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The Acoustic Analysis of Pashto Vowels

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Abstract

The study investigates the acoustic analysis of Pashto vowels. The materials included carrier minimal pairs which were produced by a group of ten Pashto native speakers of Yuzafzi dialect. The recorded vowel sounds, 9 in number, were acoustically analyzed. The durations of those vowels were recorded and tabulated along with their respective F1 and F2 frequencies. These vowel sounds were then mapped on a quadrilateral giving us the idiosyncratic quality of Pashto vowels.

Introduction

Pashto is an Eastern Indo-Iranian language. It has forty to fifty million speakers. Pashto is a dominant language in Southern Afghanistan and most parts of Balochistan and NWFP in Pakistan. It is also one of the two national languages of Afghanistan. Pashto is also taught up to secondary level in NWFP. It has five major dialects (Rahman (2009)). The dialect under research is the Yusafzi dialect..

Many impressionistic studies have been done on the Pashto vowels; but none of them are based on the scientific speech processing research. These studies are more phonologically based than phonetic in nature. The main reason behind the present study is to check the

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phonetic (acoustic) structure of those vocalic sounds and provide a sound base for further phonetic research on scientific grounds.

Literature Review

Various inventories of Pashto vowels have been proposed in previous studies. These inventories relate to the different dialects of Pashto. For example, the study of Tegey and Robson (1996) is based on the central dialect of Pashto spoken in the main areas of Afghanistan. According to this inventory, there are nine vowel sounds in central dialect of Pashto. Another such proposed inventory (Yusafzi dialect) is by Hallberg (1992) wherein eleven vowels inventory has been proposed. A third inventory based on the combination of Kandahar and Kabul dialect consisting of seven vowels has been proposed by Lavi Susannah (2004).

The inventory used in the present study is based on the inventory proposed by Hallberg (1992) and Rahman (2009) with the modification that here the researchers have taken nine vowels instead of eleven, the reason for this being the absence of minimal pairs for the two of the vowels in the dialect under research. It is also worth mentioning that all the above inventories have never been tested acoustically.

This paper is written with the expressed purpose of testing the phonetic validity of the above mentioned inventory.

Methodology

The target population for the present study is Pashto speakers of Yusafzi dialect. A sample of ten subjects was chosen for this study.

Sample

The sample consists of ten native speakers of Yusafzi dialect of Pashto. All the speakers (male) belonged to Malakand Division. Their ages ranged from 20 to 37 years.

Materials

The list of minimal pairs used in this study for recording and the subsequent analysis of the targeted vowel sounds is given in table 1 below. All the sounds occurred in stressed syllables.

Data Collection

The recording was done with a microphone which had a frequency response of 50 Hz to 18 kHz. An Acer laptop and high quality head phone were used for recording. The software used for the recording and processing of the data was Praat. The materials

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(minimal pairs) were administered individually to the participants under sound proof conditions. The pairs were administered randomly.

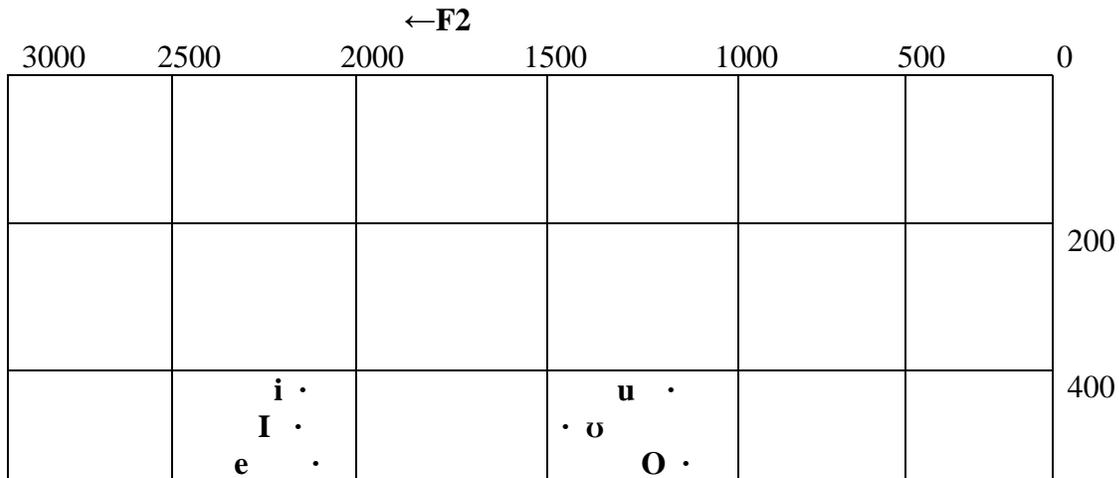
Results

The recorded data was retrieved from the laptop using the above mentioned tools and tabulated. The data included F1 and F2 values of each sound and their respective durations. Since each speaker had uttered each sound three times, mean values of F1, F2 and durations were calculated individually. After this we calculated the means values of all the speakers for each sound and the resultant data was tabulated (see table 1).

