

An Acoustic Analysis of Azerbaijani Vowels in Tabrizi Dialect

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ABSTRACT

Determining the acoustic properties of the sounds of any language and its related dialects is assumed to be the initial step in pedagogical or linguistic studies and comparing languages. No attempt to study Azeri vowels in Tabrizi Dialect has been reported yet according to our knowledge. The reported works are on North Azerbaijani variety (spoken in Azerbaijan). The present paper tried to do a computer-based acoustic analysis of Tabrizi dialect with the help of spectrographic and F1 and F2 comparison of Azeri vowels in Tabrizi dialect, and provided a digitized and authentic chart of its vowels. As a result, based on the formant values, a vowel space plot was developed. The participants in the study were 30 male and 30 female with an age range of 20 to 30. To have a more homogenous data we tried to have the subjects with the same or adjacent accents. The findings of the present study could be utilized in linguistic studies or in language pedagogy to help the foreign language learners to improve their pronunciation.

Keywords: acoustic analysis, formant analysis, Azeri vowels, vowel plot.

INTRODUCTION

1.1 Azeri language and research

The Azerbaijani language has the 34th rank in the world with overall 27 dialects and 7 dialects in Iran [1]. It is also called 'Azeri', 'Azeri Turk', or 'Azerbaijani Turkic' which is spoken in Azerbaijan and northwestern of Iran and some parts of Georgia, Iraq, northwestern Turkey and Ukraine [1]. South Azerbaijani, ISO 639-3 (azb), is the variety of Azerbaijani spoken in northwestern Iran. Iranian Azerbaijanis often call it 'Azari', 'Türki', or 'Türki Azari'. This variety is mainly spoken in the northwest provinces i.e. East Azerbaijan, West Azerbaijan, Ardabil, Zanjan, and some regions of Kurdistan, Hamadan, Qazvin and Markazi as the dominant language and as lingua franca. Azerbaijani has 34 phonemes including 9 vowels /a, æ, e, i, y, ə, Ø, o, u/ and 25 consonants. Vowel duration is not phonemic in Azerbaijani language. There are 9 diphthongs in Azerbaijani which are sequences of vowel (except ə) and following /y/ or /v/ sounds, although mostly 7 of them are used by Tabrizi dialect [2].

Trudgill [3] in *Dialects in Contact* discusses geographical diffusion models to describe how and why diffusion takes place in language contact situations, at a micro-level. A study by Narang and Mirza [4] on acoustic vowel space of Hindi and Punjabi coexisting in Delhi for a number of years, and the subjects claimed to be monolinguals in Hindi and Punjabi showed a clear influence of the presence of the other language in environment and the redefined acoustic space of the two languages in contact. South Azerbaijani variety known as Tabrizi dialect is in contact with Persian and heavily influenced by it and also Arabic, so that this dialect differs with the North Azerbaijani variety especially in that it contains a much great amount of Persian and Arabic loanwords, phrases and syntactic elements while the north Azerbaijani influenced by Russian language [5], [1]. Speakers of north and south Azerbaijani sometimes have problem in understanding each other [5], as some words used by the latter have Persian or Arabic origin may be unknown to the former.

Azeri language and especially Tabrizi dialect is comparatively much less researched compared to other languages such as English and Spanish. Most of the reported studies to-date has been conducted on Turkish and north Azerbaijani and their vowel formants and other acoustic features have been examined. But, there is nothing or few about Tabrizi dialect. Hillenbrand, Getty, Clark and Wheeler [6] stated that studies to evaluate vowel normalization which are used in cross-language comparison are typical of a special dialect at a specific time in the history of that dialect. As Alghamdi [7] showed by a spectrographic analysis of Arabic vowels based on a cross dialect-study, the phonetic implementation of the standard Arabic vowels system differs according to dialects; so the present study attempts to achieve the vowel plot in the Tabrizi dialect through analyzing its first and second formants of present vowels.

1.2 Acoustic Analysis

Studies on acoustics of vowels and their position in vowel chart are beneficial in many areas such as speaker identification study, speech technology, sociolinguistic studies, speech pathology and particularly in

language pedagogy. Beginning with Peterson and Barney's work on formant frequencies in 1952, the studies on formant patterns followed by other researchers such as Fant in 1960, Ladefoged in 1975 and a number of acoustic studies have contributed to our understanding of vowels and vowel spaces in different languages.

