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INVESTIGATING THE EFFECTS OF GENDER AND DIALECT ON WORD AND SENTENCE DURATION IN YEMENI ARABIC DIALECTS

AISHA SALEH ALI MOHDAR[1], FAHMI ABDO MOHAMED AL MAFALEES[2]
[1]University of Abyan
Email:aishamohdar@gmail.com
[2]University of Aden
Email:fahmiabdo@gmail.com

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ABSTRACT

This study investigates the effects of gender and dialect on the production on word and sentence durations of three Yemeni Arabic dialects: Abyani Yemeni Arabic (AYA), Hadhrami Yemeni Arabic (HYA), and Ta'izzi Yemeni Arabic (TYA). Read speech data was collected from three female and three male Yemeni Arabic speakers per dialect and analyzed to identify whether the duration of words and sentences is symmetrical for both groups (i.e., female and male speakers) and among dialects. An automated script was used to measure the duration of the words and sentences. Results of the duration data show that the female speakers of all the three Yemeni Arabic dialects produce words and sentences with longer durations than male speakers do. Furthermore, the results reveal that dialect has an effect on word and sentence duration. TYA has the highest word duration compared to the other Yemeni Arabic dialects AYA and HYA, and HYA has the highest sentence duration compared to the other dialects TYA and AYA.

To determine the difference in the production of the word and sentence durations between gender groups (per dialect) and among dialects, a linear mixed-effects model lmer (Bates, Maechler, Bolker, and Walker 2015) was used to provide better values with random and fixed factors. A post hoc Tukey test was also done to investigate the significance of effect. The results of the study show that the effect of gender on the production of the word and sentence duration per dialect is significant in all of the three dialects. The effect of dialect on word duration is significant only between TYA and AYA. TYA speakers produced words with longer duration compared to AYA and HYA speakers. In addition, dialect effect on sentence duration is highly significant. HYA speakers produce sentences with longer durations compared to AYA and TYA. Thus, the results reveal that Abyani speakers speak significantly faster (produce short word and sentence durations) than Hadhrami speakers and Ta'izzi speakers.

Keywords: gender, dialect, Arabic, word and sentence duration.

1. Introduction

This section reviews the most suitable work done to date on durational differences of vowels, words and sentences across dialects and languages. The acoustic literature reported from various languages concerning the effect of gender and dialect on the duration of vowels, words and sentences. Several acoustic studies have found that male speakers produce their speech (i.e., vowels, words and sentences) with shorter durations compared to the female counterparts (Byrd 1992, 1994 and Whiteside 1986, Simpson 1998, Ericsdotter & Ericsson 2001, Simpson & Ericsdotter 2003). In an acoustic study [2, 3] using the TIMIT database of read speech data of 630 female and male American English speakers, female speakers produced longer sentence durations compared to the male ones.

Another acoustic study [16] of 3 female and 3 male British English speakers is also compatible with Byrd's study results. She found that longer sentence durations and slower speaking rate of the female speakers compared to the male ones. In addition, another acoustic study [8] examining speech rate of two varieties of American English; Wisconsin (the northern variety) and North Carolina (the southern variety), 192 speakers of men and women produced a spontaneous and read speech data. The results of the study revealed that Wisconsin speakers speak significantly faster than North Carolina speakers and men speak faster than women in both varieties.

With respect to vowels, the results of an acoustic investigation of 54 male and female German speakers [cited in 12] revealed that there were a systematic gender differences in duration of vowels; females produce greater vowel durations compared to the male ones in both read and spontaneous speech. Furthermore, the results of an acoustic analysis of gender vowel duration (5 males and 5 females) of Swedish speakers [5] showed that female speakers produce vowels with longer durations than male speakers do in stressed syllables, but this is not found in unstressed vowel tokens (i.e., the female speakers used similar or shorter vowel durations).

