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Vowel Reduction in Kermanian Accent

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Abstract

The purpose of this paper is investigating vowel reduction in Kermanian accent. Vowel reduction is a process which occurs in an unstressed syllable. It leads to change unstressed vowels and tend them to other vowels. In order to investigate vowel reduction in Kermanian accent, 6 male native speakers of Persian are participating which 3 of them are native speakers of Kerman and 3 others, speakers of standard Persian accent. The data included 12 words were recorded by a Shure microphone in the acoustic room of the linguistic department of Sharif University of Technology. Then duration, intensity, F1, F2, COG and f0 of the vowels were measured. The results show that duration, intensity and fundamental frequency of the vowels are less in Kermanian accent than in standard Persian accent. Also, the results of studying F1 and F2 of [æ, i, o] prove that these vowels in Kermanian accent are tending to center. So, this kind of vowel reduction in Kermanian accent is called centripetal.

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1. Introduction

The vowel reduction is the process in which the acoustic quality of vowels changes. A well-known type of reduction is the neutralization of acoustic distinctions in unstressed syllables. Vowel reduction appears whenever a vowel tends to schwa [ɪ]. Whereas full vowels are distinguished by their acoustic quality such as height,

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backness and roundness, the reduced vowels are unaffected by these characteristics [2]. Schwa phenomena might depend on the region where someone lives, or on his or her sex [3, 4]. In a study of controlled speech in Dutch, word stress has an impact on the spectral quality of vowels. In this way, the unstressed words were more reduced than the stressed ones [5]. Vowels have shorter duration and more centralized formants, when are reduced, than non-reduced ones [6, 5, 7]. Vowel reduction is categorized as two major types; centripetal reduction and centrifugal reduction. In centrifugal reduction, vowels are led towards the corner figures [i, u, a] and in centripetal reduction, vowels on edges are centralized towards some schwa-like quality. Both centripetal and centrifugal reductions have identical effect of reducing the amount of phonetic information in the speech signal [8].

Two more examples of vowel reduction in which mid central schwa contrasts with higher vowels are standard Russian [9] and Bulgarian [10]. Dutch, also, is a language in which vowels are reduced to schwa [11]. In this language, vowel reduction is not obligatory, but vowel reduction can be applied to all vowel qualities, including high vowels like English. As different languages have different types of reductions, some languages such as Finnish, Spanish and Hindi are recognized to lack vowel reduction.

This research aims to investigate the reduction of [æ, o, i] in pronunciation of Kermanian speakers and compare Kermanian accent with standard Persian accent. Kermanian accent is currently used in Kerman, Southeast region in Iran. In Kermanian accent, vowel [æ] shifts to schwa [ə] [12], for example:

[kæ'mær] (Waist) ► [kə'mær]

[næ'maz] (Praying) ► [nə'maz]

2. Method

Data of the research included three vowel [æ, i, o] in unstressed syllables (syllables except final syllable in Persian) such as [pæ'tu] (blanket), [somæ'je] (a proper name) and [hi'tʃi] (nothing). The data including a total number of sentences 12(words) x 2(Accent) x 3(speakers) =72 were analyzed.

The data were read by 6 native speakers of Persian (Three native speakers of Kermanian accent and three native speakers of standard Persian accent) and recorded by a Shure microphone in the acoustic room of Sharif University of Technology. Using Praat, all of the words were segmented so that the boundaries of vowels were determined [13]. In making a textgrid, using sound wave and spectrogram, simultaneously, increases accuracy in measuring the data. First, the boundary of consonants, vowels and the burst of consonant were determined and specific label was used to define each phone. Then, duration, energy, F1, F2, fundamental frequency and center of gravity (COG) of [æ, i, o] were measured using a Praat script. In order to compare these vowels in Kermanian accent and standard Persian accent, Spss 16 and Repeated Measure ANOVA were used.

3. Results

We report the results of the effect of Accent (Kermanian accent and standard Persian accent) on intensity, duration, fundamental frequency and spectral measures of the vowels [æ, i, o]. The spectral information is F1, F2 and centre of gravity (COG).

