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A Durational Comparison of the Vowels of Argobba Dialects: Shonke and Gachine

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ABSTRACT

This paper presents an acoustic investigation of the duration of vowels of the two dialects of Argobba: Shonke and Gachine dialects. The data were collected from 40 subjects (10 female and 10 male subjects from each dialect). The recordings were made in 8 consonantal contexts embedded in disyllabic real and nonce words and in the context of wordlists and carrier sentences to investigate the effect of contexts on vowels' duration. The statistical analysis was done with repeated measures ANOVA to investigate the effects of consonantal contexts (4 levels of voice/voiceless, 2 levels of geminate/nongeminate consonants) and 2 levels of wordlists and carrier sentences as within-subject factor, and dialects and genders as between-subject factors. The findings showed that both dialects, (Shonke and Gachine) had similar durational features. Consequently, vowels spoken between voiced consonants had higher duration than vowels between voiceless consonants, and vowels followed by a nongeminate consonant had higher duration than followed by geminate consonants. Furthermore, in both dialects, the duration of vowels in a wordlist was higher than the duration in a carrier sentence. Generally, lower vowels measured the longest duration while higher vowels had the shortest measure. With regard to front-back contrast, front and back high vowels had equivalent durations and similarly front and back mid vowels had similar durations in both dialects as well. Comparison of dialects showed that Shonke dialect vowels had a longer duration than their Gachine equivalents but the differences were not statistically significant and the results were not consistent when compared for the two genders separately. The effect of gender on the duration of vowels in the two dialects was not statistically significant and the patterns were different for the two dialects.

Key words: Context, duration, geminate/non-geminate, voiced/voiceless, vowel

INTRODUCTION

Vowel Duration

Each vowel is identified in terms of its respective height, frontness and roundness in the articulatory description of a vowel (Ladefoged and Maddieson, 1996). In addition, acoustic values such as duration, fundamental frequency and formants are physical measurements of vowels that determine the phonetic quality of each vowel. Duration of vowels is a physical measurement of time which is spent in uttering a vowel.

Vowel duration and vowel length are usually used interchangeably for they indicate the time length of a certain utterance. Nevertheless, they can be distinct in phonetics and phonology. Length is a perceived distinction of long and short vowels of the same vowel category. According to Paul and Docherty (2005), it is usually restricted to phonology. "… It refers to the relative time a sound is sustained as perceived by the listener (P.11)." Vowel length causes a meaning change of words in many languages; hence, it is phonemic. On the contrary, duration is simply the physical measurement of time taken to produce a vowel. Thus, as far as duration measures the physical dimension of a vowel, it is phonetic (Lehiste, 1970).

Studies showed that vowel duration is affected by many factors such as the nature of adjacent consonants (voiced, voiceless, geminate, non-geminate), the position of a vowel in a word or phrase (initial, penultimate or final position), dialect, gender and position of a vowel in a vowel chart

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(House and Fairbanks, 1953; Chen, 1970; Maddieson, 1997; Ladefoged, 2001; Derib, 2011). If we consider the position of a vowel in a vowel chart as an example, the duration of the low vowel "a" in '*bat*' measures the longer duration than the high vowel "i" in '*bit*'. Hence, "as far as the vowels are concerned, their duration appears to be correlated with tongue height: other factors being equal, a high vowel is shorter than a low vowel" (Lehiste, 1970:18).

The Language

Argobba belongs to the South Ethio-Semitic sub-branch of the Afro-Asiatic language phylum, classified as the Central-Transversal-South Ethiopic subgroup with Amharic (Hetzron, 1972; Bender & Hetzron, 1976:29). It is "critically endangered" (Getahun, 2009; Moseley, 2010). In many places, the language had died and was replaced by Oromo (Leslau, 1957: 36-39) and Amharic (Hussein, et al, 2014). As a result, the Argobba community members in many areas believed that "unless a miracle happens" the language might not be revived (Hussein, et al., 2014:10). Despite the scholars' prediction it may not survive, the language is still spoken by substantial population, and there is an attempt to introduce it to the education system.

Argobba is spoken in many scattered villages of Affar and Amhara regions (Girma, 2003 E.C:10; Hussein, et al., 2014).

Argobba has 7 vowel phonemes classified in three heights and in three front-back properties (Leslau, 1997; Getahun,2009; Wetter, 2010[1]; Girma, 2015).

	Front	Central	Back
High	i	ɨ	u
Mid	e	ə	o
Low		a	

Figure 1. The vowel phonemes of Argobba (Leslau, 1997, Getahun, 2009, Demeke, G. A., 2015)

There is a disagreement on the number of Argobba dialects (Wetter, 2006:149). According to Uhlig (2003:329), it has four dialects, while Lewis (2009) mentions three. On the other hand, based on the investigation of the dialects' phonological, morphological and lexical features, Getahun, (2009:7f,) and Hussein, et al., (2014:19[2]) classified the dialects into two: the Shonke dialect and the Gachine dialect. On the contrary, Girma, (2015) claims that Argobba is not a single language, but different languages stand by themselves. This study was conducted based on Getahun's classification (2009) which categorized Argobba in two dialects based on detailed analysis of the language as the Shonke dialect and the Gachine dialect.