Another investigation [13] examined gender differences of 9 speakers of Central Standard Swedish and 48 speakers of American English found that female speakers from both languages exhibited greater vowel durations for the stressed vowels but no significant difference was found in unstressed syllables and this is compatible with the results of the previous study. An investigation from a study of African American English (AAE) and White American English (WAE) speakers [6] showed that vowel duration produced by female speakers was significantly longer than male speakers for both varieties of American English. Evidence from a recent study [9] of three Yemeni Arabic dialects; Abyani Yemeni Arabic (AYA), Hadhrami Yemeni Arabic (HYA), and Ta'izzi Yemeni Arabic (TYA) revealed that there is a very highly significant difference in the female speakers vowel duration compared to the male ones in all of the three Yemeni Arabic dialects.

A sociophonetic study [15] with an acoustic analysis of Jamaican Creole-dominant and Jamaican English-dominant speakers' vowel system reported that female speakers in both groups used longer vowel durations within short and long vowels than the male speakers do. Another investigation on gender-specific duration patterns in Creek [10] reported that durational differences also existed in non-Indo-European languages; female speakers produce vowels with longer durations (long and short vowels) than the male speakers. In other acoustic investigation of three American dialects [7] reported that the effect of gender on vowel duration was not significant in the three American dialects, although the mean vowels duration of the female speakers in all dialects were slightly longer than male speakers' vowel duration (168 ms vs. 60 ms). In addition, the effect of dialect was significant in the three American dialects; Wisconsin vowels (144 ms) were the shortest followed by central Ohio (160 ms) and western North Carolina vowels were longest (188 ms).

2. Methodology of the study

2.1. The Aims of the Study

The current study aims to (a) investigate whether there are differences between the durations of the words and sentences produced by female speakers of each dialect compared to male speakers; and (b) to examine whether there are differences in the word and sentence durations among the three Yemeni Arabic dialects.

2.2. Research hypotheses

i. Female and male Yemeni Arabic speakers produce symmetrical word and sentence durations per dialect.
ii. There may be no significant differences in the word and sentence durations among the three Yemeni Arabic dialects.

2.3. Research questions

i. Do the female and male Yemeni Arabic speakers produce the same word and sentence durations per dialect?
ii. Are there significant differences in the word and sentence durations among the three Yemeni Arabic dialects?

2.4. Speakers

Six Yemeni speakers for each dialect participated in the production experiment (three females and three males). The six speakers per dialect are in their twenties and thirties with no history of hearing and speech impairment. They participated in the experiment without any payment.

2.5. Speech Material

The material consisted of 18 randomized monosyllabic words with either /CVn/ or /CV:n/. The syllable initially was one of the three stop consonants /b/, /d/ or /g/ and the syllable medially was one of the six vowels /i:/, /i/, /u:/, /u/, /a:/ or /a/ followed by the nasal consonant /n/. The material embedded in a carrier sentence: ***katab <word> thalaath maraat*** (he wrote <word> three times). Not all of the target words were real Yemeni Arabic monosyllabic words CVC and CV:C. For measuring sentence duration, the same sentences were also measured, the difference is only in the target words which have the same syllable structure (either /CVn/ or /CV:n). All materials were presented to the speakers in Arabic script right to the left. A complete set of speech material is given in the appendix.

2.6. Recording Procedure

Speakers read the sentences: '***katab <word> thalaath maraat'*** in a randomized order. Each sentence was recorded three times. A total of 54 sentences were obtained from each speaker. The stimulus was presented to the speakers in a Sony laptop "14 inches". All recordings were recorded in a sound-treated room in the phonetics laboratory at the English and Foreign Languages University, using a CSL4200 with a Shure condenser microphone SM 48 placed at one inch and half distance from the speaker's lips. Each speaker was instructed to read the sentences thrice in a normal speech rate. Then, the recordings were transferred onto a hard drive disk at a 44.1 KHz sampling rate.

