GADDI

PHONETICS AND PHONOLOGY

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Gaddi Phonetics & Phonology

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Introduction

This chapter looks at the phonetic and phonological character of Gaddi. This module covers topics regarding the phonetic and phonemic character of the vowels; the syllable structure of the phonemes and their consequent combinatorial constraints; the different phonological processes underwent by Gaddi phonemes; the morpho-phonological processes; and the foot structure.

Section 1 introduces the phonemic inventory of Gaddi. In vowels, Gaddi has eight monophthongs, thirteen diphthongs and three lexical nasals. The section describes the distinctive features of each vowel and their acoustic formants as projected on the vowel space. Gaddi phonemes identify vowel length as a distinctive but not contrastive feature in their phonemic inventory. The acoustic character of the vowels informed significant findings about the articulation of the vowel [ɑ]. F2, which corresponds to the frontness/ backness of vowels showed that [ɑ] is between [ə] and [u], indicating that it is distinctly [+back].

Section 2 illustrates the phonotactic constraints of the phonemes. This section shows the distributional restrictions of the phonemes, which define the occurrence of individual segments in different positions.

The syllable structure of Gaddi, and the combinatorial restrictions governed by said syllable structure, is discussed in Section 3. Gaddi is an onset maximal language that disallows sonorants in coda final position.

Section 4 describes the various phonological processes that are undergone by Gaddi phonemes such as nasalization, germination, retroflexion, schwa epenthesis, glide formation.

Section 5 is about the various morpho-phonological processes. It was found that certain word formation processes such as derivation triggers resyllabification. Other

phonological processes such as schwa epenthesis may be attributed to vowel final nouns when taking suffixes that are vowel initial. This indicated that there was hiatus in Gaddi.

The final section, Section 6, looks at the foot structure of Gaddi. After analysing the foot structure on the basis of four parameters- Boundedness, Weight, Headedness and Directionality- it was concluded that Gaddi is a bounded, quantity sensitive iamb with right to left direction of stress.

1. Gaddi Vowels

The vowel inventory was arrived at by collecting minimal and near minimal pairs for all vowels. Segments that were found to be contrastive constitute the phonemic inventory. However, Gaddi also made non-contrastive distinctions between vowels. Except schwa all the vowels have a long counterpart, as is evident from the words in (1).

(1) Vowel length distinction
- a. [pʰulə] 'flower'; [luːɳə] 'salt'
- b. [sinɑ] 'wet'; [siːɳɑ] 'to sew'
- c. [kɑɭɑ] 'black'; [bɑːli] 'earring'
- d. [bɛːɳə] 'sister'; [bɛgə] 'morning'
- e. [sere] 'their'; [heːɭə] 'slate on roof'
- f. [prɔɳɛ] 'guests'; [koːl] 'big bowl'
- g. [ʈɔɳɑ] 'deaf'; [tɔːlə] 'hammer'

There are 8 distinctive oral monophthong vowels, 3 lexically nasal vowels and 13 diphthongs. out of 13 diphthongs, 7 are oral and 6 are nasal. Gaddi, therefore, belongs to the category of large vowel inventory (7-14 vowels) languages.

1.1. Monophthongs

Gaddi has 8 contrastive oral monophthong vowels.

	Front	*Central*	*Back*
Close	i		u
Close-Mid	e		o
Mid		ə	
Open-Mid	ɛ		ɔ
Open			ɑ

Table 1: Gaddi Vowel Chart

The following sections describe the distinctive features of each monophthong and the environments of their respective distributions.

1.1.1. [i iː]

Gaddi has a high front unrounded vowel /i/. The Distinctive features of [i] are [+high, -back]. It occurs in word initial, medial and final positions. Examples (2), (3) and (4) show their occurrence in word initial, medial and final positions respectively.

(2)	(a)	[iiˑ]	'tomorrow'
	(b)	[ijũː]	'snow'
(3)	(a)	[giɳti]	'counting'
	(b)	[binnɑ]	'mattress'
	(c)	[sikɑɾi]	'sikɑɾi'
	(d)	[hiːtə]	'cold'
(4)	(a)	[tʃiɽi]	'bird'
	(b)	[həʈʈi]	'stick'
	(c)	[kɑŋgi]	'comb'

1.1.2. [e eː]

Gaddi has a front close-mid vowel /e/. The Distinctive features of [e] are [e] = [-high, -low, -back]. This vowel occurs word initially, medially and finally as in examples (5), (6) and (7)

(5)	(a)	[ernɑ]	'to see'
(6)	(a)	[eʈʰi]	'here'
	(b)	[besəɾmi]	'shamelessness'
	(c)	[keɭɑ]	'banana'
(7)	(a)	[buɖɖʰe]	'old'
	(b)	[əpɳe]	'own'
	(c)	[hɛlke]	'young'

1.1.3. [ɛ ɛː]

Gaddi has a front open-mid vowel /ɛ/. The distinctive features of [ɛ] are [-high, -low, -back]**.** This vowel does not occur word initially but occurs word medially and word finally, as evident from (8) and (9).

(8)	(a)	[həɽɛnə]	'smell'
	(b)	[bəɾɛnɖɑ]	'porch'
	(c)	[bɛːɳə]	'sister'
(9)	(a)	[tʃɛ̃nʈɛ]	'clothes'
	(b)	[əpəɳɛ]	'own'
	(c)	[tʃɛ̃ː]	'root'

1.1.4. [ə]

Gaddi has a central vowel /ə/. The Distinctive features of [ə] are [-high, -low, -front, -back]. This vowel occurs word initially, word medially and word finally.

(10)	(a)	[əmbə]	'mango'
	(b)	[ədʒə]	'today'
	(c)	[əŋgə]	'part'
	(d)	[əpɳi]	'own'
(11)	(a)	[bərɛndɖɑ]	'porch'
	(b)	[pəŋkʰə]	'feather'
	(c)	[pəɳiː]	'fodder'
	(d)	[besərmi]	'shamelessness'
(12)	(a)	[ɑːgə]	'fire'
	(b)	[bɛːɳə]	'sister'
	(c)	[bəsəʊɑːɾə]	'turmeric'

1.1.5. [u uː]

Gaddi has a high back rounded vowel /u/. This vowel occurs word initially, word medially and word finally as shown in (13), (14) and (15). The Distinctive features of [u] are [+high, +back, +round].

(13)	(a)	[untʃɑi]	'height'
(14)	(a)	[sustə]	'dull'
	(b)	[hukkɑ]	'dry'
	(c)	[pʰulə]	'flower'
	(d)	[dʰundə]	'find'
	(e)	[luːɳə]	'salt'
	(f)	[dʰuːɽə]	'dirt'
(15)	(a)	[ʈopu]	'hat'
	(b)	[dəbbu]	'boy'
	(c)	[kʰinnu]	'ball'
	(d)	[hədʒu]	'now'
	(e)	[dʰũː]	'dirt'

1.1.6. [o oː]

Gaddi has a distinctive back close-mid vowel /o/. The Distinctive features of [o] are [-high, -low, +back, +round]. It occurs word initially, medially and finally as in (16), (17) and (18) respectively.

(16)	(a)	[o]	'that'

(17) (a) [boli] ‘language’
(b) [goːlə] ‘round’
(c) [ʈopi] ‘cap’
(d) [prоɳɑ] ‘guest’
(e) [gʰərоːɖə] ‘scratch’

(18) (a) [ɾəso] ‘kitchen’
(b) [ɖɑʈo] ’spade’

1.1.7. [ə ɔː]

Gaddi has a distinctive back open-mid vowel /ɔ/. The Distinctive features of [ɔ] are [-high, -low, +back, +round]. This vowel occurs only word-medially as in (19) and not word initially and word finally.

(19) (a) [lɔŋgə] ‘small nose pin’
(b) [tʃɔ̃lə] ‘rice’
(c) [sɔgi] ‘with’
(d) [bɔ̃ːkʰɾi] ‘broom’

1.1.8. [ɑ ɑː]

Gaddi has a distinctive low back open vowel /ɑ/. It is not exactly [+back] like /u/ or /o/ but occurs somewhere between the centre and back position. The Distinctive features of [ɑ] are [-high, +low, +back, -round]. This vowel occurs word initially, medially and finally as in (20), (21) and (22).

(20) (a) [ɑndɾɑː] ‘intestines’
(b) [ɑːgə] ‘fire’

(21) (a) [kətɑbə] ‘book’
(b) [ɾɑːɳə] ‘garlic’
(c) [kɑnnə] ‘ear’

(22) (a) [gʰɑ] ‘grass’
(b) [dʰɛːɖɑ] ‘day’
(c) [sinnɑ] ‘wet’

The distinctive features of the vowels have been drawn on three parameters: Frontness/ backness, tongue height, and roundedness, each giving a binary value to the vowel segments. A summary of this can be seen in the table below.

	high	*low*	*front*	*back*	*round*
i	+	-	+	-	-
e	-	-	+	-	-
ɛ	-	-	+	-	-
u	+	-	-	+	+

ɒ	-	-	-	+	+
ɔ	-	-	-	+	+
ɑ	-	+	-	+	-
ə	-	-	-	-	-

Table 2: Distinctive feature chart for vowels in Gaddi

1.2. Lexically nasal vowels

Gaddi has 3 lexically nasal vowels. All three vowels show length distinction but they are not contrastive with their oral counterparts. (23), (24) and (25) are examples of the three lexical nasal vowels and their long counterparts.

(23) (a) [kjũ] 'fava beans'
(b) [ijũ] 'snow'
(c) [dʰũː] 'smoke'

(24) (a) [bã] 'pond'
(b) [gɾãː] 'village'

(25) (a) [pɛ̃talɪ] 'forty-five'
(b) [tʃɛ̃ː] 'root'

1.3. Diphthongs

There are 6 distinctive oral diphthongs, [ɑu, ei, ɑi, əu, eo, oɑ], and 6 distinctive nasal diphthongs, [əũ , uã , eĩ , iũ , ɑũ , uɛ̃]. The examples can be seen in (26) and (27) respectively.

(26) (a) bəɖ**ɑu** 'to cut'
(b) p**ei**nnɑ 'sharp'
(c) bʰ**ɑi** 'brother'
(d) tʃ**əu**ɾə 'four'
(e) k**eo**lɑ 'coal'
(f) bʰən**oɑ** 'brother-in-law'

(27) (a) b**əũ**kʰɾi 'broom'
(b) l**uã**ːtʃiɽi 'female wedding dress'
(c) d**eĩ**ː 'curd'
(d) p**iũ**lɑ 'yellow'
(e) **ɑũ** 'I'
(f) **uɛ̃**ɾɛ 'their'

As can be seen from (27c), there occurs a diphthong with a nasal vowel /i/ in Gaddi but we do not have enough data to show that there is a monophthong lexical nasal vowel /i/ also. According to the Pattern Congruity Principle there should be one but this needs to be further explored.

1.4. Vowel Space

A formant is a concentration of acoustic energy that reflects the way air vibrates in the vocal tract. As the vocal tract produces sound, air vibrates at many frequencies at the same time. Peaks in the spectra reflect basic frequencies of the vibrations of air in the vocal tract. Areas within the spectrum with relatively high energy frequency components (i.e; areas around these peaks) are termed formants.

In vowels the frequency of formants, generally the first and second formant (F1, F2) can be used to categorise vowels. The higher the tongue in the mouth when producing the vowel, the lower F1. The further forward the tongue in the mouth when producing the vowel, the higher F2. It is possible to plot the F1 value against the F2 value of different vowels (See Tables 3 & 4 below).

This two-dimensional space can be referred to as the **vowel space.** The vowel space is of interest because it has been argued that F1/F2 differences play a major role in vowel perception.

1.4.1. F1 formant charts

F1 corresponds to vowel height and there is an inverse relation between the two. From Tables 3 and 4 we can see that F1 is low for high vowels and it is high for low vowels.

Another important observation in this language is regarding the vowels [u] and [o]. As can be seen from their F1 values, there is not much height difference between them. That is, they are located close to each other in the vowel space. And for this reason, many times we hear [u] in place of [o] or vice-versa.

