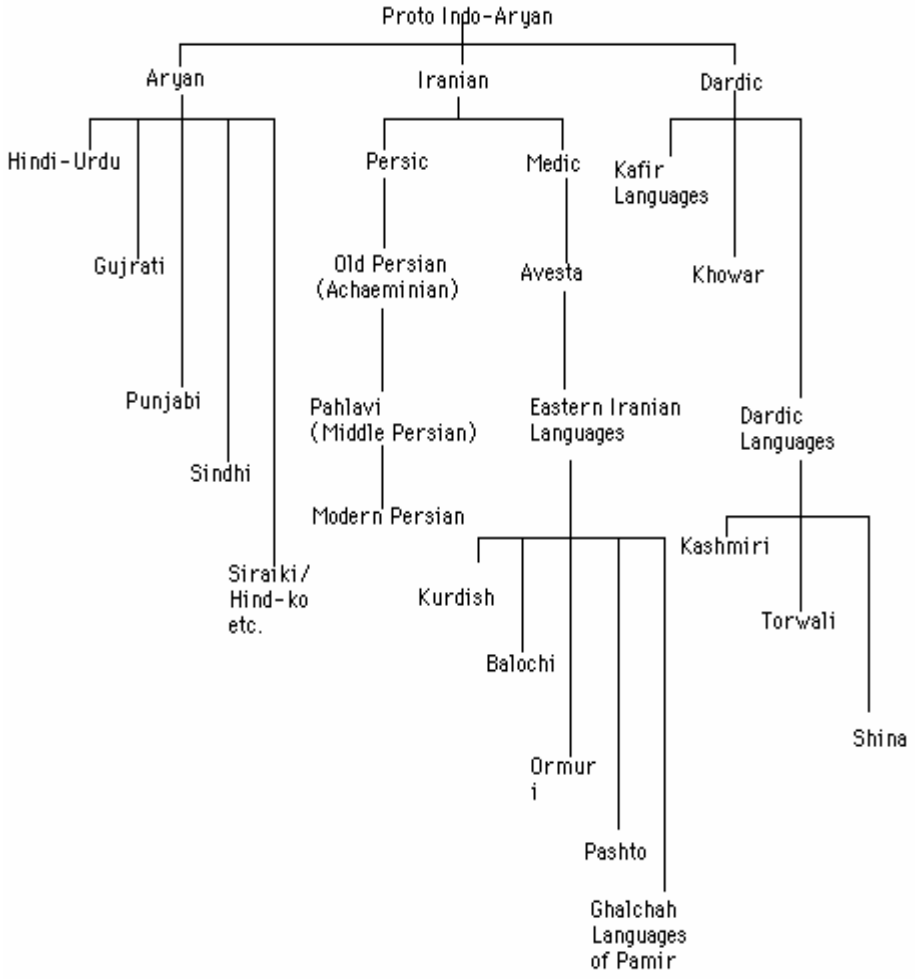


FIGURE A.1 abstracted hierarchy chart for Punjabi

8. APPENDIX B

List of minimal pairs to prove phonemic existence of consonants given in the results.

1.

/bap/	father
/pap/	sin

2.

/gəda/	cart
/gəɖa/	mattress

3.

/kʰənd/	sugar
/kənd/	back

4.

/ʈora/	unit of weight
/ʈʰora/	some

5.

/pap/	sin
/map/	measure

6.

/ləri/	string
/rəri/	desolate

7.

/ʤora/	pair
/ʧora/	wide

8.

/ʧəl/	go
/ʧʰəl/	deceive

9.

/toti/	piece
/ʧoti/	peak

10.

/sər/	a plant
/ʃər/	

11.

/sər/	a plant
/zər/	something precious

12.

/map/	measure
/bap/	father

13.

/mín/	rain
/nín/	foundation

14.

/vəl/	vine
/vəɭ/	twist

15.

/kana/	straw
/kaɳa/	blind in one eye

16.

/rən/	wife
/rəŋ/	color

List of minimal pairs to prove phonemic existence of vowels given in the results:

1.