2.7. Acoustic Measurements

An acoustic experiment was designed to measure the duration of the words and sentences from six speakers of three Yemeni Arabic dialects using Praat version (5.4.04) [1]. The beginning and end of each word and sentence of interest were manually segmented and labelled. The duration of the words and sentences were measured automatically from the beginning to the end of the word and sentence. A sample waveform and a spectrogram of one of AYA speakers saying '***katab di:n thalaath maraat'*** is given in figure (1) below:

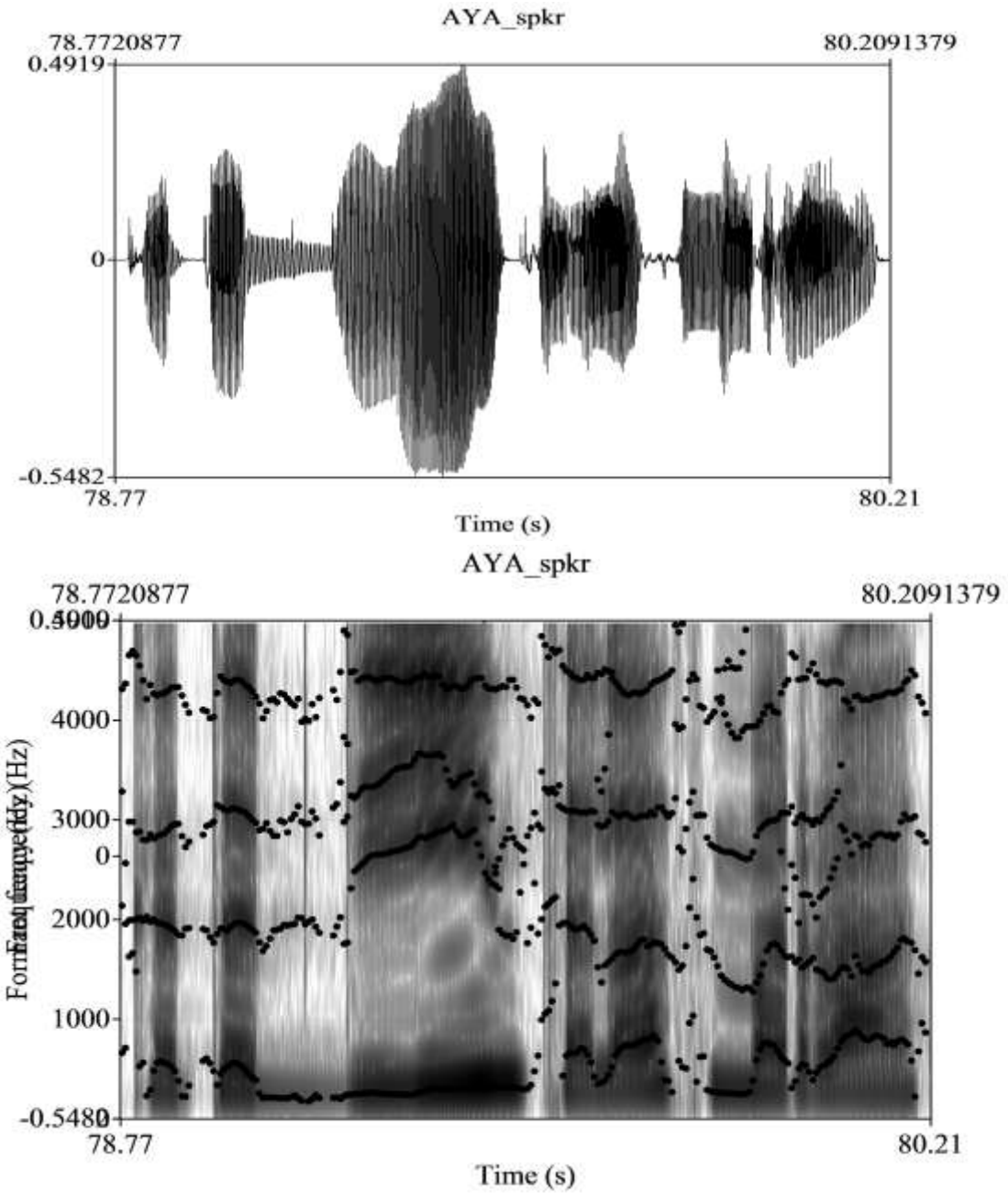

Figure 1: ***Waveform and spectrogram of one of the native speakers of AYA saying [katab di:n ɵala:ɵ mara:t]***