VOWELS	*Approx range(Hz)*	*F1(Hz)*
i	350-420	383.36
u	320-430	393.37
e	400-530	450
o	400-550	473.89
ə	450-700	623.38
ɔ	520-730	663.65
ɛ	620-740	691.12
ɑ	700-890	796.17

Table 3: F1 formant chart for female speaker

VOWELS	*Approx range(Hz)*	*F1(Hz)*
i	340-390	375.58
u	340-400	381.38
e	400-520	444.77

o	420-500	458.75
ɔ	450-560	557.34
ə	520-640	566.41
ɛ	530-650	582.37
ɑ	530-670	613.38

Table 4: F1 formant chart for male speaker

1.4.2. F2 formant charts

F2 corresponds to the frontness/backness of vowels. Frontness is directly proportional to F2. We can see that the vowels to the front of the vowel space have a higher F2 as compared to others.

Another important observation is regarding **the vowel [ɑ]**. From the F2 values of [ɑ], [ə] and [u] we can see that [ɑ] is between [ə] and [u] which means that it is [+back] but not as back as [u].

VOWELS	*Approx range(Hz)*	*F2(Hz)*
i	2100-2600	2416.18
e	2160-2300	2244.62
ɛ	1820-2100	2020.96
ə	1600-2100	1843.21
ɑ	1530-1780	1631.66
u	1080-1500	1209.86
ɔ	1010-1280	1117.32
o	960-1190	1060.66

Table 5: F2 formant chart for female speaker

VOWELS	*Approx range(Hz)*	*F2(Hz)*
i	1850-2120	2019.55
e	1830-2290	1981.8
ɛ	1710-1810	1759.50
ə	1300-1630	1457.6
ɑ	1180-1520	1288.56
ɔ	1000-1170	1163.56
u	860-1230	1055.34
o	960-1090	1031.75

Table 6: F2 formant chart for male speaker

1.4.3. F3 formant charts

F3 corresponds to roundedness of vowels. It is inversely proportional to F3. The lower the F3, the more rounded the vowel. Thus, from Tables 7 and 8, we can see that [u] and [o] have the lowest values for F3 and they are rounder than the other vowels.

As for the **gender difference**, we can see that all three formants (F1, F2, F3) are higher for the female speaker as compared to the male speaker in compliance with the universal physiological factor that women have smaller larynx and thus high-pitched voice as compared to men.

VOWELS	*Approx range(Hz)*	*F3(Hz)*
i	2780-3130	2949.51
e	2820-2950	3010.56
ɛ	2970-3170	3053.65
ə	2950-3240	3082.14
ɑ	3000-3200	3067.45
ɔ	2830-3020	2969.16
u	2660-3000	2886.22
o	2820-2960	2900.95

Table 7: F3 formant chart for female speaker

VOWELS	*Approx range(Hz)*	*F3(Hz)*
i	2660-2970	2737
e	2600-2770	2704.15
ɛ	2430-2750	2646.82
ə	2130-2760	2587.47
ɑ	2520-2850	2671.11
ɔ	2480-2610	2554.52
u	2090-2440	2373.16
o	1950-2710	2441.5

Table 8: F3 Formant chart for male speaker

1.5. Vowel Space Plot

Below is the plot of the vowel space for the female as well as the male speaker. It has been plotted in accordance with the Bark scale, in which perceptually equal intervals of pitch as perceived by listeners are represented by equal distances on the scale.

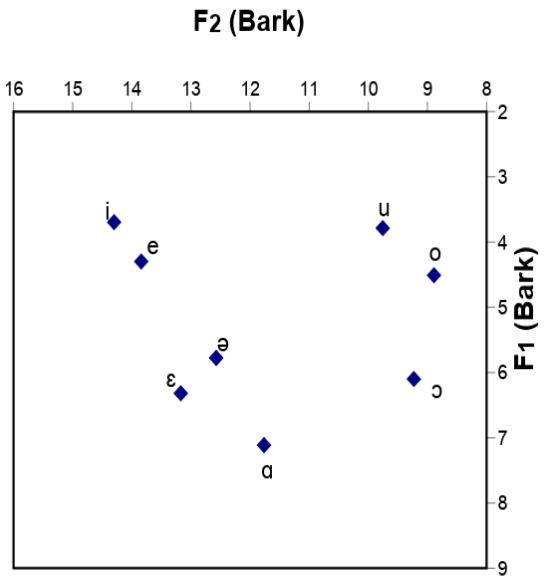


Figure 1: For female speakers

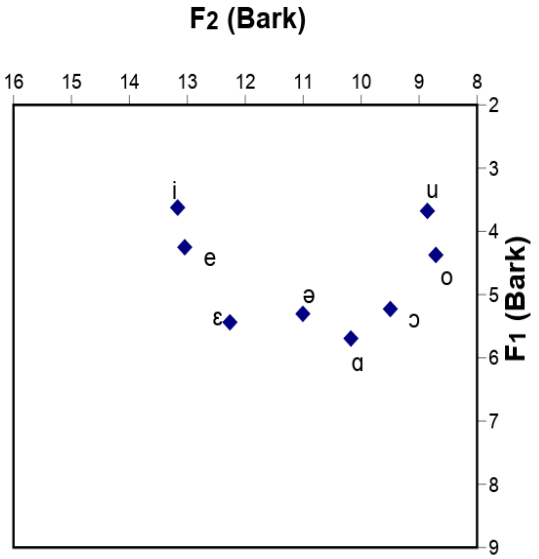


Figure 2: For male speakers

2. Phonotactics

Phonotactic constraints define the restrictions of the phonemes with respect to (i) their distribution in word initial, medial and final positions and (ii) their occurrence with respect to other adjacent segments. The following section describes the selectional and combinatorial constraints of consonants and vowels respectively.

2.1. Distribution of consonants

Distributional constraints define the occurrence of individual segments in different positions.

2.1.1. Word-final consonants

The distribution of word final consonants depends on whether we consider the epenthetic schwa after every consonant ending word or not.

Hall (2006) talks about vowels that are phonetically weaker than other vowels and terms them 'excrescent' vowels. According to this proposal, excrescent vowels are short in duration and centralized in quality. Excrescent vowels are systematically ignored by other phonological processes. The commonly expressed notion is that excrescent vowels are a kind of phonetic effect, likely a transition between consonant articulations.

However, since Hall's claim was primarily directed at word medial epenthetic schwas in Gaddi, we may refrain from generalising this claim to word final epenthesis. Therefore, the list of word final consonants after considering the occurrence of epenthetic schwa is as follows [see example (28)].

(28)	/ɾ/	[gʰɑɾ]	"house"'
	/m/	[nərəm]	"soft"
	/ɳ/	[bɛɳ]	"sister"
	/s/	[kʰus]	"happy"

2.1.2. Word-initial consonants

All consonants except *j, l* and *ɳ* occur in word initial positions.

(29)	/p/	[pɑ:ɖə]	"mountain"
	/pʰ/	[pʰuki]	"burn"
	/b/	[billi]	"cat"
	/bʰ/	[bʰɑ:ɳɖɛ]	"vessel"
	/t/	[tɛrnɑ]	"to swim"
	/tʰ/	[tʰɑũ]	"case marker"
	/d/	[duttɛ]	"yesterday"
	/dʰ/	[dʰoi]	"to wash"
	/ʈ/	[ʈu:ɳɑ]	"magic"
	/ʈʰ/	[ʈʰellɑ]	"trunk of a tree"
	/ɖ/	[ɖɑ:lə]	"tree"
	/ɖʰ/	ɖʰiɖə	"stomach"
	/k/	[kəmrɛ]	"room"
	/kʰ/	[kʰi:ɖɛ]	"snake"
	/g/	[golə]	"round"
	/gʰ/	[gʰɑrə]	"house"
	/tʃ/	[tʃərnɑ]	"to graze"
	/tʃʰ/	[tʃʰori]	"lass"
	/dʒ/	[dʒo:rə]	"strength"
	/dʒʰ/	[dʒʰo:lə]	"alcoholic beverage"

/ɾ/	[ɾaŋgə]	“colour”
/l/	[ləmbɛ]	“long”
/m/	[moʈa]	“fat”
/n/	[nərəmə]	“soft”
/s/	[seɾe]	(3S.GEN) his/her
/h/	[hərɑːɭə]	“hair”

2.1.3. Word initial vowels

All monophthongs occur in word initial positions. Diphthongs were never found to occur in word initial positions.

(30)	/i/	[ijũ]	“snow”
	/e/	[eɾnɑ]	“to see”
	/o/	[oɖi]	“there”
	/u/	[uɖɖəɽɳə]	“clothes”
	/ɛ/	[ɛʈiɳɑ]	“to climb”
	/ə/	[ədʒkəɳɑ]	“today”
	/ɑ/	[ɑmbə]	“mango”

2.1.4. Word final vowels

Word finally, you have both monophthongs and diphthongs. All monophthongs except /o/ is found to occur in word final positions.

(31)	/i/	[kuɭi]	“girl”
	/e/	[uɭʈe]	“left”
	/o/	[kədʒdʒo]	“because”
	/u/	[ʧəɾoʈʈu]	“alum”
	/ɛ/	[tusɛ]	2S.ERG
	/ə/	[goɭə]	“round”
	/ɑ/	[ʧəɾnɑ]	“to graze”

The diphthongs of Gaddi are still a matter of debate since some of them may be just a case of colocation of two monophthongs. However, two of the recognised diphthongs occurring in word final positions are listed below.

(32)	/oi/	[s**oi** kɑrdɑ] “sleeping”
	/əi/	[pɑɖi l**əi**] “have read”

2.2. Distribution of consonant clusters

Combinatory constraints state the restriction of occurrence of the phonemes with respect to their neighbouring segments. The following section describes the combinatory constraints of consonants.

2.2.1. Word initial clusters

Word initial clusters always comprise of obstruents as C1 and liquids or glides as C2. Examples below illustrate all the possible word initial clusters.

(33)	/br/	[bɾɑg]	“tiger”
	/dr/	[dɾubɑɖɑ]	“trash”
	/gr/	[gɾɑ]	“village”
	/kr/	[krɑːr]	“promise”
	/gl/	[glɛdʒ]	“window”
	/pj/	[pjɑɾ]	“love”
	/sʋ/	[sʋɑːd]	“taste”

2.2.2. Word final clusters

The word final epenthetic schwa to applies to all consonant ending words except /ɾ m ɳ s/ and incidentally, these segments do not occur as C2 in complex codas. Therefore, no word final clusters were found in Gaddi.

3. Syllable Structure

3.1. Possible syllable types

Given the phonotactic restrictions that govern the constituent structure of the syllable in Gaddi, we can break down the canonical syllable to a number of types, based on their occurrence as monosyllables.

The following syllable types were found in monosyllables.

(34)	(a)	V	[e]	“this”
			[o]	“that”
			[ɑũ]	“I”
	(b)	CV	[hɑ]	“breath”,
			[gʰɑ]	“grass”
			[bi]	“seed”
	(c)	CCV	[gɾɑ̃ː]	“village”
			[dɾɛ]	“river”
	(d)	CVC	[gol̪]	“round”
			[gʰɑɾ]	“house”

One of the main ideas behind understanding what constitutes a well-formed syllable in a language is its compliance to the sonority hierarchy. The idea is that the nucleus of each syllable constitutes a sonority peak, while the other segments belonging to the same syllable are arranged according to a falling sonority profile from the nucleus outwards (Wiebke Brockhaus, 1999).

The sonority hierarchy is as follows in its increasing order of sonority.

Plosives>> Fricatives >> Nasals >> Laterals >> Flaps >> Vowels

It can be clearly seen that examples in (34) conform to the sonority hierarchy. Thus, we understand (34) to be legitimate syllables in Gaddi.