/sur/	pig
/sɔr/	developed
/sar/	importance
/sir/	relation
/ser/	measure of weight
/sɛr/	walk
/sɪr/	head
/sur/	tone
/sər/	a wild plant

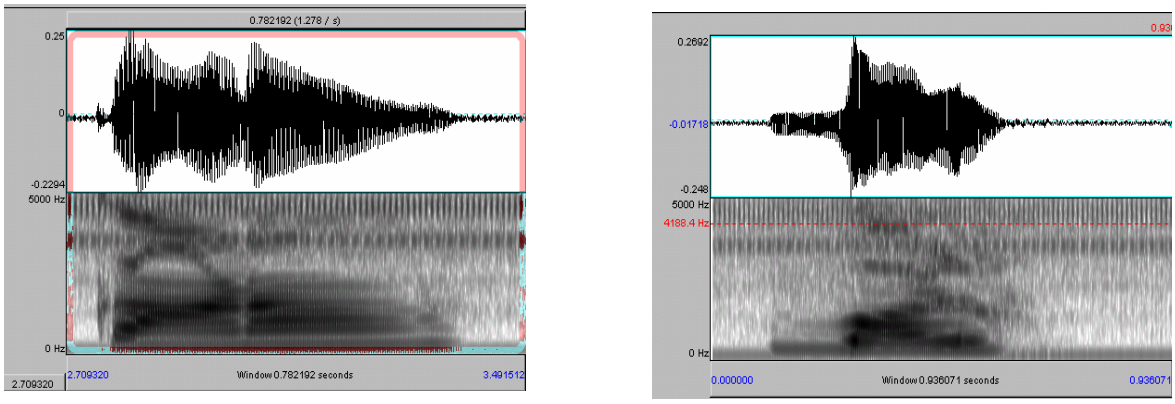
2.

/roɭ/	devalue
/rəɭ/	mix

9. APPENDIX C

[ʧa]	enthusiasm	
[ʧà]	peep	
[ʧá]	tea	
[kora]		whip
[kòra]		horse
[kóra]		leper
[lòrə]	lahore	
[lor]	need	
[lór]	flood	
[pɛ̀ra]		bad
[pír i]		stool
[bɛ́ɳ]	to sit	
[pɛ̀ɳ]	sister	