2.8. Statistical analysis

In order to assess the statistical significance of the word and sentence durational differences between female-male Yemeni Arabic speakers per dialect, a linear mixed effects regression test was done ***lmer*** [4] to measure the durational differences of the word and sentence duration between female-male speakers per dialect and among dialects. Word and sentence durations are also plotted using **ggplot2** package [15] to show the effect of gender on the word and sentence duration per dialect and to determine whether the durational differences in the word and sentence durations among the three Yemeni Arabic dialects exist. The statistical analysis was done in R software version 3.2.5[11].

3. RESULTS

The results of the word and sentence durations of all tokens for both genders (females and males) per dialect and among dialects (AYA, HYA, TYA) are shown in the following tables and figures.

3.1 Gender effect on word and sentence duration

Figures (2& 3) show a summary of the word and sentence durations in the three Yemeni Arabic dialects. It can be observed that gender has an impact on both word and sentence durations. As it can be seen from Figure (2), the median line (the thick line in the middle of the boxplot) is higher in the female word duration than the male ones in all of the three dialects.

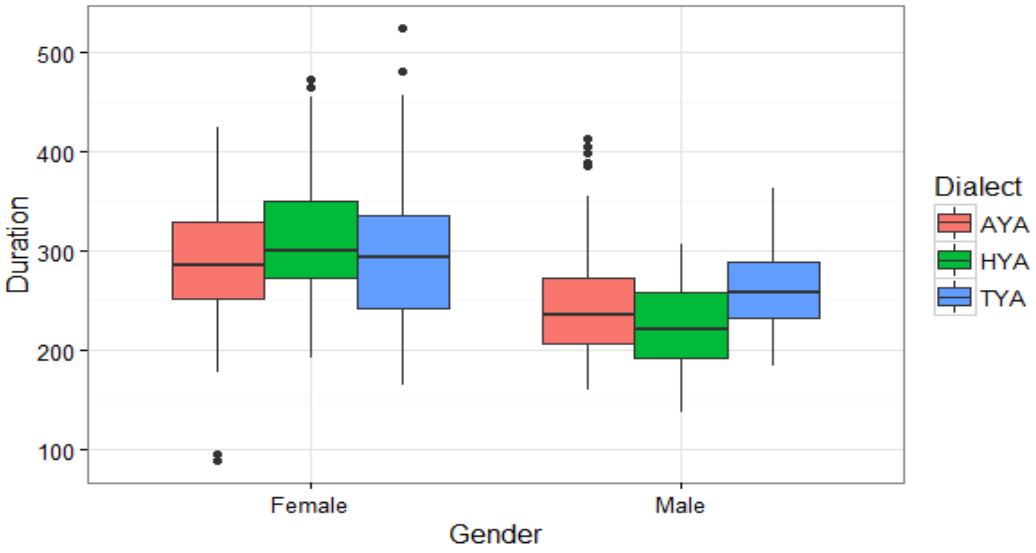

Figure 2: Female-male mean word durations in AYA, HYA and TYA.

Results of the linear mixed effect regression test reveal that AYA male speakers have lower word duration compared to the female ones by about (-37 ms). The test shows that female speakers have higher word duration (283 ms > 246 ms) than the male ones. The test also shows that HYA male speakers have lower word duration compared to the female ones by about (-86 ms). Females have higher word duration (312 ms > 226 ms) than the male ones in HYA. In addition, TYA male speakers have lower word duration compared to the female ones by about (-30 ms). The test reveals that female speakers have higher word duration (294 ms > 264 ms) than the male speakers.