3.2. Syllable division

For the sake of simplicity of description, we are going to follow the method adopted by Asher & Kumari (1997) to divide word medial segments:

> 'What is therefore proposed here is that we take consonant classes rather than actual segments in the consonant system. Three major types of consonants are needed: 'i' stops, oral and nasal 'P'; 'ii' fricatives 'F'; and 'iii' liquids and glides 'L'. This makes it possible to show that the onset of all syllables has the same structure as that allowable for word-initial consonants, and that the coda of any syllable has the same structure as the possibilities for word-final consonants.' (Asher & Kumari, 1997, p.429).'

Since Gaddi lacks word final consonants, we also consider here, the speaker intuitions of syllable division. These judgements, in addition to the word initial consonants, may give us a clearer picture of the permissible coda and onset consonants respectively.

Thus, we understand the syllable division in Gaddi with respect to medial segments according to the above method followed.

All intervocalic single consonants are assigned to the following syllable

(35) (a) bɛɳɑ → bɛ.ɳɑ sit.INF

(b) hɑtʰi → hɑ.tʰi "elephant"

Word medial geminate consonants behave like single phonological units and are therefore assigned to the following syllable.

(36) (a) ʈʰellɑ → ʈʰe.llɑ "trunk of a tree"

(b) suttura→ su.ttu.rɑ "asleep"

Sequences of two homorganic oral plosives where the first is unaspirated and the second aspirated are treated in the same way as geminate consonants.

(37) tʃiʈʈʰi → tʃi.ʈʈʰi "letter"

Sequences of two consonant clusters that are not geminates have each assigned to the onset and coda of the first and second syllable respectively.

(38) pɑkkɑɖni → pɑkkɑɖ.ni "to catch"

Sequences of three consonant clusters where no two segments are geminates, they split up according to the permissible clusters in the word initial positions:

(39) dʒəndrɑ → dʒən.drɑ "lock"

Sequences of three consonant clusters where the second and third are geminates, the first consonant goes as the coda of syllable 1 and the geminates as onsets of syllable 2.

(37) bərkkʰɑ → bər.kkʰɑ "rain"

3.2.1. Syllabification

Syllables in every language either tend to maximise their onset or maximise their coda. With an example from Gaddi and given its phonotactic constraints, we arrive at a conclusion on whether it is onset maximal or Coda maximal. In any case, the nuclear material has to be identified first which must be followed by the onset or coda, depending on which gets maximised in the respective language.

Consider Gaddi to be Coda maximal. The next step would be to identify the codas and then finally associate the onset to the rhyme. However the phonotactics of Gaddi disallows sonorants in coda final position, making gɑːɳ an ill formed syllable. Now, consider Gaddi to be Onset maximal. The steps then would be to identify the nucleus, then onset and then finally associate the coda (if any) to make it a full syllable.

Now, consider Gaddi to be Onset maximal. The steps then would be to identify the nucleus, then onset and then finally associate the coda (if any) to make it a full syllable.

The below syllables perfectly comply the phonotactic constraints of the language and are therefore well-formed syllables. Thus, we understand the constituent structure of Gaddi to follow the Onset Maximisation Principle, which is defined as intervocalic consonants being maximally assigned to the onsets of syllables in conformity with universal and language-specific conditions (Kahn, 1976).

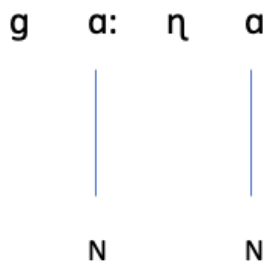


Figure 3: Identifying the nucleus

3.3. Grid like summary of combinatory segments

The vertical list are the segments that occur in C1 position of onset and the horizontal list shows consonants that occur in C2 position in the onset. The bracketed consonants in the vertical list are those that are disallowed in the word initial position.

	p	pʰ	b	bʰ	k	kˠ	g	gʰ	t͡ʃ	t͡ʃʰ	d͡ʒ	d͡ʒʰ	ʈ	ʈʰ	ɖ	ɖʰ	t	tʰ	d	dʰ	ɾ	l	ɭ	j	ʊ	m	n	ɳ	s
p	*	*													*									*					
pʰ																													
b			*	*																	*		*						
bʰ																													
t																	*	*			*								
tʰ																													
d																					*			*					
dʰ																													
ʈ													*	*															
ʈʰ																													
ɖ															*	*													
ɖʰ																													
k					*	*															*								
kʰ																													
g							*	*													*	*							
gʰ																													
t͡ʃ									*	*																			
t͡ʃʰ																													
d͡ʒ											*	*																	
d͡ʒʰ																													
(j)																													
ɾ																													
l																						*							
(w)																													
(ɭ)																													
m																										*			
n																											*		
(ɳ)																												*	
s																									*				*
h																					*								

The canonical syllable type in Gaddi, in which no distinction is made between vowel length, is (C)(C)(V)(C).

4. Phonological Processes

4.1. Nasalization

In phonetics, nasalization (or nasalisation) is the production of a sound while the velum is lowered, so that some air escapes through the nose during the production of the sound by the mouth.

4.1.1. Nasal consonants

On close auditory and acoustic analysis it is established that Gaddi has 3 nasal stops /m/, /n/, /ɳ/ and one allophone /ŋ/. A few examples of words with nasal stops are:

(41) (a) [mĩndʒo] 1SG.DAT
(b) [kʰĩnnu] "ball"
(c) [gɑ̃ɳɑ] "song"
(d) [nərəmə] "soft"
(e) [əmmɑ] "mother"
(f) [bãndərə] "monkey"
(g) [gĩɳti] "counting"
(h) [nɑːhə] "nail"

As we mentioned earlier that /ŋ/ is an allophone as it occurs in complementary distribution with a nasal consonant N. /ŋ/ always occurs before homorganic consonants (i.e) it always occurs preceding a velar plosive. Let us take a few examples.

(42) (a) [lõŋg] "nose ring"
(b) [pʰəŋg] "feather"
(c) [kãŋgi] "comb"
(d) [sĩŋkʰə] "meat"

4.1.2. Nasal vowels and diphthongs

Nasal vowels are found in many languages but unlike the nasal consonants these are not so common. It is not necessary that if a language has nasal consonants it would have nasal vowels. The most common nasal vowel across all languages is the low vowel [ã]. The maximum number of nasal vowels in a language can be the corresponding number of oral vowels in that language and typically the number is from 3 to 7 (Ferguson, 1963). The position of maximal contrast of nasal vowel is word finally after a non-nasal consonant and the position of minimum contrast are next to a nasal consonant or another nasal vowel.

Gaddi has 3 lexically nasal vowels [ũː ãː ɛ̃ː]. Given below are a few examples.

(43) (a) dʰũː "smoke"
(b) gɾãː "village"
(c) pɛʈɑli "forty five"

Gaddi has 6 nasalized diphthongs (əũ uã eĩ iũ aũ uɛ̃). Let us look at some examples. In Gaddi, the second vowel in the diphthong always tends to gets nasalized.

(44) (a) [luãː tʃĩɽi] "traditional attire"
(b) [piũlɑ] "yellow"
(c) [ɑũ] "I"
(d) [uɛ̃ɾɛ] "his/her"

I call it 'lexically nasal' as in these given words we see that there is no nasal consonant present, so it is quite evident that there is no nasal assimilation and that the vowels must

be underlyingly nasal in this case. It would be also too abstract to suggest that there may be a nasal segment present in the UR which got elided after assimilation. Therefore, such complexity and abstractness is avoided. The other reason I call it lexically nasal is because there is no evidence for proving them to be phonemic as I was unable to see any contrast and find any minimal pairs.

4.1.3. Contextual Nasalization

Vowels assimilate to surrounding nasal consonants in many languages creating nasal vowel allophones. Some languages exhibit a nasalization of segments adjacent to phonemic or allophonic nasal vowels also. This could also be referred to as nasal assimilation where two or more segments in a form agree in their value for some phonological features or feature classes.

$$V \dashrightarrow V \,/\, \_\_\_\_ \quad [+nasal]$$

In Gaddi, we see that there is local assimilation that takes place, i.e. it takes place between adjacent segments. The vowel takes up the feature [+nasal] from the following nasal consonant and therefore gets nasalize(d) Let's look at some examples from Gaddi:

(45)	(a)	[nijũndər]	"invitation"
	(b)	[rəə̃ŋgĩːn]	"colourful"
	(c)	[lĩ̃ŋɳə]	"tail"
	(d)	[ʈũnʈũɳ]	"bell"
	(e)	[ləm̃bɑ]	"long"
	(f)	[bĩnnɑ]	"mattress"

In these examples, we saw that there is local assimilation that takes place i.e.; it takes place between adjacent segments, the vowel preceding the nasal consonant assimilates into it and takes its feature [nasal] and therefore, gets nasalized. Nasal assimilation is discreetly predominant in Gaddi.

4.1.4. Spread of Nasality

The spread of nasality from one segment to another is a universal phenomenon found across many languages. This is apparent in vowels becoming nasalized preceding a nasal consonant. The spread of nasality can be regressive or progressive from a nasal consonant to a neighbouring vowel but regressive spread is more common. Nasal spreading from a consonant to the neighbouring vowel can stop part way through the vowel or can all the way to the next syllable unless blocked by another consonant. 'Consonants differ in the amount of resistance they offer to nasal spread: glottal consonants (h or ?) offers least resistance, liquids and semivowels somewhat more, and voiced fricatives still more; only rarely does nasality spread across voiceless obstruent.' (Ferguson, 1975).

(a)	lɔŋg	+N →	lɔ̃ŋg
(b)	tʃɛ̃nʈe	+N →	tʃɛ̃nʈe
(c)	kɑŋgi:	+N →	kɑ̃ŋgi:

(d) mandʒ +N → mãndʒ

Let's consider the case of Gaddi:

As we saw from the examples above that in Gaddi, local assimilation takes place (i.e, the vowel preceding the nasal consonant takes up the feature [nasal] from the nasal consonant and thereby becomes nasalized. Therefore, the spread of nasality in Gaddi takes place in the direction from right to left. This is also known as Regressive Assimilation.

4.1.5. Prenasalization

Pre-nasalized consonants are phonetic sequences of nasals and obstruents. Gaddi also displays pre-nasalization in some contexts. Perceptually, pre-nasalization was not evident at first, but, after a close auditory and acoustic analysis we could clearly find pre-nasalization taking place. The effect of pre-nasalization is quite interesting in Gaddi. In Gaddi, the process of pre-nasalization takes place word initially before voiced plosives. Let us look at look at some examples.

(46)
(a)	[ᵐbinnɑ]	"mattress"
(b)	[ᵐbəsəndə]	"summer"
(c)	[ᵐbɑːldə]	"'bull"
(d)	[ᵐbərkʰɑ]	"rain"
(e)	[ⁿɖəkkɑ]	"push"
(f)	[ⁿdɑːɾə]	"door"
(g)	[ᵑgəʈʈə]	"big flower"
(h)	[ᵑgirkɑ]	"heavy"

In the above examples we saw that the voiced plosives /b/, /d/, /g/ and their aspirated counterparts become pre-nasalized in word initial position. Whereas, voiceless plosives

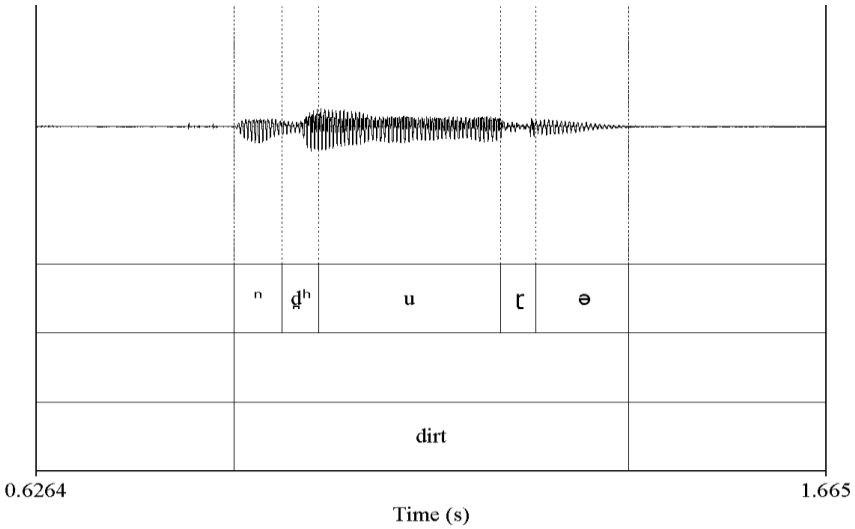


Figure 4

do not undergo such change such as in words like pʰullə (flower), pʰələ (fruit), kɑdə (male traditional dress), kʰinnu (ball), təlɑːbə (pond). Figures 4 and 5 illustrate the acoustic evidence for prenasalization in Gaddi.

