VARIATION BETWEEN PALATAL VOICED FRICATIVE AND PALATAL APPROXIMANT IN URDU SPOKEN LANGUAGE

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1. INTRODUCTION

Urdu is the national language of Pakistan. It has most of the common vocalic and consonantal sounds present in other languages. There is not much research done on distribution of Urdu sounds. There is no official record of allophones, which exists in Urdu, and consequently no data available about the distribution of Urdu allophones.

This paper is proposed to find the distribution between the palatal voiced consonants (palatal voiced fricative [ʒ] and palatal approximant [j]).

2. LITERATURE REVIEW

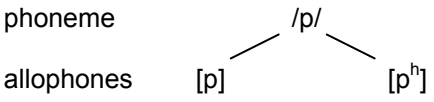
This part explains the conditions necessary for two sounds to be allophones. And if they are allophones than how their distribution can be determined.

2.1 Phonological Distribution

For any given consonant or vowel, the range of possible locations is constrained by the phonology of the language. This range of permitted locations constitutes the phonological distribution of that consonant or vowel. The distributional range of contextual occurrences of a given consonant or vowel in an accent is said to constitute its phonotactic range. The distribution of two consonants is often compared, for purposes of describing the phonological function of the segments in question. When two consonants or two vowels share the same distribution exactly (that is, when they can be said to have exactly the same phonotactic range), they are said to be in parallel distribution. When they share no locations, they are said to be in complementary distribution (Laver, 1994, pg. 38).

2.2 Allophones

Allophones are the predictable variants of a phoneme. The different phones that represent or are derived from one phone are called allophones of the phoneme. Allophones have to be phonetically similar like [h] and [ŋ] (Clark and Yallop, 1992, pg.127-128). Now consider phoneme /p/ as an example. English has two “P” sounds [p] and [p^h] (i.e. unaspirated and aspirated). These two sounds are phonetically similar. Native speakers of English tells us immediately that [p] and [p^h] are actually just two varieties of the same sound, that is, they are allophones of /p/. Concrete evidence for this intuition would be the complete absence in English of any minimal pairs differing on [p] and [p^h]. These allophones of /p/ can be visually represented as



2.3 Complementary Distribution

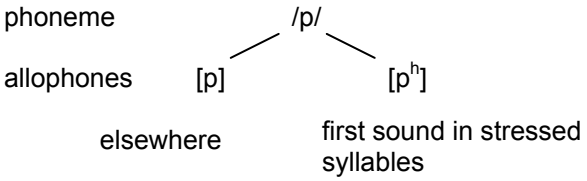
When two or more sounds never occur in the same environment, they are said to be in *complementary distribution* (e.g. aspirated voiceless stops vs. unaspirated voiceless stops). When two or more sounds are in complementary distribution, we know which sound occurs in which environment. That is, the distribution of those sounds is predictable. For those sounds in complementary distribution to be allophones of a single phoneme, they have to be

phonetically similar. (Clark and Yallop, 1992, pg. 130).

In fact, when we look carefully, we discover something interesting about the distribution of [p] and [p^h] in English. Consider the listings below:

[p^h]	[p]
port	sport
peace	soup
append	apple

By inspecting the two listings above, we discover the condition under which the aspirated variety of /p/ appears: Only when /p/ appears as the first sound in a stressed syllable does aspiration show up. In all other positions we find the usual, unaspirated variety of /p/. More generally, when we find that allophones of a single phoneme appear in different environments, we speak of their being in *complementary distribution*. The allophone that appears in the larger number of positions is then said to meet the *elsewhere* condition. We can thus add more information to the visual representation we made before for [p] and [p^h].



Allophones of a single phoneme in complementary distribution are thus ones where the phonetic environments are not the same. The allophone that appears in the greatest number of environments meets the elsewhere condition.