Since the ***lmer*** test does not give p-values for significance of effect, a post hoc Tukey test was done to investigate the significance of effect. The test reveals that [$F(1, 322) = 36.73$; $p<0.05$] the effect of gender on word duration is significant in AYA. It also reveals that [$F(1, 322) = 238$; $p<0.05$] the influence of gender on word duration is significant in HYA. Moreover, the statistical test shows that the impact of gender on word duration is significant [$F(1,322) = 25.4$; $p<0.05$] in TYA as well.

Regarding the effect of gender on sentence duration Figure (3) reveals that the median line (the thick line in the middle of the boxplot) is higher in the female sentences duration than the male ones in all of the three dialects.

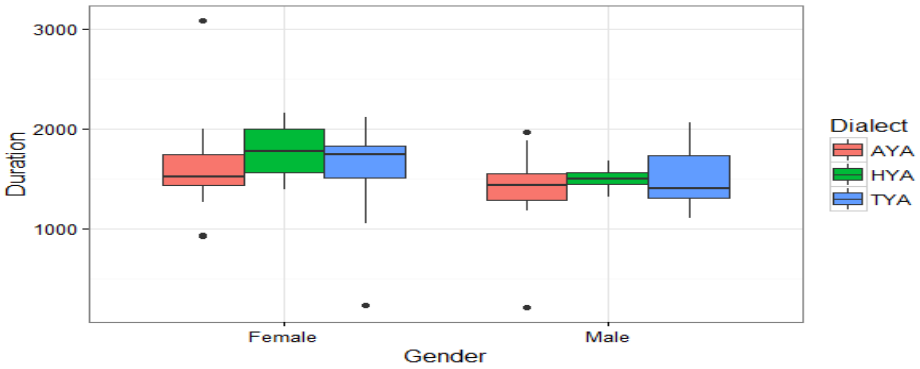

Figure 3: Female-male mean sentence durations of AYA, HYA and TYA.

Results of the ***lmer*** test reveal that AYA male speakers have lower sentence duration compared to the female ones by about (-152 ms). The test shows that females have higher sentence duration (1582 ms > 1430 ms) than the male ones. The test also reveals that HYA male speakers have lower sentence duration than the female ones by about (-287 ms).The test shows that females have higher sentence duration (1786 ms > 1499 ms) than the male ones. In addition, TYA male speakers have lower sentence duration compared to the female speakers by about (-197 ms).The test interprets that females have higher sentence duration (1685 ms > 1488 ms) than the male ones. Thus, the effect of gender is systematic in all of the three Yemeni dialects (i.e., female speakers have higher word and sentence duration than the male speakers).

A post hoc Tukey test was done to investigate the significance of effect on sentence duration. The test reveals that [F (1, 322) = 37.51; p<0.05] the effect of gender on sentence duration is significant in AYA. It also reveals that F (1, 322) =217.5; p<0.05] the effect of gender is significant in HYA. Moreover, the statistical test shows that the impact of gender on sentence duration is also significant [F (1,322) = 25.4; p<0.05] in TYA as well. In brief, the effect of gender on word and sentence duration is highly significant in all of the three dialects.

3.2 Dialect effect on word and sentence duration

Figures (4 & 5) show a summary of the word and sentence durations among the three Yemeni Arabic dialects. It can be observed that dialect has an impact on both word and sentence duration. As it can be seen from figure (4), the median line is higher in TYA word duration compared to the other Yemeni Arabic dialects HYA and AYA.