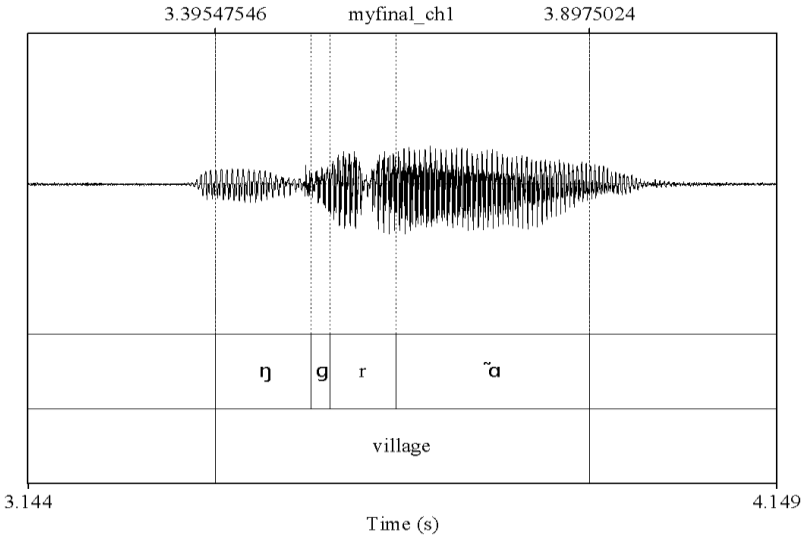


Figure 5

Therefore, prenasalization in Gaddi takes place when a nasal segment is inserted before a homo-organic voiced plosive word initially. One of the reasons for prenasalization to occur only before voiced plosives may be due to the ease of articulation as both the nasal segment [N] and the plosive agree in voicing and place of articulation. I would call it rather a phonetic process as there is no contrast between a prenasalized consonant ^{N}C and normal consonant C as NC neutralizes to C word initially.

4.1.6. Gemination

It is the process whereby single consonants are pronounced for a distinctly longer period of time. Some instances from Gaddi are:

(47)
(a) [həɖḍi] "bone"
(b) [kʰinnu] "ball"
(c) [ᵑgəʈʈə] "by flower"
(d) [ləmmɑ] "long"
(e) [pʰullə] "flower"
(f) [tilli] "nose ring"

There can be two types of geminates: derived geminates and underived geminates. Gaddi has both the kinds. Derived geminates are those that are formed in derived environments. In Gaddi, the proper nouns such as [rɑm] or [hənumɑn] when take up ergative case tend to form geminates such as [rɑmmɛ], [hənumɑnnɛ] etc. Underived geminates are those that are inherently geminates and are not formed in derived environments. Gaddi has many underived geminates such as [nikkɑ] 'child', [buʈʈɑ] 'tree', [dʒɑnnu] 'knee', etc.

Gemination in Gaddi is a morpho-phonological process. As we saw earlier the case of germinate formation when they occur in derived environment is quite common. When a proper noun takes up the ergative case, a geminate is formed. For example

(48) (a) ɾɑm + ɛ ɾɑmmɛ
(b) əltɑ:p + ɛ əltɑ:ppɛ
(c) sjɑm + ɛ sjɑmmɛ

4.1.7. Degemination

Apart from gemination, there are also cases where we find degemination, for example, when a geminate root undergoes some morphological process it gets de-geminated. Let us look at some examples for a clear understanding:

(49) (a) [gətʃ͡tʃʰ] "go"
(b) [gətʃʰurɑ] go.PERF.M
(c) [gətʃʰi] go. F
(d) [gətʃʰɑ] go.M

In the above-mentioned example, we saw that the monosyllabic geminate verb root [gəctʃʰ] 'go', undergoes degemination when inflectional affixes are added to it as it undergoes re-syllabification and the geminate consonant in the root word which occupies the syllabic position of coda and takes two timing slots becomes the onset of the following syllable to fulfil the **maximal onset principle.**

4.2. Schwa epenthesis in borrowed words

Vowel epenthesis has been in the spotlight of theoretical and empirical investigations in phonology and phonetics. Epenthesis is done basically as a phonotactic repair strategy.

(50) (a) /sku:l/ [səkul] "school"
(b) /pʌrs/ [pərəs] "purse"
(c) /film/ [pʰiləm] "film"
(d) /bʌlb/ [bəlbə] "bulb"

In Gaddi, schwa epenthesis is done as a phonotactic repair strategy schwa in-order-to break the consonant clusters in the loan words following the maximal onset principle The loan word undergoes adjustments and adaptations to bring about the surface representation by the grammar of L1 (recipient language).

4.3. Glide Formation

In glide formation, a glide is inserted between two adjacent vowels. It is one of the major processes of hiatus resolution. Diphthongs are an exception to this as they are considered to be a single unit. Gaddi has 5 diphthongs namely:

(51)	(a)	[səugi]	"with"
	(b)	[bəɖɑu]	"cut"
	(c)	[guɑtʃĩ]	"lost"
	(d)	[leiɑ]	bring-IMP
	(e)	[bʰɑi]	"brother"

Clearly, diphthongs are an exception to this. But, when two vowels are collocated, a glide is inserted to break the VV sequence In Gaddi, it is [j] that is inserted.

$$\emptyset \rightarrow [j] \ / \ V_1\_V_2$$

(52)	(a)	[ijũ]	"snow"
	(b)	[tʃə̂lijɑ]	"come"
	(c)	[nijũndəɾ]	"invitation"
	(d)	[sejɑu]	"apple"

In all the above-mentioned examples, we saw that the glide [j] is inserted between two vowels. The same cannot be claimed for the glide [w] as we lack the evidence for it.

The examples shown above depict the formation of glide lexically. One of the interesting facts observed in Gaddi is that this phenomenon of glide formation is also encountered post lexically, i.e.; a glide is inserted between two vowels that are present adjacently but belong to different words.

(53)

(a) sɛrɑ iɳɑ dʒəruri + ɑ
sɛrɑ iɳɑ dʒərurijɑ
'It is important for him to come'

(b) mindʒo giɳti indi(j) ɑ
'I know counting'

(c) tʃə̂ʈʰi bəɖi gəndəgi(j) ɑ
'It is very dirty here'

(d) mindʒo meɾi kuɭi tɑ̃ijɛ kutʃʰ pɛse di de(j) ɑ
'I need some money for my daughter'

(e) muʈʈi bɛɳ hɛlke bʰɑidʒo sulɑɳɑ ləguɾɛ(j) ɑ
'Elder sister is putting her younger brother to bed'

In the above examples, we saw how glide formation also occurs post lexically in Gaddi This usually occurs only when the first vowel is a front vowel and the second vowel a back vowel. Hiatus is allowed in Gaddi post lexically but not when this structural description is met.

4.4. Retroflexion in Gaddi

A retroflex consonant is a coronal consonant where the tongue has a flat, concave, or even curled shape, and is articulated between the alveolar ridge and the hard palate. The

four main characteristics of retroflexes (Hamman) are - *apicality*, *posteriority*, *sublingual cavity*, and *retraction*.

Cross-linguistically, retroflexes are known to be marked because of their articulatory complexity and their context dependent perceptibility. Retroflexes occur relatively infrequently cross-linguistically, for instance only 11% of the languages of the world have a retroflex stop. This restricted occurrence of the retroflex class can be attributed to their articulatory complexity as retroflection involves raising and displacement of the tongue tip towards the post-alveolar region as compared to apical alveolar sounds which involve only the tongue tip raising.

Gaddi has 7 distinctive retroflex sounds, all of which are CORONAL. These are -

[ʈ ɖ] – retroflex unaspirated plosives

[ʈʰ ɖʰ] – retroflex aspirated plosives

[ɳ] – retroflex nasal

[ɽ] – retroflex flap

[ɭ] – retroflex lateral approximant

Of these 6 are oral [ʈ ɖ ʈʰ ɖʰ ɽ ɭ] and one nasal [ɳ]. The sounds /ʈ/ and /ʈʰ/ are voiceless and the rest are voiced. Some examples of the retroflex sounds of Gaddi can be seen in (54) to (57) as retroflexed plosives, aspirates, approximants and nasals respectively.

(54)	(a)	[tʃo̰ʈə]	“wound”
	(b)	[tʃ̃ɛnʈe]	“clothes”
	(c)	[gəʈʈə]	“big flower”
	(d)	[beʈəɖi]	“woman”
	(e)	[tʃʰinɖə]	“hole”
	(f)	[ɖɑːɭə]	“big tree”
(55)	(a)	[ʈʰiːkə]	“okay”
	(b)	[piʈʈʰɑ]	“dough”
	(c)	[kəʈʰi]	“where”
	(d)	[ɖʰiɖə]	“stomach”
	(e)	[uɖʰənə]	“cloth”
(56)	(a)	[dʰuɽə]	“dirt”
	(b)	[lɑɽɑ]	“husband”
	(c)	[goːɭə]	“round”
	(d)	[dɾubəɽə]	“trash”
	(e)	[həɽɛːnə]	“smell”
(57)	(a)	[kʰindʒəɳɑ]	“pull”
	(b)	[ɾɑːɳə]	“garlic”

All of the retroflex sounds except /ɽ/, /ɭ/ and /ɳ/ occur word initially as can be seen from 58(a-d).

(58)	(a)	/ ʈ /	[ʈopi]	“hat”
			[ʈuŋgurɑ]	“hang”
	(b)	/ ɖ/	[ɖɑːlə]	“branch”
			[ɖəkkɑ]	“push”
	(c)	/ ʈʰ/	[ʈʰikə]	“correct”
	(d)	/ ɖʰ/	[ɖʰiɖə]	“stomach”

All of the retroflex sounds occur word medially but never occur word-finally.

(59)	(a)	/ʈ/	[koʈi]	“sweater”
			[gəʈʈə]	“big flower”
	(b)	/ ɖ/	[kiɖɑ]	“snake”
			[bəɖɑ]	“big”
	(c)	/ ʈʰ/	[kəʈʰi]	“where”
			[piʈʈʰɑ]	“dough”
	(d)	/ ɖʰ/	[uɖʰəɳə]	“cloth”
	(e)	/ ɽ/	[dʰuːɽə]	“dirt”
			[səŋgɽɑ]	“narrow”
	(f)	/ ɭ /	[heɭɑ]	“cold”
			[uŋgəɭi]	“finger”
	(g)	/ ɳ /	[kʰɑɳɑ]	“food”
			[siːɳɑ]	“sewing”

Distinctive features of the retroflex sounds are –
[ʈ] = [+cons, -son, -voice, CORONAL, -dist]
[ɖ] = [+cons, -son, +voice, CORONAL, -dist]
[ʈʰ] = [+cons, -son, -voice, +spr glottis, CORONAL, -dist]
[ɖʰ] = [+cons, -son, +voice, +spr glottis, CORONAL, -dist]
[ɽ] = [+cons, +son, +voice, +approx, -ant, -lateral, CORONAL]
[ɭ] = [+cons, +son, +voice, +approx, +lateral, CORONAL]
[ɳ] = [+cons, +son, +voice, +nasal, CORONAL, -ant]

4.4.1. The retroflexion process

A theory surrounding retroflexes, in literature, is that of occurrence of retroflection via rhotics, that is, the presence of a rhotic sound (alveolar tap ɾ or the retroflex flap ɽ) in the underlying form. This rhotic, either along with another apical dental/alveolar sound or on its own, surfaces as a retroflex. This process has been attested as a diachronic or a synchronic process in different languages.