Unlike many Ethio-Semitic languages (such as Amharic, Tigrinya or many Gurage languages), Argobba did not get attention from researchers until recent times. Besides, the existing studies on Argobba focus on grammatical description, vocabulary or morphosyntax (Leslau, 1957; Leslau 1997a, Getahun, 2009; Wetter, 2010). The dialect differences in Argobba varieties need to be approached from various perspectives; one of which is phonetics. A study on the phonemes of the two varieties may contribute to the ongoing discussion on their distinctness.

This paper focuses on exploring the durational comparison of vowels in Argobba dialects: Shonke and Gachine dialects. Specifically, the study tried to answer the following research questions:

1. Is there a difference in the duration of vowels between the two dialects?
   - 1.1. Which vowels are intrinsically longer and which ones are shorter in each dialect?
   - 1.2. Is there any significant durational difference of vowels of the two dialects due to:
     - 1.2.1. Different consonantal contexts (voiced versus voiceless and geminate versus nongeminate consonants)?
     - 1.2.2. Different positions of vowels (in a word versus in a frame sentence)?
     - 1.2.3. Gender differences?
2. What are the dialect/language-specific as well as universal implications of the Argobba vowels in terms of duration?

[1] *Wetter (2010) proposes four heights: close, half close, half open and open.*

[2] *Hussein, et al., (2014) used the terms Ankober-K'awat variety and the t the Dawa Ch'affa variety of Argobba and presented that the lexical similarity between the two variaties is only 52–58 percent (2014:19).*

RESEARCH METHOD

Selection of Subjects

As the language is seriously endangered (Moseley, 2010, Getahun, 2009), it was very difficult to get a monolingual Argobba speaker, especially among Gachine variety speakers. But, most of the elder females and children of the Shonke dialect speakers are monolinguals. Hence, the recruitment of subjects was carried out after their fluency in Argobba was evaluated by the community representatives, and if they had lived throughout their lives in the area where Argobba is spoken (Shonke village and in the vicinity of Gachine).

For both dialects, a total of 40 subjects (10 female and 10 male subjects from each dialect) were recruited. All subjects, aged 20-47 years (average: Shonke subjects 28.6 years, and Gachine subjects 32.2 years) were checked not to have any language (speech and/or listening) defects due to physiological and/or psychological disorders.

Data collection procedures

Each of the seven vowels (ə, u, i, a, e, ɨ and o) were written in a power point with Ethiopic script in disyllabic nonsense words. The use of nonsense words was chosen because it was not possible to get real words that met the strict phonetic environment in which the target vowels were placed. This was a choice made despite the tendency of nonsense words resulting in a better place differentiation such as dental-retroflex (Maxwell et al., 2015). Vowels were identical in both syllables of a nonsense word (e.g., /tutu/, /tata/, /bete/, /butu/), and the first vowel is always the target vowel. The bilabial voiced stop /b/ and the alveolar voiceless stop /t/ were used to construct the disyllabic nonce words with different contexts voice (voiced vs. voiceless), gemination (geminate vs. nongeminate) and position of a vowel (wordlist vs. carrier sentence) to investigate their effect on the duration of vowels, as indicated in Table 1. Accordingly, each subject was allowed to practice before the actual recording and there was also a trial recording in order to familiarize the subjects with the recording. Then the wordlists and carrier sentences were written on a PowerPoint slide as follows:

> ***Eg. 'tubu***' */inni k'al* ***tubu*** *nəy/* '*tubu*.' 'This word is *tubu'* (Shonke dialect),
>
> '***tubu***' */hud k'al* ***tubu*** *ne/* '*tubu*.' 'This word is *tubu*' (Gachine dialect).

The recording was done using a Marantz PMD 660 digital solid state recorder attached to Rhodes Mic. The mic was placed approximately 10 cms in front of the speaker. A total of five randomized repetitions were recorded from each of the 40 speakers and only the middle three repetitions were analyzed.

Contexts	Geminate		Nongeminate	
	In word	In sentence	In word	In sentence
between voiced stops	b**v**bbv	b**v**bbv	b**v**bv	b**v**bv
between a voiced stop and a voiceless stop	b**v**ttv	B**v**ttv	b**v**tv	b**v**tv
between voiceless stops	t**v**ttv	T**v**ttv	t**v**tv	t**v**tv
between a voiceless stop and a voiced stop	t**v**bbv	t**v**bbv	t**v**bv	t**v**bv

Table 1. Different contexts used to measure acoustic values of vowels of the two dialects

In Argobba, geminate consonants or two consecutive consonants are not allowed at the word initial position. Therefore, the onset of the first syllable in every test word is always nongeminate. Hence, one vowel was put in 8 phonetic environments as per the number of different consonantal contexts, and all the 7 vowels in 8 contexts were presented as words and in a carrier sentence: 'This word is ___.' in three randomized repetitions. A total of 336 vowel tokens (7 vowels * 4 consonantal contexts * 2 frames (sentence and word) * 2 geminate/nongeminate contexts * 3 repetitions) were analyzed from each of the 40 speakers, making a total of 13,440 vowel tokens.

All 336 vowel tokens were taken from 40 subjects (10 female and 10 male subjects from each dialect), which sums up a total of 13,440 vowel tokens. In this case, each vowel was uttered 48 times by a single subject and 1920 times by 40 subjects.

Data Analysis Procedures

The recorded data were imported to a computer. Praat version 6.0.26 (Boersma and Weenink, 2010) was used to annotate the boundaries of each of the vowels. The vowels' boundaries were demarked manually based on the spectrographic display coupled with the waveform display from Praat window. The beginning of each vowel was taken to be the beginning of a regular waveform where the formants start stably. But, if the beginning of a regular waveform was not the beginning of a vowel, the point where the formants start to be stable was taken as the beginning of a vowel and the end boundaries of vowels were demarked in the same way.