2.4 Free Variation

Sometimes we observe allophones in exactly the same environment. A good example of this phenomenon involves, once again, our model-organism phoneme /p/. Before we noted that this phoneme has two allophones, the unaspirated [p] and the aspirated [p^h]. In both of these sounds, the blockage of the airflow is released before the following sound. There is, however, another allophone of the phoneme /p/ in English, however. This one is the *unreleased* variety, which we represent with a diacritic: [p']. This allophone of /p/ appears when we do not release the blockage of the airflow (i.e., lips not open) at the end of its articulation. Consider the following:

a. heap [hiyp'] or [hiyp]
b. rope [rowp'] or [rowp]
c. laptop [læp'top]
d. popcorn [p^h op'krn]
e. hippy [hıpiy]

As these data indicate, [p'] appears at the end of words, including words that are used together with other words to form what we call *compounds*. Crucial, however, are the examples in (a) and (b) above, which show that the allophones [p] and [p|] can also appear in exactly the same environment. When allophones of a single phoneme appear in exactly the same environment in this way, we speak of *overlapping distribution* (as opposed to complementary distribution), and we conclude that these allophones are in *free variation*.

3. PROBLEM STATEMENT

Palatal voiced fricative and palatal approximant are allophones of each other because they are phonetically similar and there are no existing minimal pairs for both the consonants (These conditions are stated in the previous section.)

The question is about its phonological distribution, which is discussed in the paper with the help of experiments. The scope of this paper is to show whether these two consonants share the same distribution exactly (that is, when they can be said to have exactly the same phonotactic range) or they share no locations.

4. METHODOLOGY

According to (Fromkin V. 2000, pg.537) here is a procedure for examining the target sounds in the data. For each sound, we compile all of the contexts in which it appears. Since the conditioning environment for allophones is usually (though not always) found in the immediately preceding and following segments. So the Urdu into English dictionary (Qureshi B. 1992) was used to find all the words of Urdu containing [j] or [ʒ] in the syllable initial, final or at both positions. Than those words were selected which had the same syllable context or at least the same vowel following or preceding both the target consonants as displayed in 4.1. For example the words ʒəd.vaṛ(meaning ”root”) and jə.dæ.be.zaṇ(meaning ”luminous hand”) have the same vowel in the first syllable following the target consonants.

(4.1)

ʒaʒ”nonsense” tə.jag.nạ”renounce”

ʒəd.var ”rooţ”jə .dæ .be.zạ”luminous hand”

ʒo.li.da “confused” kə.jo.ţi”mixture”

4.1 Speakers

Recordings were obtained from 5 speakers, all males. All subjects were native speakers of Urdu and they knew about the purpose of the experiment. All the speakers belonged to age group of 20 to 22 years and they were normal in speech and hearing.

4.2 Recording Procedure

All the speakers were given words to be recorded written in Urdu script and transcribed phonetically so that they pronounce them correctly. All the words were written in a sequential manner as shown in 4.2. All speakers were asked to rehearse on these words before recording so that they don’t fumble any word during recording.

(4.2)

ʒaʒ ʒədvar ʒolida təjagna jədæbeza kəjoti

The speakers were also asked to speak at a natural rate and loudness. After the speakers were ready their voice was recorded using the ESPS (Entropic Signal Processing Software) version 5.3. The same sequence of words was recorded three times by each speaker in order to have better results. Recorded speech was than filtered using the lowpass filter of Entropic to remove the noise added by the recording machine.

4.3 Analysis

Recorded speech was analyzed using the *xwaves* (Speech data Visualizing facility by Entropic). The time waveform was marked between word’s start and end places using the *xmark* facility in *xwaves.* Then the spectrogram of each marked word was drawn using the spectrogram facility of the *xwaves*. Then the target consonant was marked in the spectrogram of the word and *align & rescale* facility was used to align the selection with the time waveform.

4.4 Measurements

The formant utility of *xwaves* was used to calculate F0 and the Formants of the recorded speech. Than the cursor was moved between the selected area and the value of fundamental frequency and the first formant was recorded at that point. Spectrograms are not ideal for examination of the detailed spectral features of fricatives. For this purpose, it is preferable to use spectra determined by methods such as DFT or LPC (Kent & Read, 1992, pg.123). So DFT was taken to calculate the amplitude of the F0 and Formants. DFT was taken of the selected signal using *xspectrum* utility of xwaves. The parameters were set according to 4.3. The amplitudes of the F0 and first formant (calculated previously) were recorded. The ratios of both amplitudes were calculated to find whether both the target consonants show similar acoustic behavior in some context or are they totally different from each other.