Two possible phonetic explanations for the change of nonretroflex to retroflex caused by a rhotic (*t* stands for an apical dental/alveolar, and *ʈ* for a retroflex).

ɾt > ɽt > ɽʈ > ʈ or tɾ > tɽ > ʈɽ > ʈ : articulatory explanation
ʈ or tɾ > ʈ : perceptual explanation

In Gaddi, this theory could hold true but since we do not have sufficient data to prove it here, this process needs to be explored further.

However, some observations made from the data. From the examples cited above, we can see that there are only two kinds of consonant clusters involving retroflexes in Gaddi:

i. geminates which are formed by the unaspirated plosives [ʈ, ɖ] only.
ii. clusters of alveolar nasals [n] and the retroflex sounds [ʈ, ɖ, ɭ]

Geminate Retroflex clusters

(60) (a) [gəʈʈə] "big flower"
(b) [pʰərɡuɖɖi] "butterfly"

These could be underived geminates (inherently present in the language) or if the above hypothesis holds true and retroflexion is via the alveolar rhotic sound in this language, then there could be a complete place of articulation assimilation taking place.

Clusters of alveolar nasal [n] and the retroflex sounds [ʈ ɖ ɭ]

These retroflexes /ʈ ɖ ɭ/ have an alveolar nasal in their environment, leading to consonant clusters as seen in (61).

(61) (a) [tʃʰɛ**nʈ**e] "clothes"
(b) [dʒo**nʈ**u] "small axe"
(c) [bərɛ**nɖ**a] "veranda"
(d) [tʃʰi**nɖ**ə] "hole"
(e) [ba**nɖ**ɛ] "utensils"
(f) [gʰu**nɖ**u] "scarf"

From the examples cited so far, it is clear that all of the retroflexes appear inter-vocalically.

Points 1 and 2 can be summarised in the following table 9.

Context	ɳ	ʈ	ɖ	ʈʰ	ɖʰ	ɽ	ɭ
V_V	*	*	*	*	*	*	*
n_V		*	*				
V_n							*
C_V		*	*				
V_C		*	*				

Table 9

In Gaddi, the infinitive of verbs is marked by two allomorphs –na and -ɳa. These two allomorphs seem to be phonologically conditioned as the allomorph with the retroflex [-ɳa] always appears inter-vocalically whereas the one with the alveolar nasal [–na] appears between liquids (ɾ, l) and the vowel [a]. (62) and (63) show the distribution of [–na] and [-ɳa] respectively.

(62) (a) [ernɑ] "to see"

	(b)	[mərnɑ]	“to kill”
	(c)	[məɭnɑ]	“to rub”
	(d)	[kʰeɭnɑ]	“to play”
(63)	(a)	[kʰɑɳɑ]	“to eat”
	(b)	[piːɳɑ]	“to drink”
	(c)	[hiŋgəɳɑ]	“to smell”
	(d)	[lɛɳɑ]	“to take”

There are words in Gaddi which consist of geminate retroflex consonant clusters, with the first segment of the cluster unaspirated and the second segment being aspirated Some examples are given below in (64).

(64)	(a)	[piʈʈʰi]	“back”
	(b)	[piʈʈʰɑ]	“dough”
	(c)	[miʈʈʰe]	“sweet”

It can be argued that these underived words follow Layman‘s Law which can be formalized as a general phonotactic restriction, the OCP(aspiration)[1], which prohibits two aspirated retroflex consonants within the same morpheme[2] Thus, to respect the OCP, a dissimilation process takes place and the first member of the cluster becomes non-aspirated. This explanation also has phonetic grounding in that the articulation of a geminate aspirated retroflex is not feasible as it is impossible to articulate two aspirated sounds consecutively and thus the dissimilation occurs where the release of the first retroflex consonant in the cluster overlaps with close and hold phase of the second

The process of Retroflection in Gaddi seems to involve lot more than is visible at the surface An in-depth study is needed to prove if there is retroflection in rhotic context or if there is any patterning of retroflexes with back vowels (which can be the case as both retroflexes and back vowels have low F3) or if there is any local/non-local assimilation of retroflection taking place Also, the phonetic grounding of retroflection should be looked into and provided for any hypothesis regarding this class of sounds.

5. Morphophonological Processes

Morphophonological processes are born out of word-margin interactions. Upon addition of morphemes to a stem, the syllable make up is altered at the edge of the word to which the respective morpheme is added In such a situation, the word resyllabifies in order to restore its syllable design. Resyllabification can result in a variety of phonological phenomena. Since these processes occur due to the interaction of multiple morphemes, we will study them all under the basket term of Morphophonology.

[1] OCP(aspiration) is a modified version of OCP(voice) proposed by Ito and Mester, 1986. The phonology of voicing in Japanese: Theoretical consequences.

[2] Layman‘s law and OCP can be used interchangeably here.

5.1. Processes caused by derivation

Resyllabification may be triggered by word formation processes like derivation. The following kinds of derivational processes were observed in Gaddi.

(65)

Category of the stem	Category of the derived word	Stem	Derived Word
NOUN	NOUN	pɖes 'neighbourhood'	pɖe.hi 'neighbour'
NOUN	NOUN	sandʒ 'evening'	sən.dʒɛl.lu 'evening snack'
NOUN	NOUN	skaɾ 'hunt'	ska.ɾi 'hunter'
ADVERB	NOUN	dʒin.da 'alive'	dʒin.də.ɖi 'life'
NOUN	ADJECTIVE	paɖ 'paɖi'	pa.ɖi 'mountain'
NOUN	ADJECTIVE	nə.sa 'addiction'	nə.se.di.ja 'addict'

In examples [pɖes], [sandʒ] and [skaɾ], the stems that're closed syllables before derivation undergo resyllabification and become open syllables after derivation. [sandʒ] is an example of a stem with a complex coda turning into a simple coda in its resultant word.

5.2. Processes caused by inflection

5.2.1. Case marking inflection

Nominal declensions of case morphology can be seen on subject noun phrases in Gaddi In this section, we restrict our observations to those morphemic interactions that give rise to some phonological phenomenon.

The ergative case marker /ɛ/ occurs in Gaddi subject Noun phrase, which triggers a host of other phonological phenomena as can be seen in examples 66(a-h) below.

(66)	(a)	sjəm.mɛ	sab	miʈʰai	kʰai	ʧəɖɖi
		shyam.ERG	all	sweet	eat	AUX
	(b)	pu.dʒɛ	sab	miʈʰai	kʰai	ʧəɖɖi
		puj(a)ERG	all	sweet	eat	AUX
	(c)	an.dʒə.l(i)jɛ	sab	miʈʰai	kʰai	ʧəɖɖi
		anjal(i)ERG	all	sweet	eat	AUX

(d)	əl.t(ɑ)pɛ	sɑb	miʈʰɑi	kʰɑi	tʃəɖḍi
	ɑltɑp.ERG	all	sweet	eat	AUX
(e)	u.sɛ	sɑb	miʈʰɑi	kʰɑi	tʃəɖḍi
	us(ɑ)ERG	all	sweet	eat	AUX
(f)	b(i)sɑl.lɛ	sɑb	miʈʰɑi	kʰɑi	tʃəɖḍi
	bisɑl.ERG	all	sweet	eat	AUX
(g)	kɑɾ.t(i)kɛ	sɑb	miʈʰɑi	kʰɑi	tʃəɖḍi
	kɑrti(k)ERG	all	sweet	eat	AUX
(h)	ɾidʒ.ʋɑn.nɛ	sɑb	miʈʰɑi	kʰɑi	tʃəɖḍi
	rijwɑn.ERG	all	sweet	eat	AUX

It can be observed in 66 (a), (f), (h) in the above paradigm that words ending in [m], [n] and [l] are geminated prior to affixation of the ergative case. We understand from the paradigm illustrated above that this is applicable only to noun phrases ending in sonorants. The presence of exceptions to this rule suggest that gemination here may be a lexical rule.

Moreover, this process of duplication of consonants may be motivated by ambisyllabicity. Fallows (1981) conducted experiments on syllable boundaries. In her experiments, the subjects repeated the first syllable of two syllable words based on their intuition. The results of her experiments revealed that the subjects tended to consider that consonants after stressed vowels take part of previous syllable if the preceding vowels are lax. In her definition, the vowels before ambisyllabic consonants are lax. Therefore, it could be possible that 66(a), (f) and (h) are a result of stressed syllables with monomoraic lax vowels requiring a coda consonant to become bimoraic, which is a typologically more general requirement for stressed syllables.

Also, 66(c) tells us that subject noun phrases ending in high vowels are epenthesised with a glide before attaching the ergative case marker. This epenthesis may be with the intention of breaking hiatus between the word final /i/ and the ergative marker /ɛ/. We can see that 66(b) and (e), which are also vowel ending noun phrases, get dropped instead of a glide epenthesis. This can perhaps be justified by inferring that only stem final high vowels retain their presence in the event of ergativity.

5.2.2. Aspectual marking inflection

The imperfective marker in Gaddi alternated between [dɑ] and [ndɑ] and the data collected seem to reveal a pattern of syllable typology behind this alternation. Consider examples 67(a-f).

(67)	(a)	kər.dɑ hɑ	“doing”
	(b)	pɑɖ.dɑ hɑ	“studying”
	(c)	pɑkkɑɖ.dɑ hɑ	“holding”
	(d)	gən.dɑ hɑ	“going”
	(e)	kʰɑn.dɑ hɑ	“eating”

In examples 67(a-c), one can notice that the stem is a closed syllable it takes –dɑ as the imperfective marker. However, examples 67(d-e) are open syllables and are resyllabified upon affixation of the imperfective aspect. This can perhaps be attributed to the possible requirement of the language to allow only closed syllables as stems for affixation of imperfective aspect.

6. Foot Structure

Stress in Gaddi is <u>not contrastive</u>. Gaddi is a Fixed stress or Predictable stress language. Based on the stress pattern in the language, the foot structure can be analysed with the help of following 4 parameters.

6.1. Bounded / Unbounded feet

Gaddi has **bounded feet**, stress falls on a fixed syllable, which is the first syllable from the right.