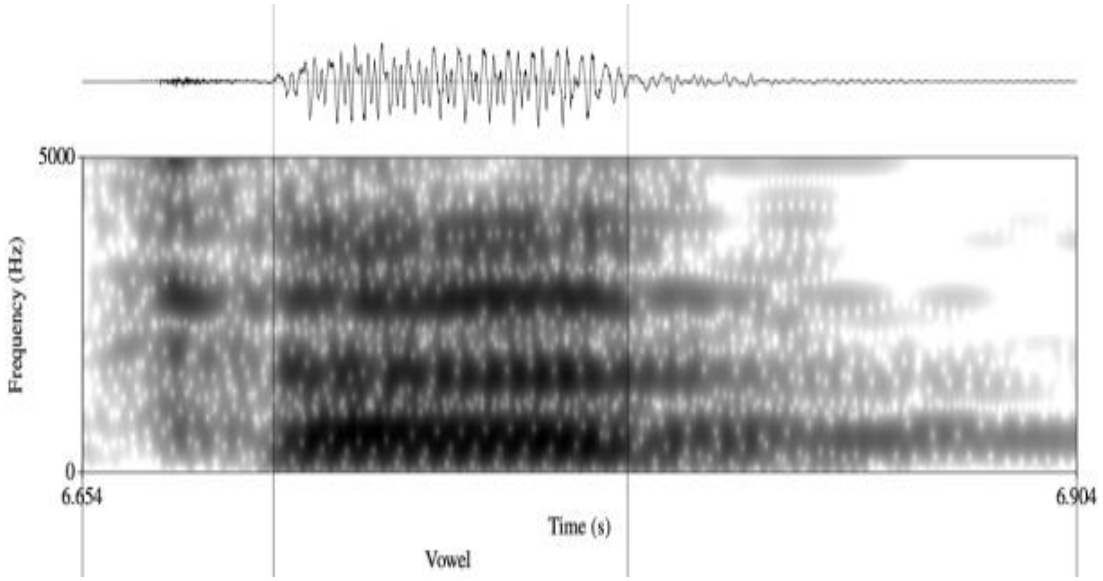

Figure 2. Segmentation of the vowel boundary (between the two vertical lines) in a tVtV context.

The contexts (voice/voiceless, geminate/nongeminate , wordlist/carrier sentence), gender and dialect of a given vowel were annotated on a tier within respective boundaries on the Praat window. After that, durations of the 7 vowels were measured in milliseconds (ms) by considering the boundaries made at the Praat window. Hence, the first boundary was considered as the starting of the vowel production and the last boundary as the ending time. A Praat script was used to extract the duration of each of the annotated vowels.

Statistical Analysis

All of the vowel data extracted by a Praat script was copied to Microsoft Excel program for coding subjects, contexts and dialects. The statistical analysis was conducted with two-way repeated measures ANOVA using IBM SPSS Version 21 to investigate if there are statistically significant effects between the contexts, genders and dialects on the durational values of vowels. Before proceeding to the statistical analysis, the mean values of vowels were taken from the three repetitions. After that, assumptions were considered by SPSS (version 21). Hence, significant outliers were checked by Studentized residuals and replaced with mean values of the same vowel formant in identical contexts. The data was also computed to obtain normalized values for further statistical analysis.

The statistical analysis was done with repeated measures ANOVA as follows: 4 levels of voice versus voiceless consonantal contexts (bvbv, bvtv, tvtv and tvbv), 2 levels of geminate versus nongeminate consonants (cvcv and cvccv), and 2 levels of vowel positions (wordlist versus carrier sentence) were used as within-subject factor. Similarly, 2 dialects (Gachine and Shonke) and 2 genders (males and females) were taken as between-subject factors. Thus, 4 levels of voice * 2 levels of frame * 2 levels of gemination * 40 subjects * 7 vowels = 4,480 vowel data were restructured and computed.

In addition, the variances of the differences between all combinations of related groups were evaluated by Mauchly's test of Sphericity. After assessing the assumptions, the repeatedly measured duration of vowels and all contexts were treated as within-

subjects variables while gender and dialects as between-subjects factors.

When Mauchly's test of Sphericity was insignificant, Multivariate Tests were used to see if the contexts had a significant effect on the within-subjects variables. On the other hand, when Mauchly's test of Sphericity was statistically significant, the Greenhouse-Geisser correction method was used. Furthermore, when there was a statistically significant difference between levels, post-hoc analysis was employed to identify between which levels the difference occurred. We used R Version 4.1 to draw violin plots of the duration of vowels.

RESULTS AND DISCUSSIONS

Results

According to the result of the analysis, among Argobba vowels, the high vowels /ɨ/, /i/ and /u/ had the shortest duration of 83ms, 91.63ms and 92.4ms respectively. This was also true for both genders though there were durational differences, as Table 2 shows. On the other hand, the longest durations were recorded for low and middle vowels /a/ (115ms), /e/ (103.2ms) and /o/ (102.2ms).