Vowels are syllabic sounds made with free passage of air down the mid-line of the vocal tract, usually with a convex tongue shape, and without friction. They are described by IPA using a set of cardinal vowels [8]. As Fant in 1960, cited in Cox [9], mentioned vowels are frequently described with reference to their formant structure, which provides an indication of vowel tract resonance and therefore articulatory shape. There is relatively simple correspondence between tongue height, frontness/backness and the relative position of F1 and F2. The first formant relates to vowel height. The second formant relates to frontness, backness and also lips rounding. Rounding the lips lowers F2 [10] & [8].

As Ladefoged and Broadbent [11] point out by analyzing "information-bearing elements of speech" when listening to a person talking, we can receive information from his accent about linguistic significance of the utterance, about the general background of the speaker such as speaker's place of origin and his social status (socio-linguistic), and personal information by idiosyncratic features (anatomical and physical considerations such as the particular shape of vocal cavities) of a person's speech. He found that at least possible both the linguistic and sociolinguistic information conveyed by vowels depend largely on the relative position of the formants. When we interpret the socio-linguistic information conveyed by a person's vowels by appreciating the relative formant structure of the vowels. Ogden [8] points out that vowels being highly variable sociolinguistically are an important starting point in the phonetic analysis of any variety of a language. The correlation of F1 and auditory quality of height, and F2 and the auditory impression and effect of the front/back dimension ensures that when the first two formants of a set of vowel targets are plotted on axes the result closely resembles the traditional auditory vowel map [9].

As indicated above, physical representation of vowels of a language is basic and of vital importance in any theoretical or empirical study. Being conscious about aforementioned practical goals, the present study tries to plot vowel chart of Azeri vowels in Tabrizi dialect by analyzing its first and second formants.

METHODOLOGY

2.1 Subjects:

The participants in the study were 30 male and 30 female with an age range of 20 to 30. Hillenbrand et al. [6] regarded gender and age of participants as important factors in acoustic analysis. They considered not reporting of participants' age and children's gender as some of the Peterson and Barney study in 1952. To have a more homogenous data we tried to have the subjects with the same or adjacent accents. We had the subjects from both genders. The result of a study by Anderson et al. in 1996, as cited in Ansarin [12], showed significant differences in terms of gender differences. In addition, subjects were eliminated if they 1) were non-native speakers of Azeri, 2) showed any evidence of a speech, language or voice disorder, 3) showed any evidence of a current respiratory infection.

2.2 Instrument:

The instrument consisted of nine Azeri words, each containing a vowel in middle environment. That is, all words started with the phoneme /f/ and ended with the phoneme /r/ except /fɪr/ which ended with the phoneme /t/ because there is no word with the form of /fɪr/ in Tabrizi dialect.

2.3 Procedure:

Audio recordings were made of nine words, each containing an Azeri vowel, i.e. / a, æ, e, ə, i, ɪ, u, o, Ø/, in the context of /f-r/ except for phoneme /Y/ which was in the context of /f-t/ because there is no word with the form of /fɪr/ in Tabrizi dialect. The subjects were given as much time as needed to practice the task and demonstrate an understanding of the pronunciations that were expected for each key word. The data were recorded by Nokia E7 cell phone equipped with active noise cancellation with dedicated microphone. After transferring recorded sounds to computer, the sounds were analyzed by speech analysis software *Praat* on computer.

FINDINGS AND DISCUSSION

The recorded sound waves were analyzed by the speech analysis software *Praat*. In doing so, we arrived at the formant values of vowels and then selected the steady state formants to calculate the average. Then the average formant values of each vowel are calculated. The Table 1 represents the mean values of the first and second formants for each vowel.

Table 1: Mean Values of the First and Second Formants of Azeri language in Tabrizi dialect by Azeri speakers

| Vowels | F1 | F2 |
|--------|---------|----------|
| i | 381.93 | 1997.86 |
| ɣ | 417.14 | 1715.17 |
| e | 526.87 | 1834.47 |
| ə | 506.86 | 1596.211 |
| æ | 781.09 | 1527.83 |
| a | 704.94 | 1226.06 |
| ø | 495.48 | 1472.41 |
| o | 538.755 | 1020.8 |
| u | 406.92 | 1028.75 |

The relationship between the first and second formants is primarily summarized in a vowel space plot. This was done by matching grid references of first and second formants of each vowel. Thus, as shown in Figure 1, based on the formant frequency values, a vowel space plot of Azeri vowels in Tabrizi dialect was developed. The plot shown in Figure 1 is not a normal one. So it was inverted (Figure 2) to achieve the common way of the presentation which is called "inverted and reverse model" in Ansarin [12]. In this graph the X axis starts with the lowest frequency and ends with highest, and the Y axis starts with the lowest and goes up in terms of frequency values. Refer to Figure 2 for more details.