Pashto Vowels	Words	Meaning	F1 (Hz)	F2 (Hz)	Duration (ms)
/ i /	سړی	Men	412	2131	.142
/ I /	بین	Smell	423	2113	.10
/ e /	میز	Table	498	2051	.16
/ ə /	خر	Donkey	652	1535	.097
/ u /	شونډه	Lip	448	1314	.117
/ ʊ /	كوزه	Lower	458	1439	.073
/ æ /	قے	Vomiting	551	2055	.188
/ a /	بشار	City	702	1422	.163
/ O /	مور	Mother	556	1086	.166

Table 1 showing Pashto vowels with their F1, F2 and Durations.

Using the quadrilateral, all the nine vowel sounds under investigation were mapped using their F1 and F2 frequencies in the light of table 1. Table 1 also gives the exact durations of the individual vowels.



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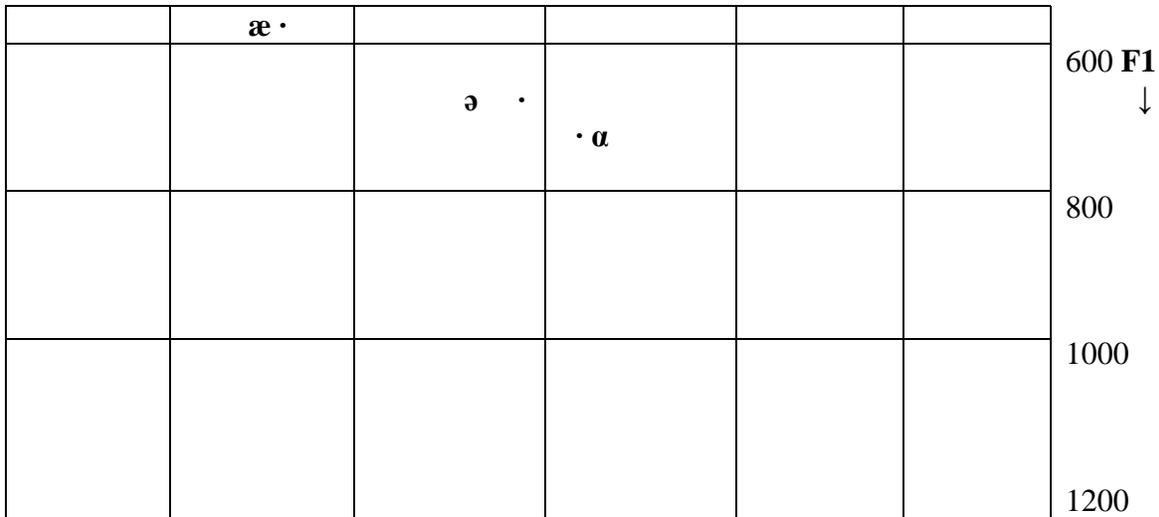


Figure 1 Quadrilateral of Pashto Vowels

Discussion

This study went into the acoustic analysis of Pashto vowels. The acoustic mapping of Pashto vowels is interesting and idiosyncratic when compared with other languages. Here the first idiosyncrasy is that, the central vowels / **ɪ** /, / **æ** /, / **ə** /, / **ʊ** / and / **ɑ** / exceed the number of peripheral vowels / **i** /, / **o** / and / **u** /.

According to Yallop and Clark (1999), “the smaller the number of vowels the lesser is their space from each other”. In our case, i.e. Pashto vowels, there is also lesser space quality-wise as is clear from the quadrilateral mapping and the number of vowels i.e. 9 compared to other languages such as Urdu and English.

Insofar as symmetry in Pashto vowel system is concerned, we can look for it in different ways. First, the high front / **i** / has a shorter / **ɪ** / and the high back / **u** / has a shorter counterpart / **ʊ** /. Again the front and back vowels are asymmetrical i.e. there are only two front vowel / **ɪ** / and / **æ** / and two back vowels / **u** / and / **ʊ** /.

Conclusion

In conclusion, it can be said that this study, on the one hand, confirmed previous findings and, on the other, raises further questions. First, it confirms that due to lesser number of vowels the articulatory space between vowels is less. Second, it raises the question why the number of central vowels exceeds those of peripherals. Finally, Pashto vowels confirm the issue of symmetry in its vowel system as well as defy it. This defiance (asymmetry) is termed by Abbercrombie (1967) as “holes in the pattern”.

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