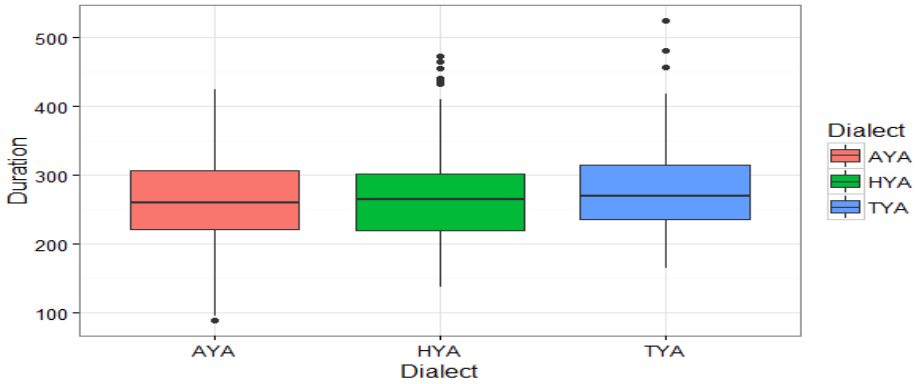

Figure 4: Yemeni Arabic dialects word durations.

Results of the linear mixed effect regression test reveal that AYA speakers produce words with short duration (265 ms) compared to other Yemeni Arabic dialects HYA (269 ms) and TYA (278 ms). The test reveals that dialect has an impact on word duration among the three Yemeni dialects. A post hoc Tukey test was done to investigate the significance of effect. The test reveals that [F (2, 969) = 4.414; p<0.05*] the effect of dialect on word duration among dialects is not highly significant. The test also reveals that the effect of dialect is significant only between TYA and AYA (p=0.01), whereas no significant difference has been found between HYA

and AYA (p=0.7) and TYA and HYA (p=0.09). Thus, dialect affects word duration to a much lesser extent than gender do (gender affects word duration to a much higher extent).

Regarding the effect of dialect on sentence duration, figure (5) reveals that the median line of the boxplot is higher in HYA sentence duration compared to the other Yemeni Arabic dialects TYA and AYA.

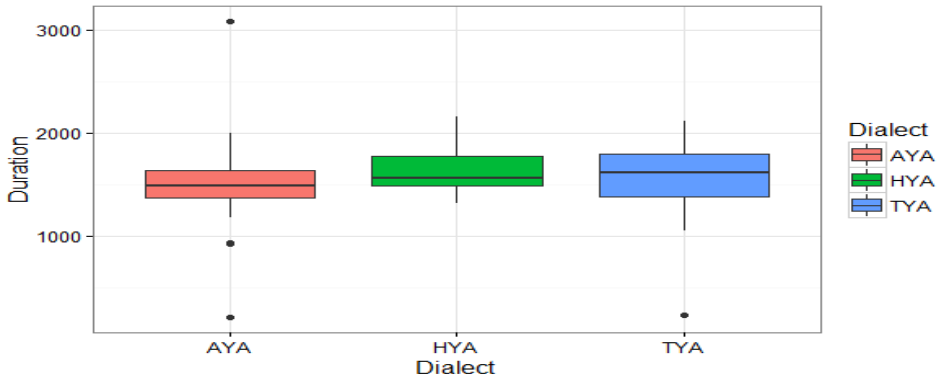

Figure 5: Yemeni Arabic dialects sentence durations

Results of the linear mixed effect regression test reveal that AYA speakers produce sentences with short duration (1506 ms) compared to other Yemeni Arabic dialects HYA (1643 ms) and TYA (1586 ms). Dialect affects sentence duration to a much higher extent than gender do (gender affects sentence duration to a much higher extent). A post hoc Tukey test was done to investigate the significance of effect. The test reveals that [F (2, 969) = 26.86; p<0.05] the effect of dialect on sentence duration among the three dialects is very highly significant. The test also reveals that the effect of dialect is significant between HYA and AYA (p= 0.000), it is also significant between TYA and AYA (p= 0.000) and TYA and HYA (p=0.007). In brief, the effect of dialect on sentence duration is highly significant among dialects; however, the effect of dialect on word duration does reach its significance among dialects.