Figure 1. Plot of Azeri vowels articulated by Azeri speakers in Tabrizi dialect

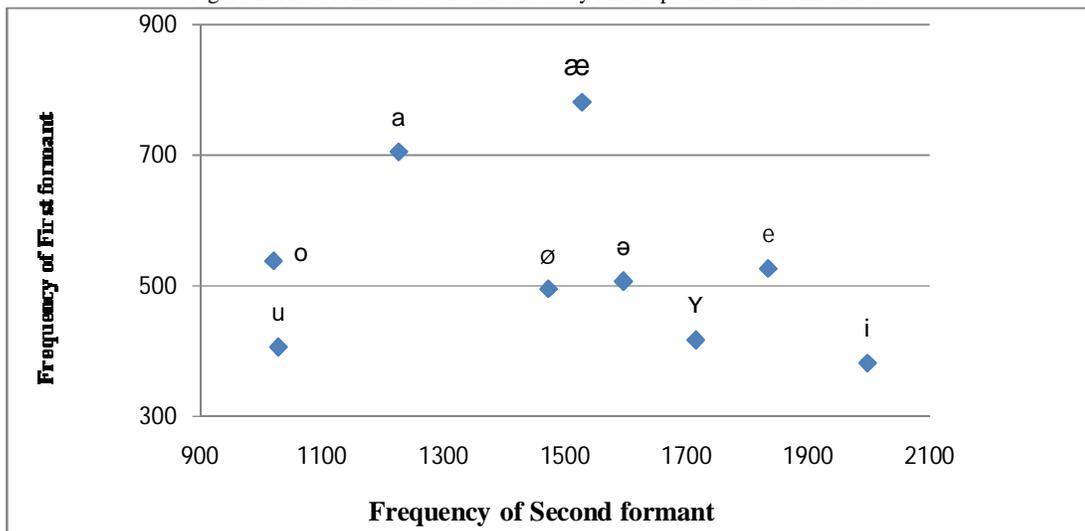
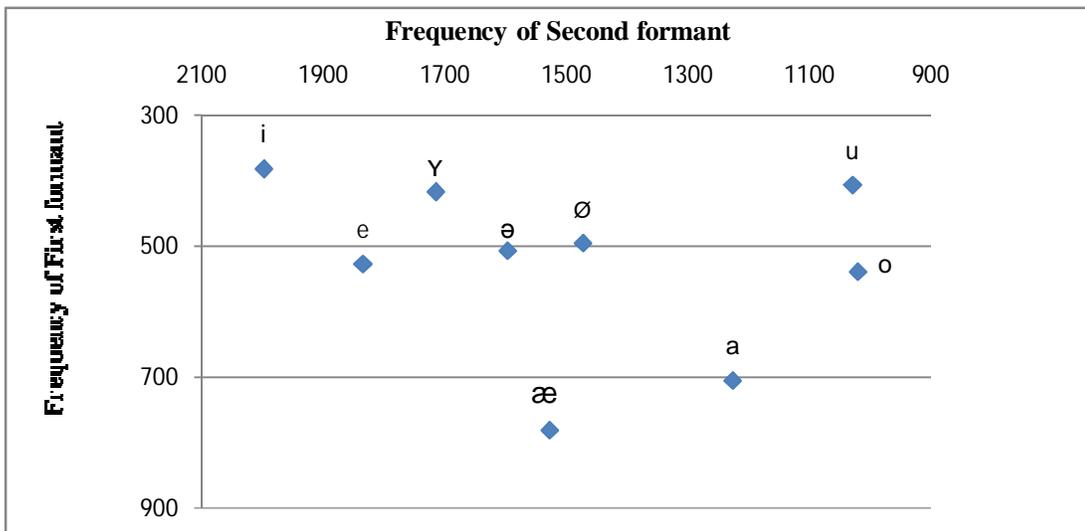


Figure 2: Plot of Azeri vowels articulated by Azeri speakers in Tabrizi dialect (inverted and reversed presentation)



Conclusion

As the chief objective of the study a phonetic chart of Azeri vowels in Tabrizi dialect is developed. The 9 vowels of this dialect i.e. / a, æ, e, ə, i, ʏ, u, o, Ø/ distributed symmetrically in the vowel space chart. Then their relevant and exact places of articulation, which are reflections of the approximate tongue positions, are plotted in a scaled format so called vowel chart.

The findings and results of the present study could be utilized in linguistic studies such as dialectology and sociolinguistic, or in language pedagogy by contrastive analysis to help the foreign language learners to improve their pronunciation.

Finally it is suggested that future studies incorporate data related to North Azerbaijani to compare the vowel charts of two languages. It is also possible to investigate the influence of Persian on Azeri.

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