10. APPENDIX D

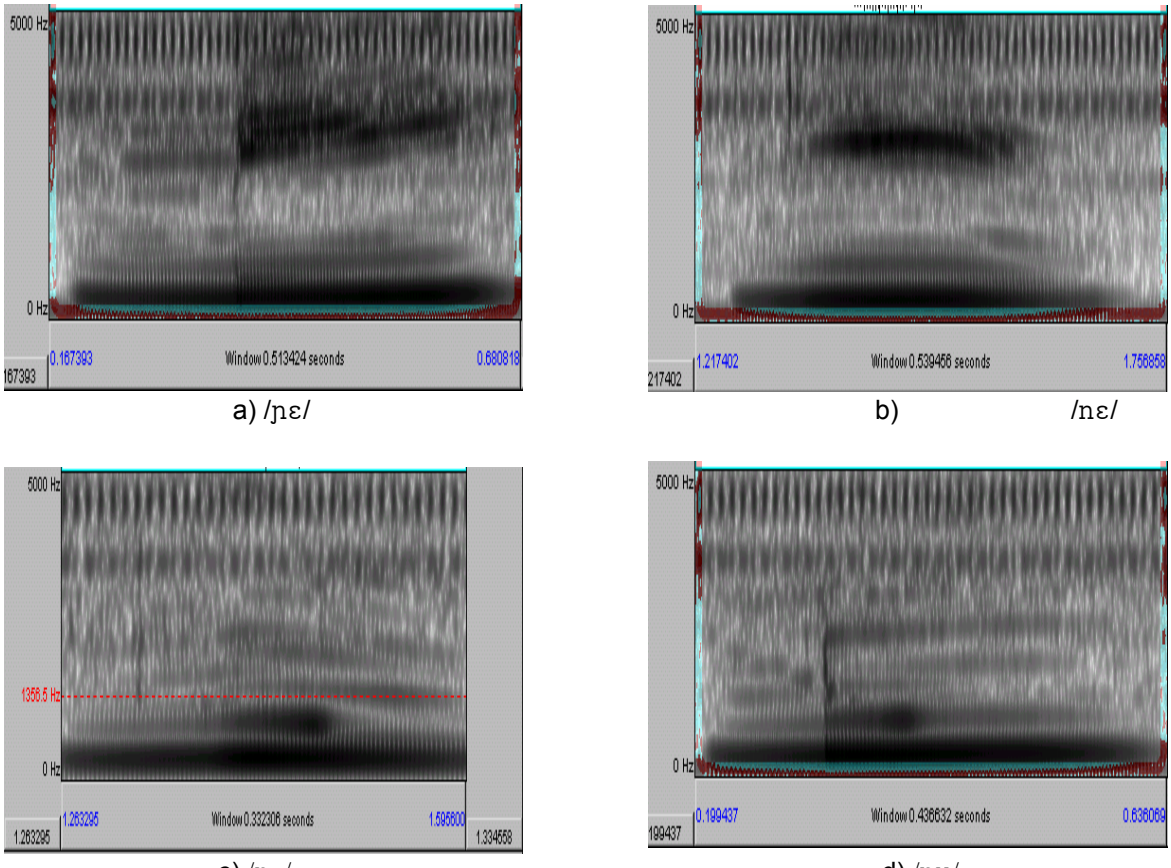


a) / kaɳa/

b) /vɔ̃l/

FIGURE D.1 Retroflex nasal and lateral spectrograms

11. APPENDIX E



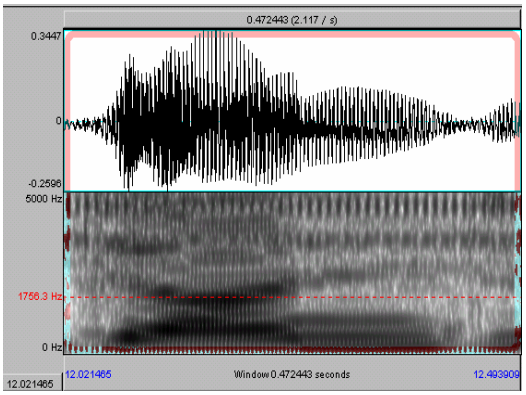
a) /ɲɛ/

b) /nɛ/

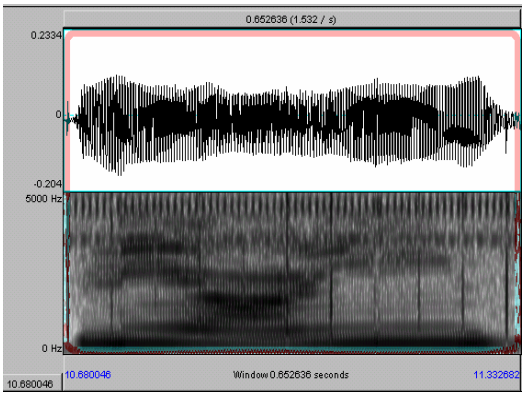
c) /ɲu/

d) /nu/

FIGURE E.1 Spectrograms for /Cɛ/ and /Cɯ/ context, where C is /n/ and /ɲ/



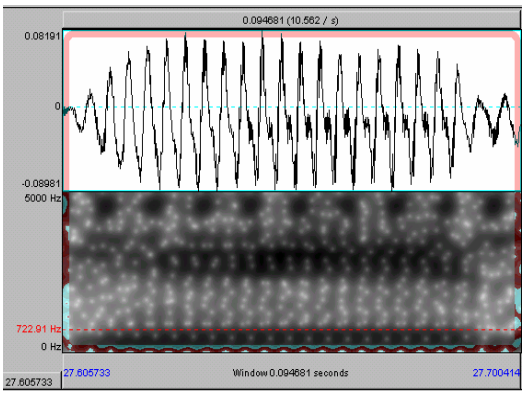
/dʒəndʒ/



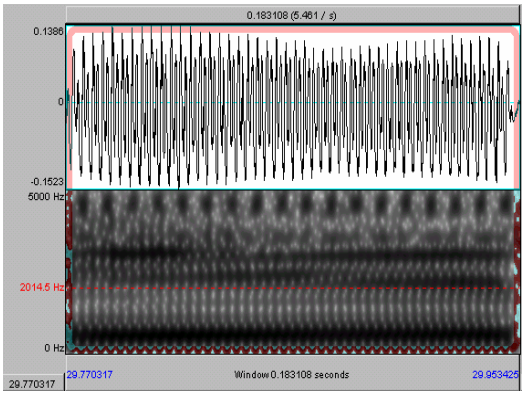
/niani/

FIGURE E.2 Spectrograms of words suspected for /ɲ/.