4. Discussion

This study examines the effect of gender and dialect on word and sentence duration of read speech data in aforementioned Yemeni Arabic dialects. In brief, the findings of the present study support those of the previous studies where it has been found that female speakers produced longer sentence durations compared to the male (Byrd 1992 and 1984; Whiteside 1986). The findings also reveal that gender has an effect on word and sentence durations in Yemeni Arabic dialects (i.e., female speakers' exhibit longer word and sentence durations than the male one in all of the three Yemeni Arabic dialects). The findings of the study prove that the effect of dialect on word does not reach its significance, whereas the effect of dialect reaches its significance on sentence duration.

Of particular interest to this study, the differences in the durations of the words and sentences among the three Yemeni dialects show the speech tempo in the Yemeni Arabic dialects; AYA native speakers produce words and sentences with a faster speech rate compared to the other Yemeni Arabic dialects TYA and HYA. Thus, I can conclude that AYA speakers use the fastest speech rate compared to HYA and TYA. And HYA speakers have the slowest reading rate compared to AYA and TYA. This may be because of pauses they include in their reading task.

With regard to word and sentence duration per dialect, the findings of the study fail to support the null hypothesis because gender has an impact on word duration and sentence durations. Regarding dialect effect, the findings of the study fail to support the null hypothesis only on one part because dialect has a greater impact on sentence duration, whereas there is no difference on word duration among dialects except between AYA and TYA.

5. Conclusion

The results provide fresh evidence for the effect of Gender on word and sentence duration per dialect. It also provides evidence of dialect effect on word and sentence duration among the Yemeni Arabic dialects. The findings on the word duration reveal that gender has an effect on word duration in AYA, HYA and TYA. The statistical test also reveals that a very highly significant effect of gender on word and sentence durations in all dialects ($p<0.05$). Furthermore, the test proves that dialect has an effect on sentence duration because the results reveal significant differences among the three dialects, whereas the effect of dialect on word duration is not significant among dialects except between TYA and HYA.

Thus, the study states how social factors interact in the speech of both men and women. The effect of dialect region is found only on the duration of sentences, whereas there is no effect of dialect region on the word duration except between TYA and AYA. Furthermore, the effect of gender is found on the word duration and sentence duration per dialect.

Suggestions for further studies

Based on the results of the study, the following suggestions are provided for further studies:

We suggest that the results of the study are preliminary and this study should be followed up with another study that has more speakers and larger amounts of data collected from all speakers of different ages.

For more details, we suggest to measure articulation rate and speaking rate of both read and free speech data for a large number of speakers.

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Appendix

The sentences were recorded by each speaker to investigate the effects of gender and dialect on word and sentence duration in three Yemeni Arabic Dialects. Target words consist of 18 meaningful and nonce words in a random order embedded in a carrier sentence: "katab <target word> ɵala:ɵ marra:t (he wrote < target word > three times)".

1. katab ban ɵala:ɵ marra:t
2. katab da:n ɵala:ɵ marra:t
3. katab gin ɵala:ɵ marra:t
4. katab bu:n ɵala:ɵ marra:t
5. katab ga:n ɵala:ɵ marra:t
6. katab din ɵala:ɵ marra:t
7. katab dan ɵala:ɵ marra:t
8. katab di:n ɵala:ɵ marra:t
9. katab gu:n ɵala:ɵ marra:t
10. katab ba:n ɵala:ɵ marra:t
11. katab gun ɵala:ɵ marra:t
12. katab dun ɵala:ɵ marra:t
13. katab gan ɵala:ɵ marra:t
14. katab du:n ɵala:ɵ marra:t
15. katab bun ɵala:ɵ marra:t
16. katab bi:n ɵala:ɵ marra:t
17. katab gi:n ɵala:ɵ marra:t
18. katab bin ɵala:ɵ marra:t