3.1. Intensity

A repeated measure ANOVA was performed on the intensity of vowels in order to compare the intensity of vowels in Kermanian accent with that of the standard Persian accent. There was a main effect for Accent ($F[1,5]=213.88, p<0.001$) on vowel reduction. A post hoc test (Bonferroni) indicated that the intensity of vowels in standard Persian accent was 23 dB higher than in Kermanian accent.

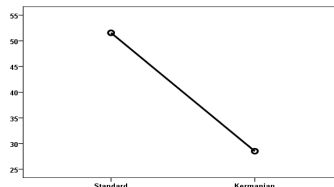


Figure 1. Mean intensity of vowels in standard and Kermanian accent

3.2. Duration

A repeated measure ANOVA was performed on the duration of vowels in Kermanian accent and standard Persian accent. Mushly's test of sphericity was significant for accent. There was a main effect for Accent ($F(1,5)=35.03$, $p<0.001$) on vowel reduction. A post hoc test (Bonferroni) showed that the mean duration of vowels in standard Persian accent was higher than their mean duration in the Kermanian accent. The results showed that vowel duration in Kermanian accent was shorter than those of standard Persian accent.

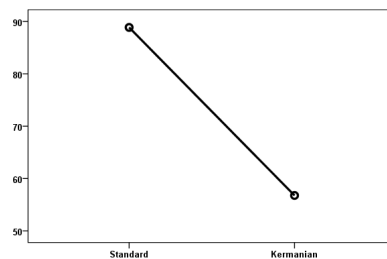


Figure 2. Mean duration of vowels in Standard and Kermanian accent

3.3. Fundamental frequency

The mean of fundamental frequency of the vowels were measured using a Praat script. In this section, we report the mean f_0 of vowels for Kermanian accent and standard Persian accent. Similar to duration, intensity and spectral measurements, the f_0 measurements also showed differences between Kermanian accent and standard Persian accent. The main effects of accent on the mean of f_0 were significant. There was a main effect for Accent ($F(1,5)=27.15$, $p<0.001$) on vowel reduction. Fig. 3 shows the mean f_0 of vowels in Kermanian accent and standard Persian accent. A post hoc test (Bonferroni) showed that mean of f_0 in standard Persian accent were, respectively, 88.18 Hz, 105.75 Hz and 83.11 Hz more than the mean of f_0 in Kermanian accent. So, high f_0 was found on the syllables in standard Persian accent.

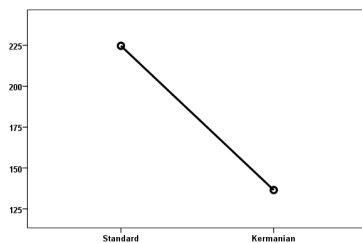


Figure 3. Mean mean F0 of vowels in standard and Kermanian accent

3.4. Spectral measures

In this research, we analyzed the values of F1 and F2 as well as centre of gravity (COG) of vowels [æ, i, o] using a Praat script in order to see if vowel quality is affected by Kermanian accent. The results of this research showed that F1 and F2 of vowels [æ, i, o] in standard Persian accent and Kermanian accent were significantly different. In the case of F1, there was a main effect for Accent ($F(1,5)=8.19, p<0.01$) on vowel reduction. In the case of F2, also there was a main effect for Accent ($F(1,5)=4.61, p<0.01$). Thus the first and the second formants of vowels [æ, i, o] are affected by Kermanian accent.

Results achieved from the comparison of centre of gravity of [a, i, o] in Kermanian accent and standard Persian accent showed that mean of COG of these vowels in Kermanian accent and standard Persian accent was not significantly different.

The results of Repeated measure ANOVA confirmed significantly more F1 for the speakers of the vowels [i] and [o] (see Fig 5 and Fig 6) and less F1 for the speakers of vowel [æ] in Kermanian accent than the speakers of standard Persian accent ($p<0.001$) (see Fig 4). Thus the speakers of Kermanian accent open their mouth more when producing vowels [i] and [o] and less when producing vowel [æ] than the speakers of the standard Persian accent.

A post hoc test (Bonferroni) indicated that F1 of vowel [i] in Kermanian accent was 86 Hz higher than that in standard Persian accent and F1 of vowel [æ] in standard accent was 230 Hz higher than that in Kermanian accent. In addition, Results of comparison between F2 of vowels [æ] and [i] showed that F2 in standard Persian accent for [i] and [æ] was, respectively, 692 and 191 higher than F2 in Kermanian accent (see Fig 9 and Fig 7). The F1 and F2 of vowel [o] in Kermanian accent were, respectively, 279 Hz and 980 Hz higher than those in standard Persian accent (see Fig 5 and Fig 8).