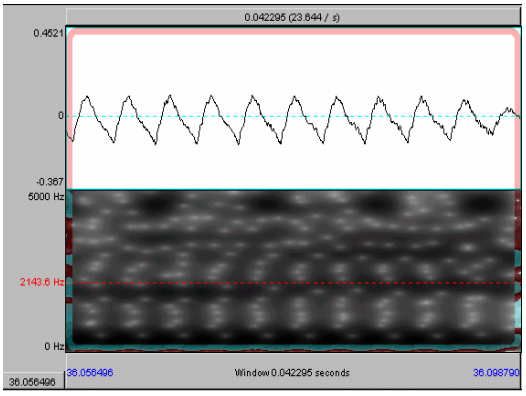
12. APPENDIX F



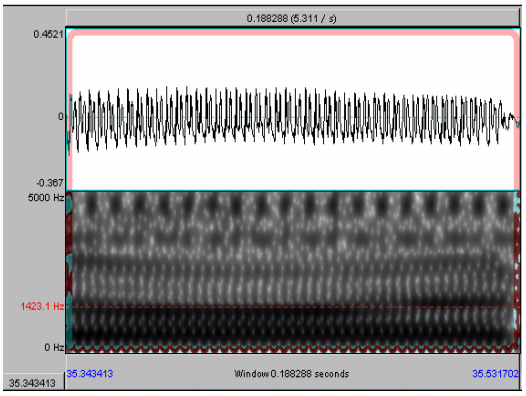
a) /ɪ/



b) /e/



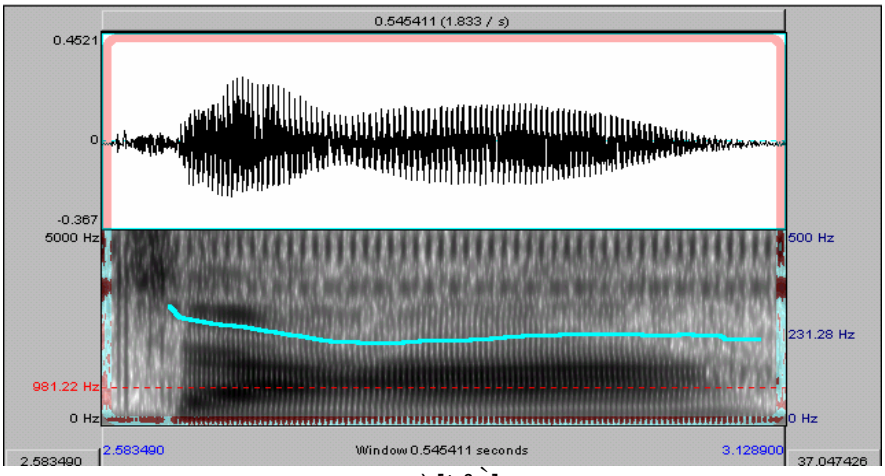
c) /ʊ/



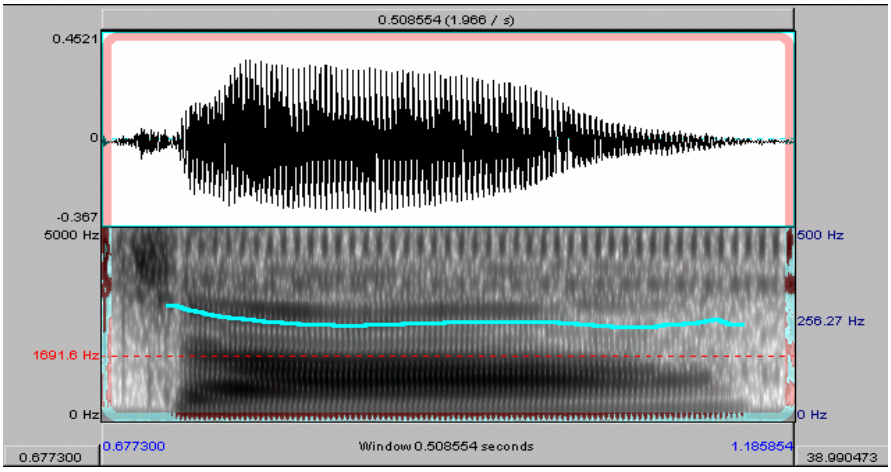
d) /o/

FIGURE F.1 Spectrograms of short /o/ and /e/ along with /ʊ/ and /ɪ/.

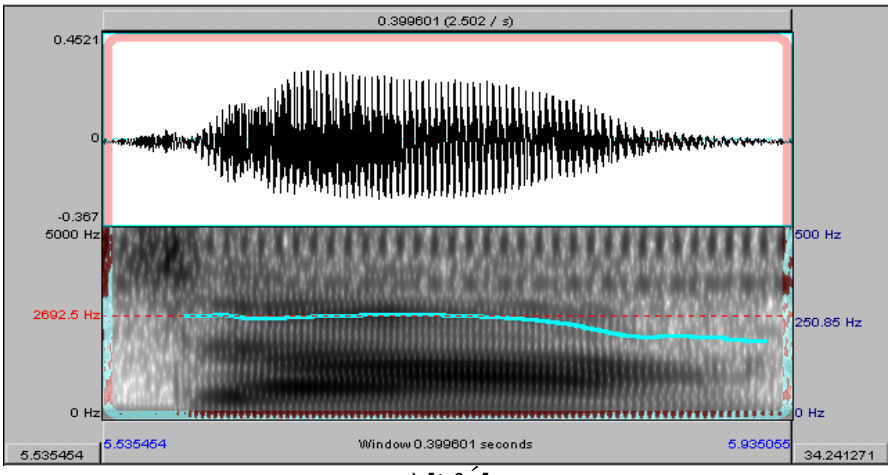
13. APPENDIX G



a) [t ʃ à]



b) [t ʃ a]



c) [t ʃ á]

FIGURE G.1 Varying tone having same sequence of consonants and vowels