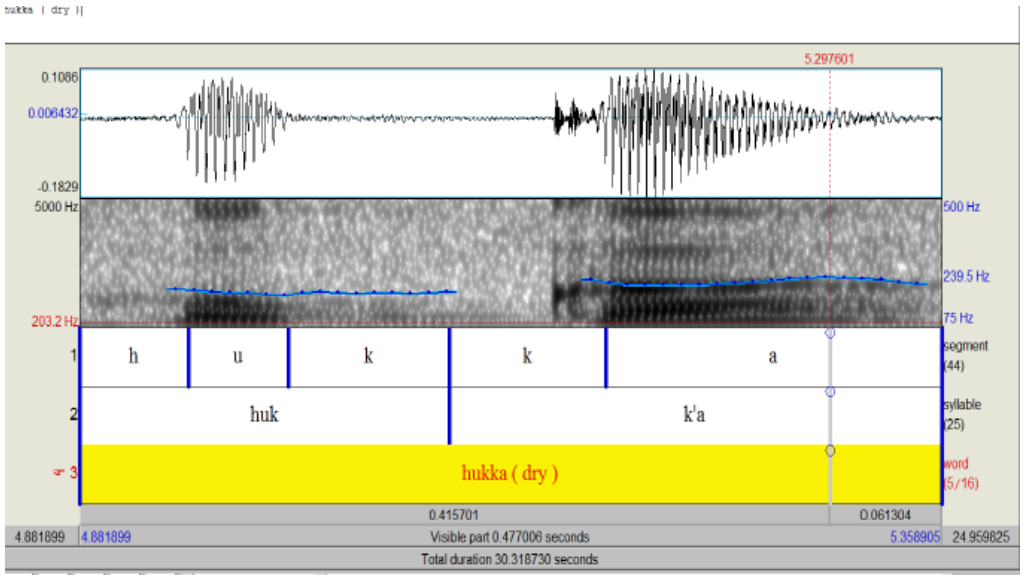
6.1.1. Monosyllables

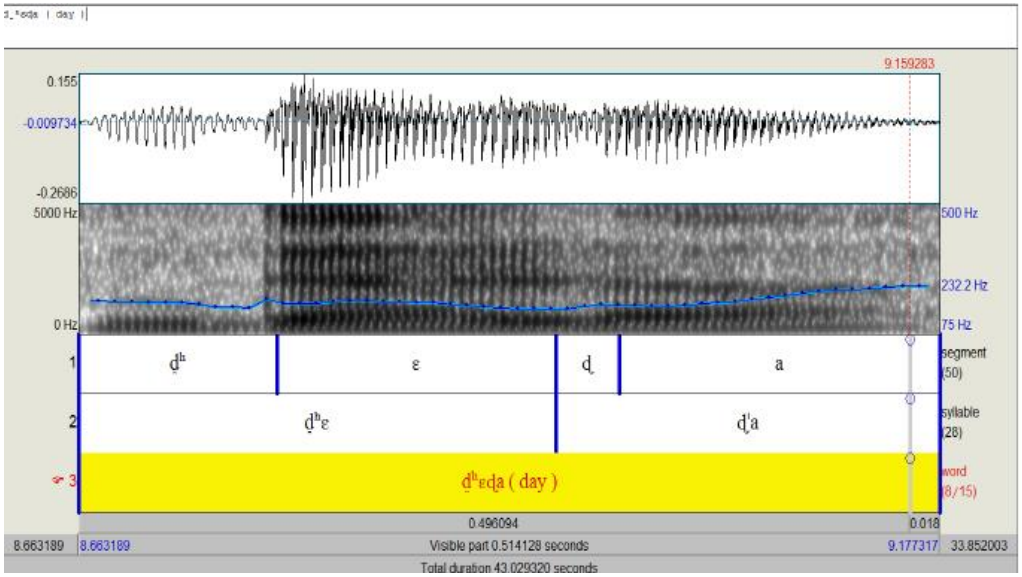
(a) ˈgɾɑ̃ː ‘village’ (b) ˈ dui ‘two’ (c) ˈ ɑũ ‘I’ (d) ˈ ʧɛ̃ː ‘root’

6.1.2. Bisyllables

x
x x
ɖ̪ʰɛ.ɖˈa (day) ; huk.kˈa (dry)

x
x x
ɑn.ɖ̪ɾˈa (guts) ; səŋ.gɽˈa (narrow)



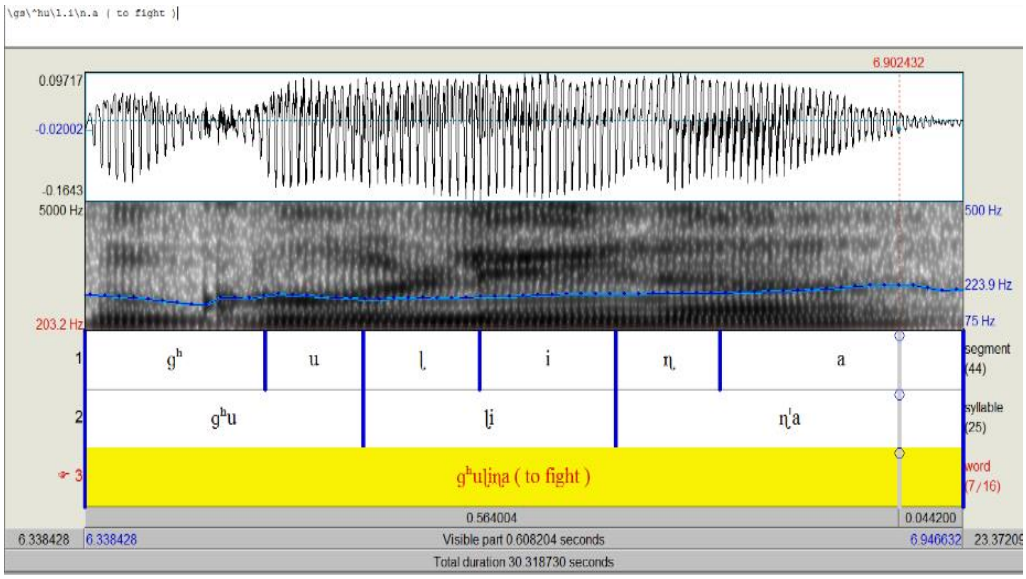


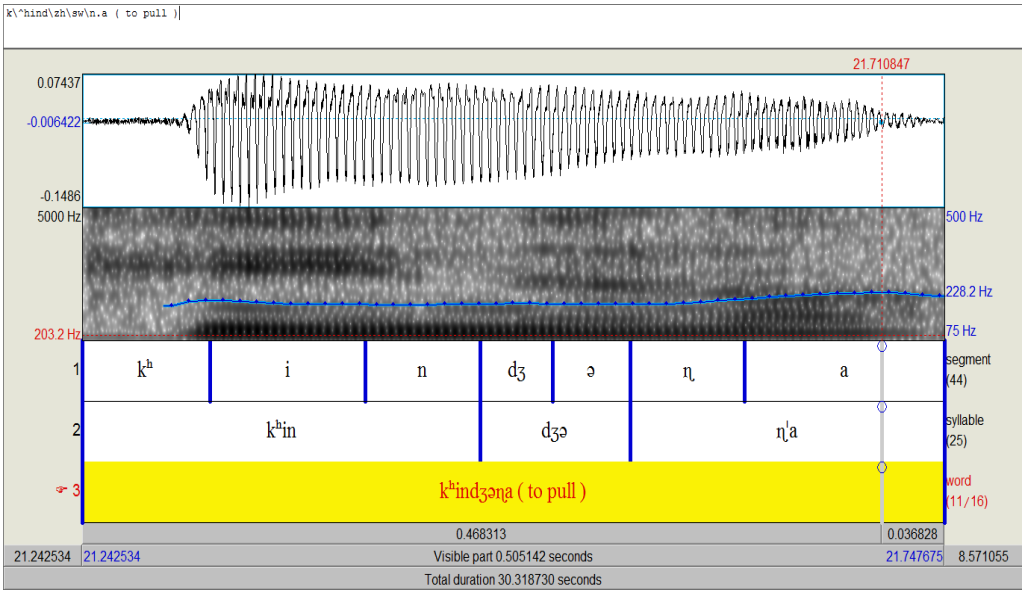
6.1.3. Trisyllables

x
x x x
gʰu.ɭi.ɳ'a (to fight) ;

x
x x x
loãː.tʃə.ɖ'i (girl's wedding dress) ;

x
x x x
kʰin.dʒə.ɲ'a (to pull)





6.1.4. Compound words

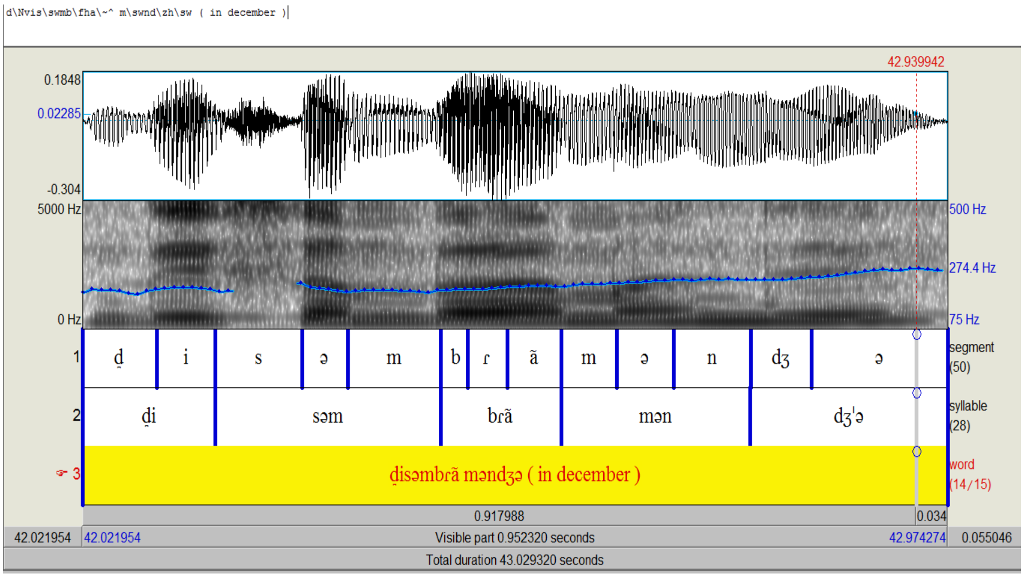
Compound words - pʰər.guḍ.rˈi (butterfly) ; tʃə.ɽai.ʈrˈai (uphill - downhill)

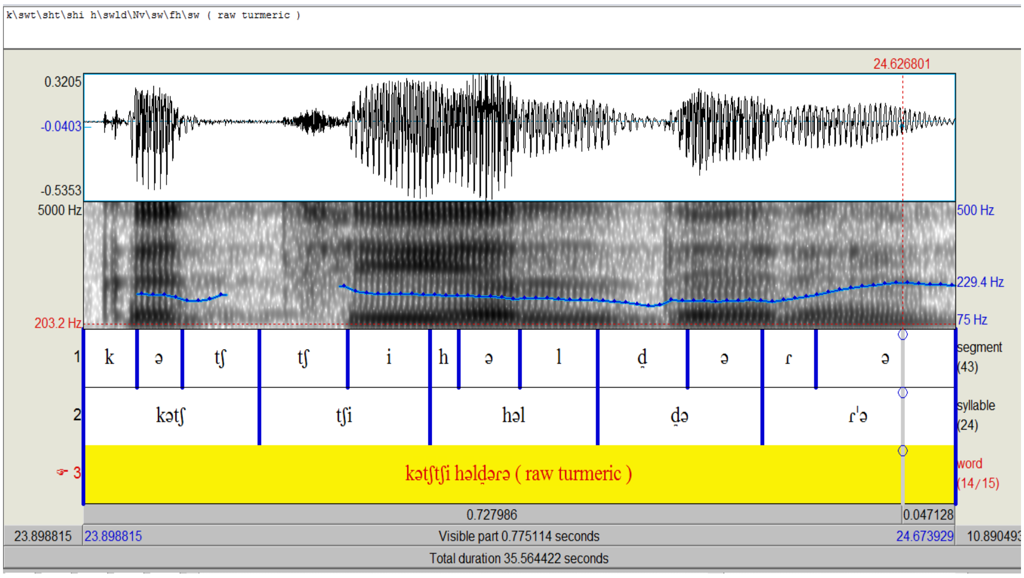
		x						x	
x	x	x				x	x	x	
pʰər.guḍ.rˈi (butterfly)			;		tʃə.ɽai.ʈrˈai (uphill - downhill)				

6.1.5. Compound Phrases

Phrase - d̪i.səm.brã.mən.dʒ'ə (in December) ; kətʃ.tʃi.həl.də.ɾ'ə (raw turmeric)

```
                    x                                x
 x  x    x   x      x                  x   x   x   x  x
d̪i.səm.brã.mən.dʒ'ə  ( in December ) ; kətʃ.tʃi.həl.də.ɾ'ə ( raw turmeric )
```