Vowel	Female		Male		Aggregate	
	Mean	SD	Mean	SD	Mean	SD
ə	97.86	17.54	97.4	15.09	97.63	16.66
u	90.41	17.59	94.35	17.19	92.38	17.66
i	90.4	19,09	92.87	17.05	91.63	18.31
a	114.64	18.42	115.23	19.03	114.93	18.71
e	103.41	16.65	102.9	16.26	103.15	16.75
ɨ	80.43	19.46	85.39	18.12	82.91	19.15
o	101.43	17.18	102.95	15.79	102.19	16.73

Table 2. Mean and SD of Argobba vowels' Duration in ms

The middle-central vowel /ə/ had a relatively medium duration, 97.63ms. These findings suggested that duration is proportional to the vowel height: duration increases as the height of a vowel decreases. With regard to front-back vowels contrast, durations were comparable in line with their height; high vowels /i/ and /u/ had equivalent durations and middle vowels /e/ and /o/ had similar durations. In the Shonke dialect, front vowels /i/ and /e/ were shorter than their back counterparts, /u/ and /o/ respectively but the differences were not statistically significant. On the contrary, in the Gachine dialect, the back vowels /u/ and /o/ were shorter than the front vowels /i/ and /e/ respectively. Other vowels' durations were significantly different from each other's values with $p < .001$.

Tests of within-subjects effects showed that vowel quality had a significant effect on duration, $F(3.8, 136.62) = 215.81$, $p < .001$, $\eta_p^2 = .86$.

Gender and Dialect

In general, vowels in the Gachine dialect had lower duration than their Shonke equivalents. As it can be observed from Table 3, Gachine females' vowels' duration were the shortest of all subjects. It was only in low vowel /a/ that Gachine females scored higher duration: (115.319ms) than the Shonke females (113.956ms). Shonke females' vowels' durations were higher than the rest of the subjects, and Gachine males' vowels' durations were higher than their Shonke counterparts.

As it can be seen from Table 3, in the Shonke dialect, front vowels /i/ and /e/ were shorter than their back counterparts, /u/ and /o/ respectively but the differences were not statistically significant. On the contrary, in the Gachine dialect, the back vowels /u/ and /o/ were shorter than the front vowels /i/ and /e/ respectively. Other vowels' durations were significantly different from each other's values with $p < .001$

Gender	Vowel	Gachine		Shonke	
		Mean	SD	Mean	SD
Female	ᵻ	94.15	14.04	101.56	19.15
	U	84.59	13.37	96.22	17.93
	I	85.54	15.29	95.26	20.1
	A	115.32	16.64	113.96	18.82
	E	102.68	14.58	104.14	17.11
	ɨ	72.79	12.49	87.89	21.6
	O	97.96	14.45	104.9	18.05
	Average	93.29	14.41	100.56	18.96
Male	ə	96.94	14.08	97.86	12.09
	u	92.51	15.68	96.2	15.93
	i	93.12	16.03	92.61	14.8
	a	121.83	19.01	108.63	12.62
	e	105.91	14.47	99.88	14.85
	ɨ	82.21	18.15	88.58	14.06
	o	105.06	13.46	100.84	14.7
	Average	99.65	15.84	97.8	14.16

Table 3. Mean Durations of vowels of Shonke and Gachine dialects

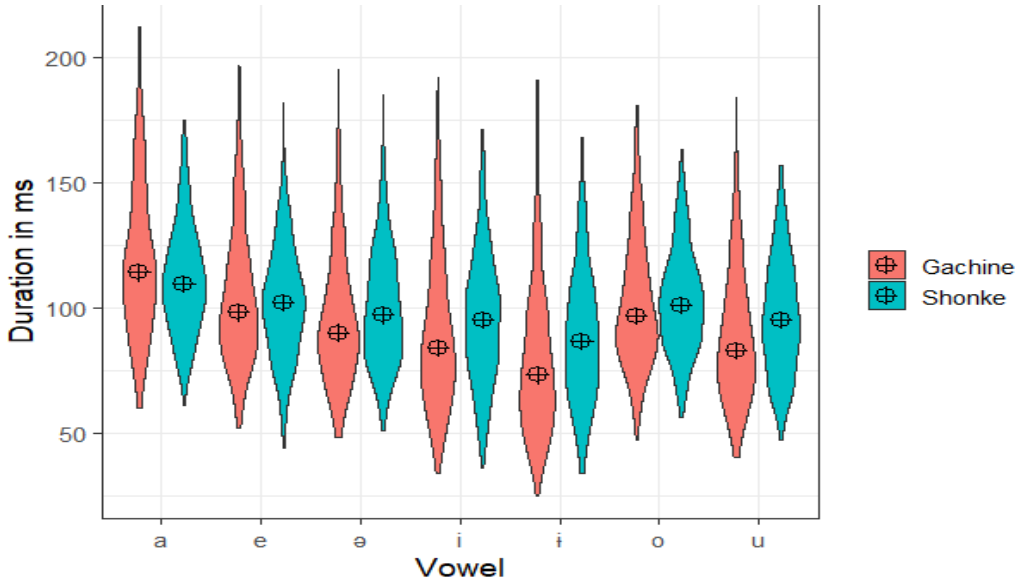

Figure 3. Violin plot of mean duration of Argobba vowels by dialect

Shonke males and females scored the same duration for vowels /u/, and /ɨ/. Similarly, Gachine males and Shonke females scored almost equal mean durations for the vowel /o/, as well as for the vowel /e/.