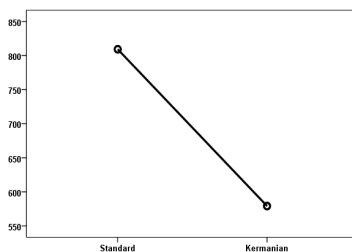


Figure 4. Mean F1 in vowel [æ] in standard and Kermanian accent

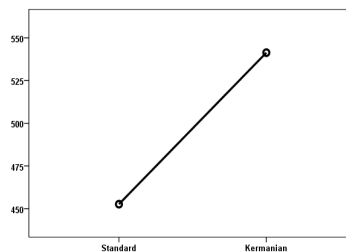


Figure 5. Mean F1 in vowel [o] in standard and Kermanian accent

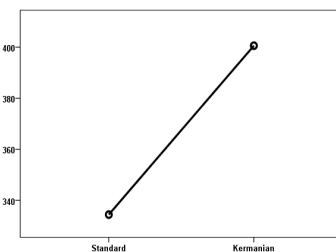


Figure 6. Mean F1 in vowel [i] in standard and Kermanian accent

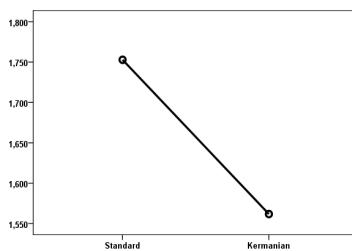


Fig 7. Mean F2 in vowel [æ] in standard and Kermanian accent

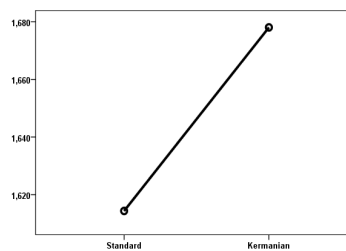


Fig 8. Mean F2 in vowel [o] in standard and Kermanian accent

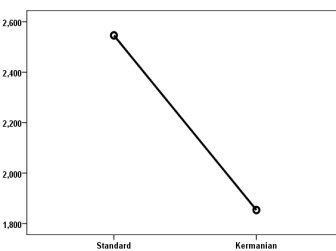


Figure 9. Mean F2 in vowel [i] in standard and Kermanian accent

4. Conclusion

This research investigated vowel reduction in casual speech in Kermanian accent and compared it with that in standard Persian accent. The results of this study indicated significant effects of accent on vowel duration and spectral qualities as well as intensity and fundamental frequency. Results showed that vowels in Kermanian accent were noticeably shorter and of lower intensity than their standard counterparts. Our results are in agreement with the

results of a study in comparing French with other languages and showing that vowel reduction is related to vowel duration and spectral qualities [14]. The results of another research showed that unstressed vowels are reduced in languages such as Swedish [15].

We investigated the influence of Kermanian accent on F1 and F2 of the vowels [æ, i, o] and compared them with those of standard Persian accent. The results of investigating F1 and F2 in the vowels confirmed that [æ, i, o] tended to center in Kermanian accent. It indicated that the speakers of Kermanian accent opened their mouth more when producing vowels [i] and [o]. Thus the weakening of perceptual properties caused the vowels in Kermanian accent to neutralize to vowel [ə]. So, our study showed that vowel qualities were highly affected in Kermanian accent. In a study, schwa was characterized as a reduced vowel. The reduced vowels approximate to the center of the vowel space. So, when vowels are reduced, vowel quality contrasts are neutralized [16]. These findings are in consistent with the findings of some other research in English, Dutch and Southern Italian dialects which show that schwa is the result of neutralization of vowel quality contrasts [17, 11, 18]. As the results showed, the vowels in Kermanian accent were replaced with vowels of neutral quality corresponding to minimal articulatory effort in Kermanian accent. In Kermanian accent, some vowels were deleted entirely and did not reduce to schwa. To summarize, this kind of vowel reduction is called centripetal. This possibility suggests that the other Persian accents behave differently.

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