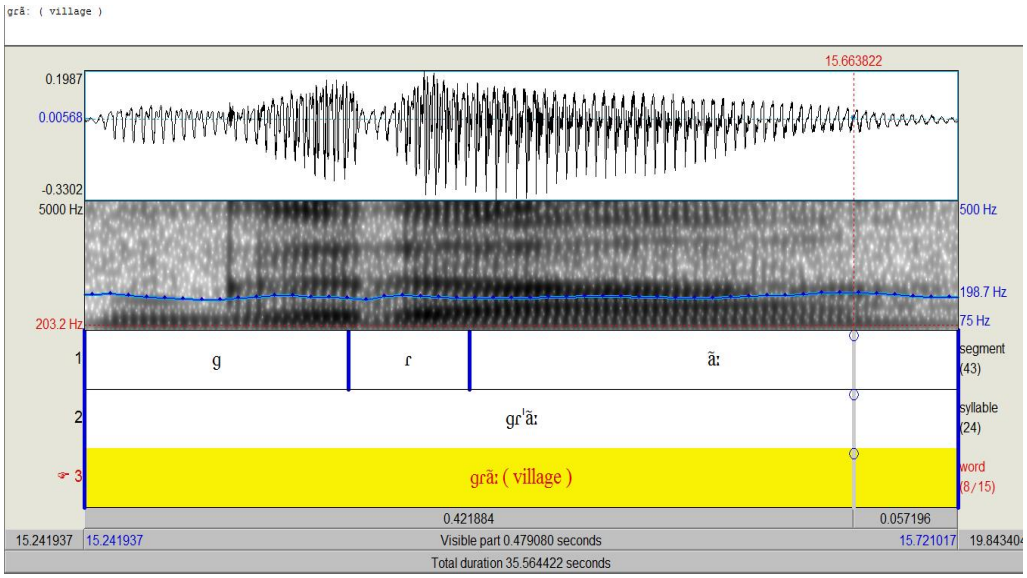


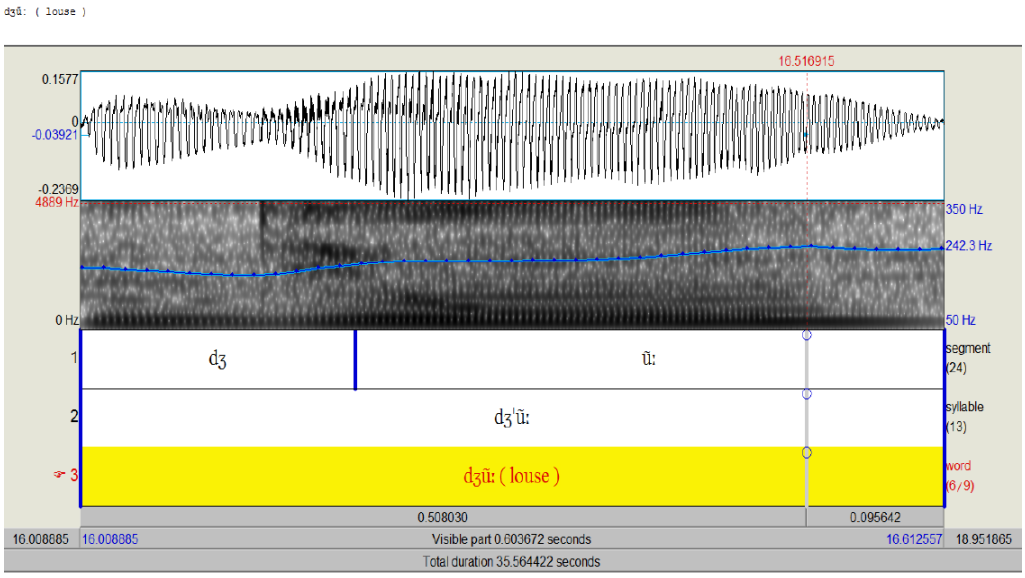
6.2. Quality Sensitive/ Quality Insensitive

Gaddi seems to be Quantity Insensitive as even the light syllables carry the primary stress.

6.2.1. Monosyllables

Monosyllables - gɾ'ã: (village) ; d̪'ui (two) ; a'ũ (I) ; dʒ'ũ: (louse) ; d̪^{h}'ũ: (smoke) ; n'oa: (new)

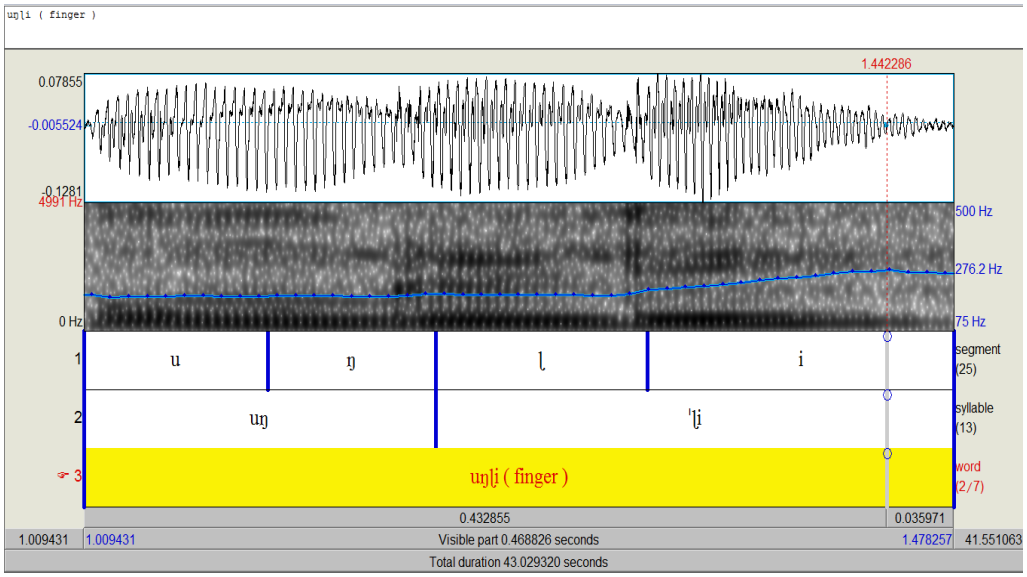


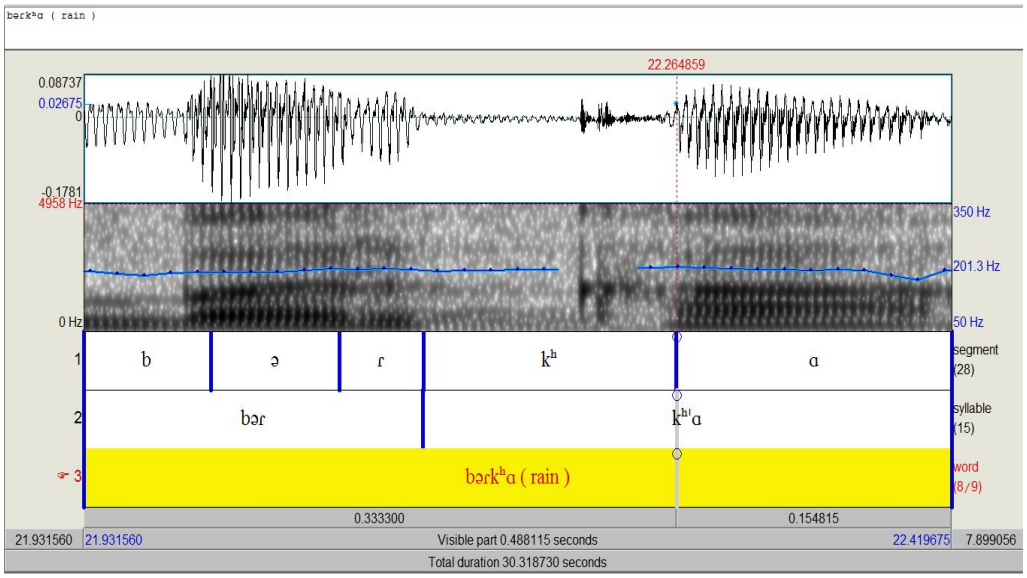


6.2.2. Bisyllables

Bisyllables with light final syllable - ɖək.k'a (push) ; bəɾ.k^{h}'a (rain) ; uŋ.ɭ'i (finger)

	x			x			x	
x	x		x	x		x	x	
ɖək.k'a	(push)	;	bəɾ.k^{h}'a	(rain)	;	uŋ.ɭ'I	(finger)	

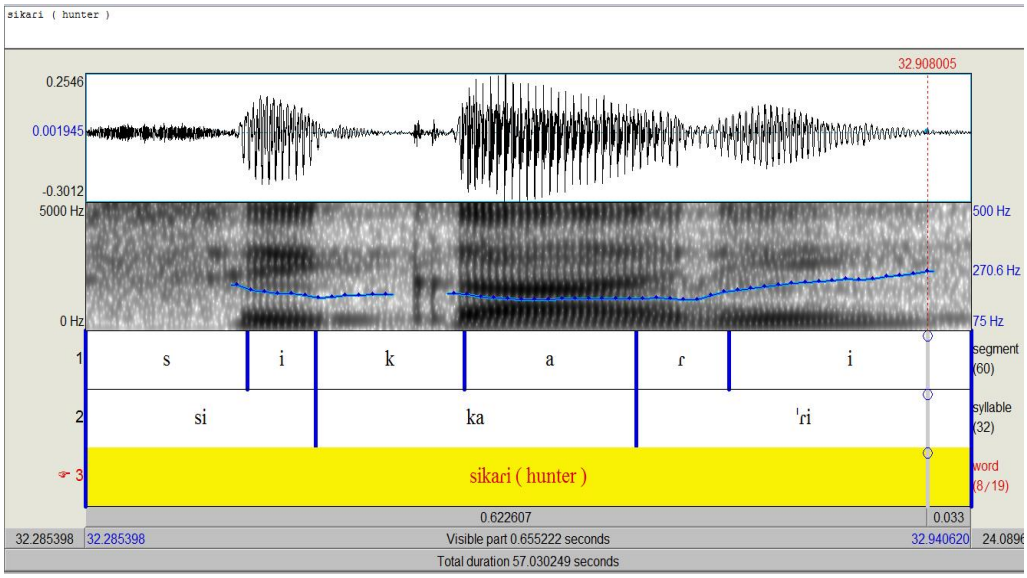


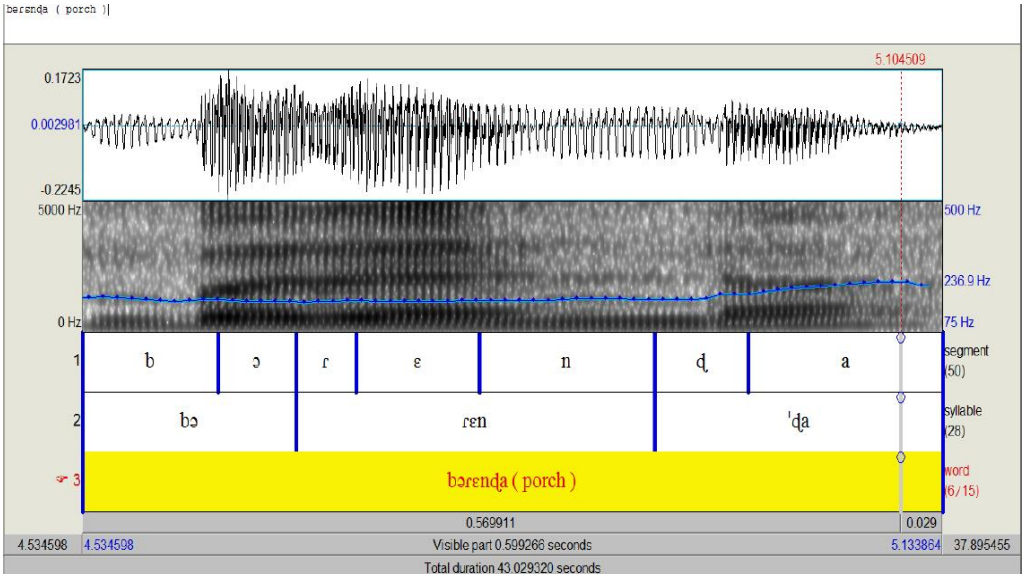


6.2.3. Trisyllables

Trisyllables with a light final syllable – si.ka.ɾi (hunter) ; ɾəŋ.i.l'a (colorful) ; bə.ɾɛn.ɖ'a (porch)

	x			x			x	
x	x	x	x	x	x	x	x	
si.ka.ɾ'i	(hunter)	;	ɾəŋ.i.l'a	(colorful)	;	bə.ɾɛn.ɖ'a	(porch)	