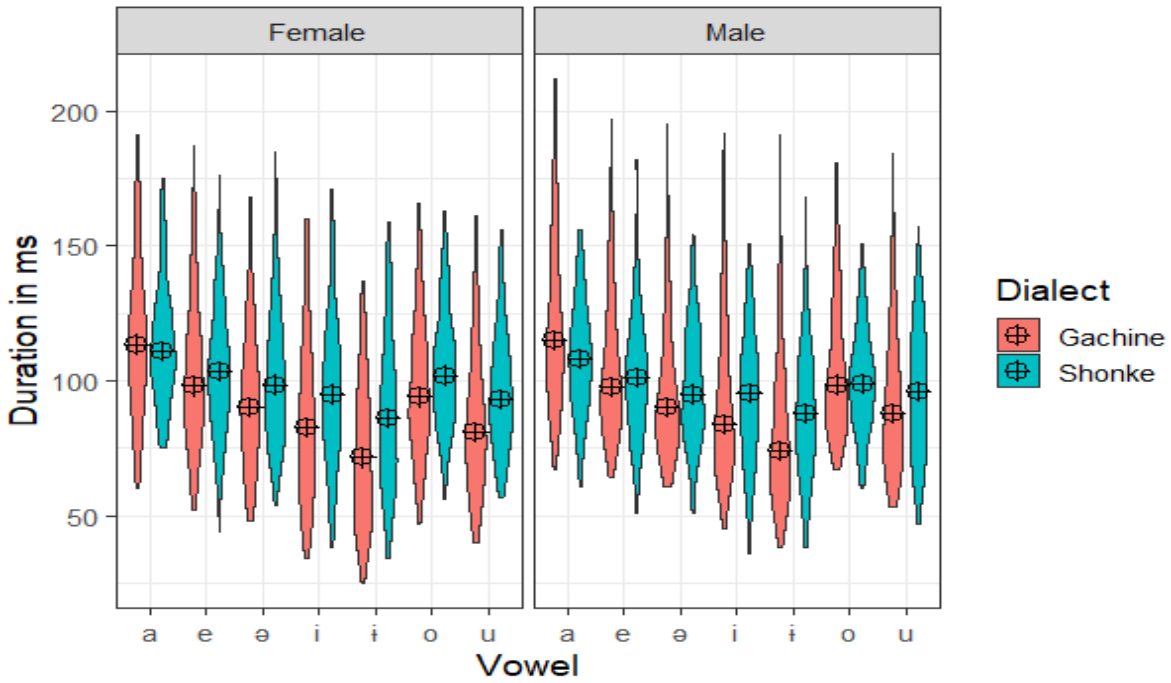

Figure 4. *Violin plot of mean duration of Argobba vowels by dialect and gender*

Tests of between-subjects effects were calculated to see the effect size of gender and dialect on vowels' duration. With regard to gender, the test revealed that it had no statistically significant main effect on vowels' duration, F (1, 36) = .321, p < .575, η_p^2= .01. Similarly, dialect had no statistically significant main effect on duration of vowels, F (1, 36) = .728, p < .399, η_p^2= .02. There was also no significant interaction effect of gender and dialect, F (1, 36) = 2.07, p < .159, η_p^2= .054.

Contexts

Voiced and voiceless consonantal contexts were used to see the effect of voice on vowels' duration. The result showed, regardless of the dialectal difference, vowels in the context of between voiced consonants had a higher duration, 103ms. But, as it can be seen from Table 4, vowels between two voiceless consonants had the lowest duration, 92.2ms.

Code	Context	Mean	SD
1	b**v**bv	103.66	16.52
2	b**v**tv	98.37	18.75
3	t**v**tv	92.18	17.03
4	t**v**bv	97.12	18.53

Table 4. Mean duration of Argobba vowels (regardless of each dialect's measures) in the context of voiced and voiceless consonants[3]

Tests of within-subjects effects indicated voice had statistically significant main effect of F (3,108) = 57.726, p < .001, η_p^2 = 0.62. There were also significant interaction effect of context*gender and a three way interaction of context*gender*dialect: F (3,108) = 3.848, p < .05, η_p^2 = 3.85 and F (3,108) = 3.68, p < .05, η_p^2 = 0.093 respectively, but there was no significant interaction effect of context*dialect, F (3,108) = 2.11, p < .10, η_p^2 = 0.055.