(4.3.)
Parameter (value)

Analysis type (DFT) Window type (Hanning)
Window limits from cursor (+ - 2 size / 2)
Reemphasis coeff. (0.000000)
Integration coefficient (0.9900)
Horizontal cursor (Off)
Reticle (On) Harmonic Cursors (Off)
Formants (On) Plot scale (log pwr (dB))
Filtering (Lowpass)

5. RESULTS

After compiling the words collected by the dictionary all of the contexts for the target sounds are listed in the chart 5.1. [$_{syllable}$ and]$_{syllable}$ represents the syllable start and syllable end respectively. The line represents the location of the target consonant.

(5.1)

[ʒ]	[j]
/ [$_{syllable}$ _____ e̞	/ [$_{syllable}$ _____ ə
/ [$_{syllable}$ _____ o̞	/ [$_{syllable}$ _____ ɑ
/ [$_{syllable}$ _____ ə /	[$_{syllable}$ _____ e
/ [$_{syllable}$ _____ o	/ [$_{syllable}$ _____ o
/ ə_____.]$_{syllable}$ /	[$_{syllable}$ _____ u
	/ [$_{syllable}$ _____ i
	/ [$_{syllable}$ _____ ɪ
	/ [$_{syllable}$ _____ ɔ
	/ [$_{syllable}$ _____ ũ
	/ [$_{syllable}$ _____ ã

The purpose of the experiment was to measure the relationship between intensity of the fundamental frequency and the first formant of target consonant. The results shown in Table 1.1 are the mean of the three repetitions taken by the speech recorded by the speaker MS. They are somewhere in between all other readings tabulated in the Appendix A.

Words Containing Target Consonant	F0 (dB)	F1 (dB)
ʒaʒ	83	76.66667
ʒə̤d.var	81.33333	78.33333
ʒo.li.da	85.66667	75.66667
tə.jag.na	85.66667	99.66667
jə.d̪ə.be.za	84.66667	85.33333
kə.jo.ti	88	92.33333

TABLE 1.1 Mean of the three repetitions recorded by the speaker MS.

The results show that the intensity of the first formant is higher than the intensity of the fundamental frequency in case of the consonant [j] and is lower in the case of consonant [ʒ].

To find the relations between the two consonants, ratio between the intensities of the two frequencies was calculated and the mean of all the resultant ratios is tabulated in Table 1.2.

Words Containing Target Consonant	Mean of ratios (F0/F1)
ʒaʒ	1.102055
ʒə̤d.var	1.044995
ʒo.li.d̪a	1.073304
tə.jag.na	0.846639
jə.d̪ə.be.za	0.979536
kə.jo.ti	0.879285

TABLE 1.2 Mean of all ratios calculated on the data of three repetitions by each of the five speakers.

6. DISCUSSION

The results can be described both phonetically and phonemically according to the data available to us.

6.1 Phonetic Description

Mean of the ratios between intensities of the fundaments frequency and the first formant for the target consonant [ʒ] are higher than one as shown in Table 1.2. This indicates that denominator (intensity of the first formant) is less than the numerator (intensity of the fundamental formant). So [ʒ] is more fricative like. But the same ratios for the target consonant [j] are less than one. This indicates that denominator (intensity of the first formant) is greater than the numerator (intensity of the fundamental formant). So [j] is more approximant like. As there is never a case when one of them converges to the other one, which proves that they are phonetically distinct and they are not allophones but different phonemes.

6.2 Phonemic Description

Analysis of the data collected from the dictionary (Qureshi B. 1992.) for the two target sounds (listed in Appendix B) shows that there are no minimal or near minimal pairs existing for the two target sounds in Urdu, which indicates that they are allophones in Urdu. They share same places like in the words ʒo̲.li.ḍ̲aand kə.jo̲.ṭ̲iso they are not in complementary distribution but they are in free variation.

6.3 Concluding the discussion

Phonemic analysis cannot be relied upon because Urdu language has very few words containing the phone [ʒ], which is the main reason for non-existing minimal pairs. Relying on the phonetic analysis it can be concluded that the two target sounds [ʒ] and [j] are phones of two different phonemes /ʒ̃and /j/ in Urdu.

7. REFERENCES

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