[3] *The vowel in the first syllable is always the target vowel.*

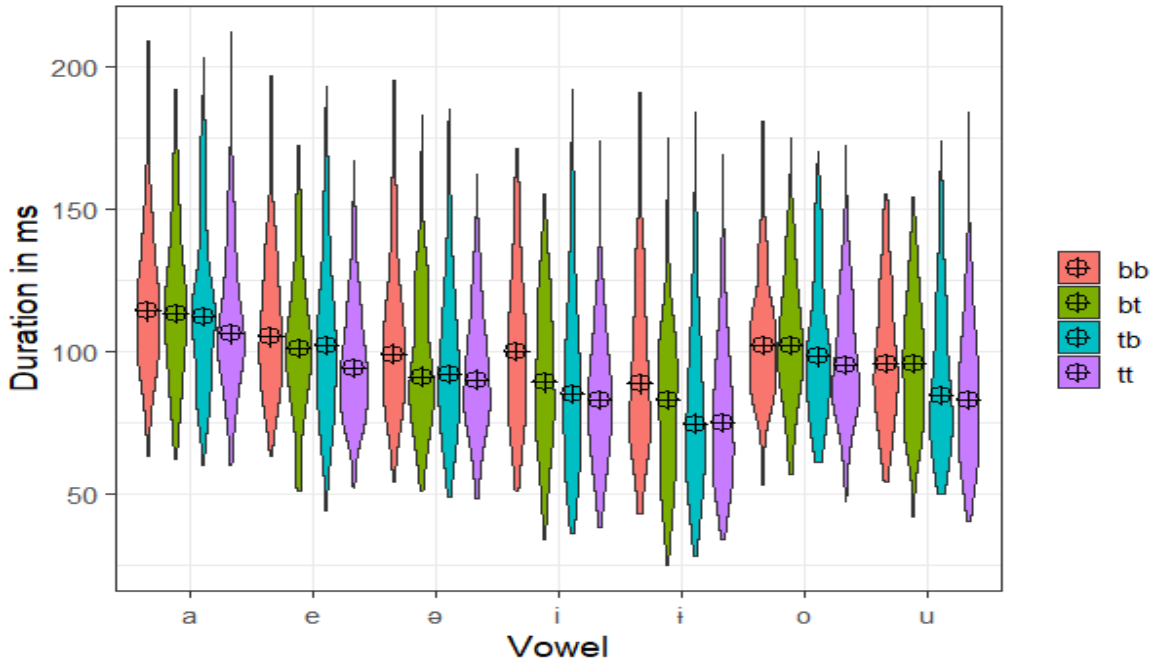

Figure 5. Violin plot of mean duration of Argobba vowels(regardless of each dialect's measures) by consonantal contexts

As presented in Table 5, pairwise comparisons of the four levels of voice contexts, with the adjustment of Bonferroni for multiple comparisons, showed that all voice contexts, except between contexts 4 and 2, had significant effect on duration of vowels with p =.000. But contexts 2 and 4, i.e., vowels preceded by voiced consonant and followed by voiceless, and vice versa (bvtv*tvbv) had no significant effect on duration of vowels, p = 1.000.

Pairwise Comparisons						
(I) context		Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
bvbv	bvtv	5.288*	.917	.000	2.729	7.848
	tvtv	11.478*	.917	.000	8.916	14.039
	tvbv	6.541*	.801	.000	4.305	8.777
bvtv	bvbv	-5.288*	.917	.000	-7.848	-2.729
	tvtv	6.189*	.791	.000	3.981	8.398
	tvbv	1.253	.923	1.000	-1.324	3.830
tvtv	bvbv	-11.478*	.917	.000	-14.039	-8.916
	bvtv	-6.189*	.791	.000	-8.398	-3.981
	tvbv	-4.937*	.906	.000	-7.465	-2.408
tvbv	bvbv	-6.541*	.801	.000	-8.777	-4.305
	bvtv	-1.253	.923	1.000	-3.830	1.324
	tvtv	4.937*	.906	.000	2.408	7.465

Based on estimated marginal means
*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Bonferroni.

Table 5. Pairwise comparisons of consonantal contexts on the mean duration of vowels

Similarly, for both dialects, vowels had different durational values due to differences in frames. As displayed in Table 6, vowels in a wordlist had a higher duration than in a carrier sentence.

Code	Frame	Mean	SD
1	Wordlist	108.45	18.21
2	Carrier Sentence	87.22	17.21

Table 6. Mean duration of Argobba vowels (regardless of each dialect's measures) in a wordlist and carrier sentence

Tests of within-subjects effects were conducted and the results indicated that frame (wordlist vs. carrier sentence) had statistically significant main effect on vowel duration, F (1, 36) = 154.2, p < .001, η_p^2 = .81. There was also frame*dialect interaction effect, F (1, 36) = 26.35, p < .001, η_p^2 = .42. However, there was no frame*gender interaction effect [F (1, 36) = 2.255, p < .142, η_p^2 = .059. There was also no three-way interaction effect of frame*gender* dialect [F (1, 36) = 1.895, p < .177, η_p^2 = .05.

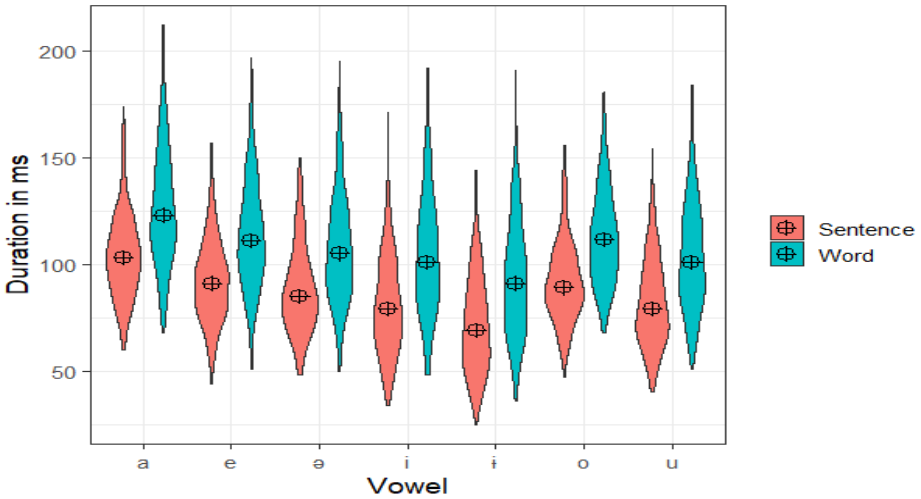

Figure 6. Violin plot of mean duration of Argobba vowels (regardless of each dialect's measures) in a wordlist and carrier sentence

The durations of vowels of both dialects in nongeminate and geminate consonantal contexts were measured as well. Vowels followed by nongeminate[4] consonants had a higher duration than those vowels followed by geminate consonants.

Code	Gemination	Context	Mean	SD
1	Geminate	c**v**ccv	84.82	15.35
2	Nongeminate	c**v**cv	110.85	20.07

Table 7. Mean duration of Argobba vowels (regardless of each dialect's measures) in geminate and nongeminate contexts

Tests of within-subjects effects revealed that gemination had statistically significant main effect on vowel's duration: F(1,36) =252.931, p < .001, η_p^2 = .88. There was also gemination*dialect interaction effect of F(1,36) = 5.764, p < .05, η_p^2 = .14. However, there was no gemination*gender interaction effect, F (1, 36) = .009, p < .924, η_p^2 = .000. There was also no three-way interaction effect gemination*gender* dialect, [F (1, 36) = .124, p < .727, η_p^2 = .003.

[4] *The language does not allow geminate or two consonants at the initial of a word.*

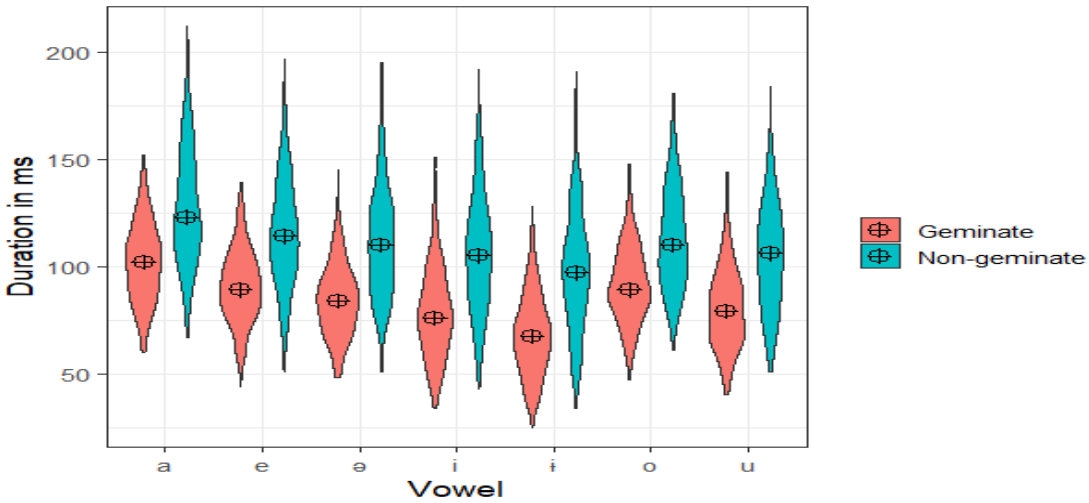

Figure 7. Violin plot of Mean duration of Argobba vowels (regardless of each dialect's measures) in geminate and nongeminate contexts

As it can be referred from Table 3, the Gachine dialect vowels had lower duration than their Shonke equivalents. The Gachine females' vowel durations were the shortest of all subjects. The Shonke dialect females' vowels' durations were higher than the rest of the subjects, and Gachine males' vowels' durations were higher than their Shonke counterparts. However, tests of between-subjects effects revealed that both gender and dialect had no statistically significant effect on the duration of vowels.

The effects of voice, gemination and wordlist/carrier sentence were similar in both dialects. Consequently, vowels spoken between voiced consonants had a higher duration, whereas vowels between two voiceless consonants had the lowest duration, and the effect was statistically significant. Similarly, vowels followed by nongeminate /single consonants had higher duration than in the geminate contexts with a statistically significant effect. Besides, vowels in a wordlist had a higher duration than in a carrier sentence, and the effect was statistically significant.

Discussion

The study showed that the duration of the vowels of Argobba dialects was inversely proportional to the vowel height. Hence, the low vowel /a/ measured the longest duration followed by front and back mid-high vowels, /e/ and /o/. And, front and back high vowels, /i/ and /u/ had the shorter duration next to the high central vowel /ɨ/ which has the least duration of all the seven vowels. The mid-central vowel /ə/ had a relatively medium duration. Lehiste (1970:18) stated that "vowels' duration appears to be correlated with tongue height: other factors being equal, a high vowel is shorter than a low vowel". Therefore, the duration the vowels of Argobba dialects was concurrent with this universal feature. In this case, longer duration is the result of the tongue movement associated with the jaw position (opening of the mouth) to produce low vowels (Lindblom, 1968; Mok, 2011) like /a/.

With regard to front-back vowel contrasts, in the Shonke dialect, front vowels /i/ and /e/ were shorter than their back counterparts, /u/ and /o/ respectively. This was also in concurrence with other languages' vowel durations like Amharic (Derib, 2011.), Oromo (Tujube, 2017) and Wolaytta (Firew, 2017). On the contrary, in the Gachine dialect, the back vowels /u/ and /o/ were shorter than the front vowels /i/ and /e/ respectively, which is not common in many languages.

Besides, the Gachine dialect vowels had lower duration than their Shonke equivalents. However, when the dialectal difference was seen separately for the two genders, the results showed there was no consistent pattern. The Shonke dialect females' vowels' durations were higher than the Gachine dialect females' vowels' durations, but the Gachine dialect males' vowels' durations were higher than the Shonke dialect males' vowels' durations. The dialectal difference in vowels' duration is common in languages such as Oromo (Tujube, 2017), Portuguese (Escudero and Boersama, 2009), Spanish and English dialects (Morrison and Escudero, 2007; Fox, 2009). Nevertheless, in the case of Argobba dialects, the differences in vowel duration due to dialectal differences do not apply consistently for the two genders and all the vowels. This could have happened due to the difference in the level of language contact and maintenance among the speakers of the two

dialects. The Gachine dialect seems to be more endangered than the Shonke dialect as there are fewer monolinguals who speak the language in Gachine than in Shonke.

Many studies showed that "female speakers tend to produce vowels with longer duration than male speakers, regardless of the speech style or speech rate" (Williams, 2013:21). This is universally true in the majority of languages of the world (Derib, 2011; Williams and Escudero, 2014; Firew, 2017). In this respect, the finding of this study, that Gachine females' vowel duration was shorter than the males' is not in agreement with universal facts. Nonetheless, still, there are languages where the females' duration is shorter than the males': "…women's vowel duration may not always be longer than men's for all languages" (Williams and Escudero, 2014: 97). Similar acoustic research on the vowels of Oromo dialects also showed that for long vowels male's duration was longer in all contexts used to examine duration in all dialects (Tujube, 2017:97). Furthermore, Ericsdotter and Ericsson (2001:2) stated that gender differences study of vowels duration in Swedish showed, in some instances, male's durations were on average 100 ms longer than those of the women. Since the Shonke dialect vowels conform to the most common pattern with regard to the duration of the vowels of male and female speakers, it is difficult to conclude that the shorter duration of the females' vowels' durations of the Gachine dialect is an intrinsic property of Argobba. One of the explanations for Gachine females' shorter vowel duration could be due to sociological or cultural influence where females are expected to speak shyly which results in a quick throw of speech, as Pépiot (2012) remarked. Another explanation is the higher degree of endangerment of Argobba among the Gachine speakers. It is known the phonology, morphology and syntax of languages that are being replaced by others in the gradual language shift phenomena, which results in the languages being labelled as 'dying languages', have elements that deviate from the most common structures (Wolfram, 2004) and there is a possibility that the duration of vowels may be one of the affected features by language shift.

However, there is no clear-cut reason why gender has an effect on the duration of vowels. It could be due to differences in the sociology of society [construction of gender identity, innate versus learned behaviour, (Pépiot, 2012)]. Besides, "…speakers' effort to maintain clarity can also override any durational effects" (Mok, 2011:542). Even, different languages can cause different durational values of vowels. For example, gender-based durational difference is relatively small in Danish but appears to be much greater in Russian (Pépiot, 2012). Therefore, "…it is worth noting that so many factors affect duration that we need to be cautious making any general statements about it (Lodge, 2009:120).

As to the effect of voice on vowels' duration, the result showed that Argobba dialects' vowels spoken between voiced consonants had higher duration, whereas vowels between two voiceless consonants had the lowest duration, and the effect was statistically significant. This is a universal feature of vowels (House and Fairbanks, 1953; Chen, 1970; Maddieson, 1997). According to Ladefoged (2001: 232) "…the vowel in **'**bad**'** is predictably longer than the vowel in **'**bat**'**, because, other things being equal, vowels are always longer before voiced consonants than before voiceless consonants". This might have happened, among other things, due to the higher vibration of vocal folds during the production of voiced consonants the continuous voicing making it difficult to identify the end of the vowel in the voiced consonantal context (Maddieson 1997 citing Javkin 1976).

In both dialects, vowels followed by a nongeminate consonant had a higher duration than vowels in the geminate context with a statistically significant effect. This is a universal feature found in other languages like Amharic (Sumner, 1957; Derib, 2011), and Italian (Smith, 1995). This is because of the tradeoff between a longer consonant and a shorter vowel and vice versa so that the larger unit they make up, i.e., the syllable, has a relatively similar duration in spite of the order of the constituents it is made of (Smith, 1995; Derib, 2011).

CONCLUSION AND RECOMMENDATION

According to the findings, in both dialects, duration increases as a vowel height decreases: lower vowels measured the longest duration, and high vowels had the shortest duration. With regard to front-back contrast, duration was comparable in line with vowels' heights: front and back high vowels had equivalent durations and similarly mid-high vowels had similar durations.

Similarly, vowels spoken between voiced consonants had higher duration than vowels between voiceless consonants for both dialects. Besides, vowels followed by a nongeminate consonant had a higher duration than vowels followed by geminate consonants. In addition, the duration of vowels in a wordlist was higher than the duration in a carrier sentence.

Durational differences of vowels of the two dialects were not statistically significant and did not have a consistent pattern for each vowels. Most of durational features of vowels of Shonke and Gachine dialects were universal or near-universal. However, the fact that Gachine females' vowels' duration was lower than the males' is a dialect-specific feature. In addition, in the Gachine dialect, the back vowels /u/ and /o/ were shorter than the front vowels /i/ and /e/ respectively. This is not common in many languages. The fact that the Gachine dialect seems to be more endangered than the Shonke dialect makes the issue of the effect of language contact a worthy area for further acoustic research.

Phonetic researchers are invited to do further durational research based on the vowels' data collected from spontaneous speech which is more natural in nature. In addition, Argobba sounds, both vowels and consonants, could be studied based on electroglottographic and aerodynamic examinations for the times to come. Above all, as much as the language is critically endangered, it is vital to make a full scale digitalized multimedia documentation so as to safeguard the language.

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