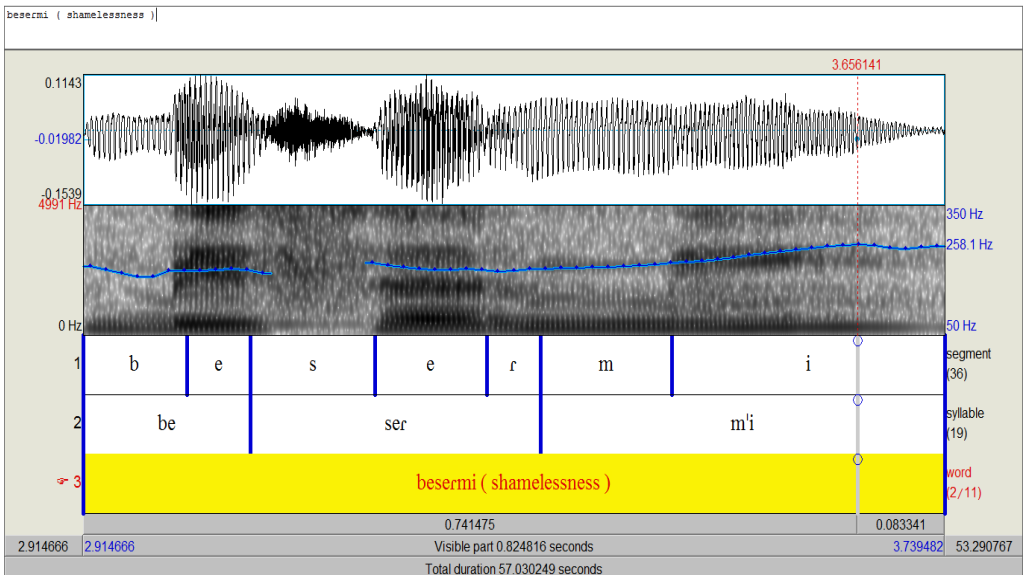




6.2.4. Complex Words

Complex words with light final syllable – si.ka.ɾ'i (hunter) ; ɾəŋ.i.l'a (colorful) ; be.səɾ.m'i (shamelessness)

```
      x                    x                    x
  x   x   x            x   x   x        x   x   x
si.ka.ɾ'i  ( hunter )  ;  ɾəŋ.i.l'a  ( colorful )  ;  be.səɾ.m'i  ( shamelessness )
```



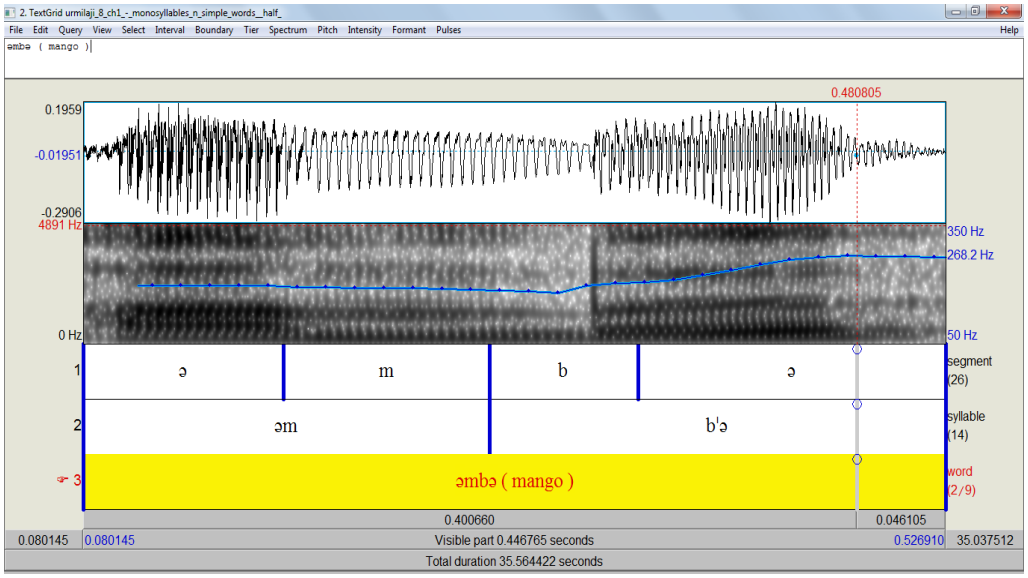
6.3. End Rule initial / End Rule final

Gaddi is **Right headed** as can be seen from the examples that stress always falls on the first syllable from the right.

6.3.1. Bisyllables

Bisyllables – əm.b'ə (mango) ; ə.dʒ'ə (today) ; ɖɑ:. ʈ'ə (tree) ; tʃî.k'ə (dirt) ; ɾɑ:.ɳ'ə (garlic)

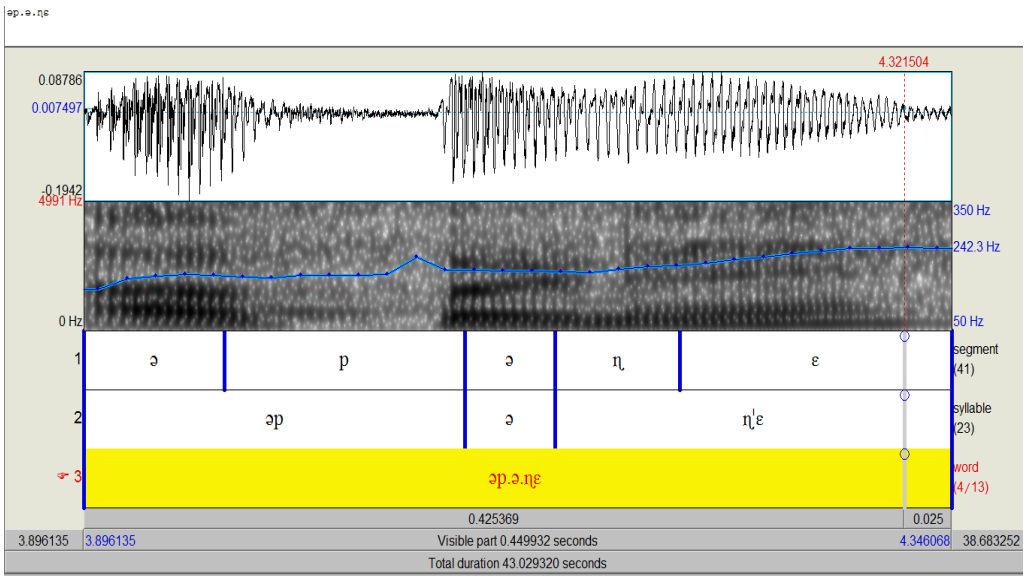
```
    x                  x                  x
  x   x              x   x              x   x
əm.b'ə ( mango )  ;  ə.dʒ'ə ( today )  ;  ɖa:. ʈ'ə ( tree )
```



6.3.2. *Trisyllable*

Trisyllables – dʒɑn.ʋə.ɾ'ə (animal) ; g^hu.ɭi.ɳ'ɑ (to fight) ; k^hin.dʒə.ŋ'ɑ (to pull); əp.ə.ɳ'ɛ (my.GEN)

		x				x	
x	x	x			x	x	x
dʒaːn.ʋə.ɾ'ə		(animal)	;		g^hu.ɭi.ɳ'a		(to fight)

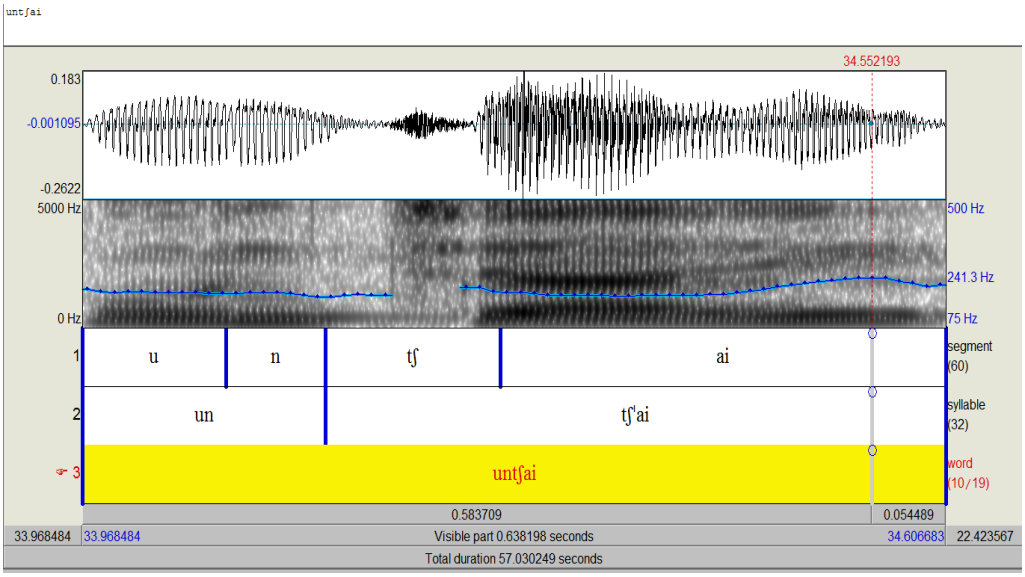


6.3.3. Complex Words

Complex words – un.tʃ'ai (height) ; k^{h}u.s'i (happiness) ; d̪os.ʈ'i (friendship) ;
li.k^{h}'ai (handwriting)

x x
un.tʃ'ai (height)

x x
k^{h}u.s'i (happiness)

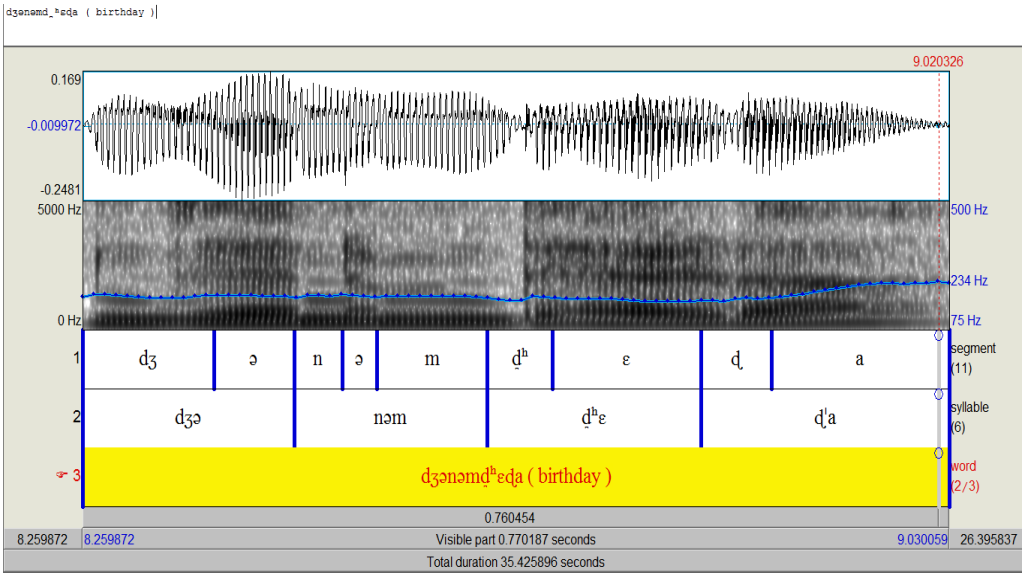


6.3.4. Compounds

Compounds – mə̃.bu.ɖ'ɑ (mother – father) ; dʒə.nəm.d̪^{h}ɛ.ɖ'a (birthday) ;
mun.ɖe.p'iː.ɽə (headache) ; tʃi.ʈɾə.mi.tʃi.ʈɾ'a (colorful)

x x x
mə̃.bu.ɖ'a (mother – father)

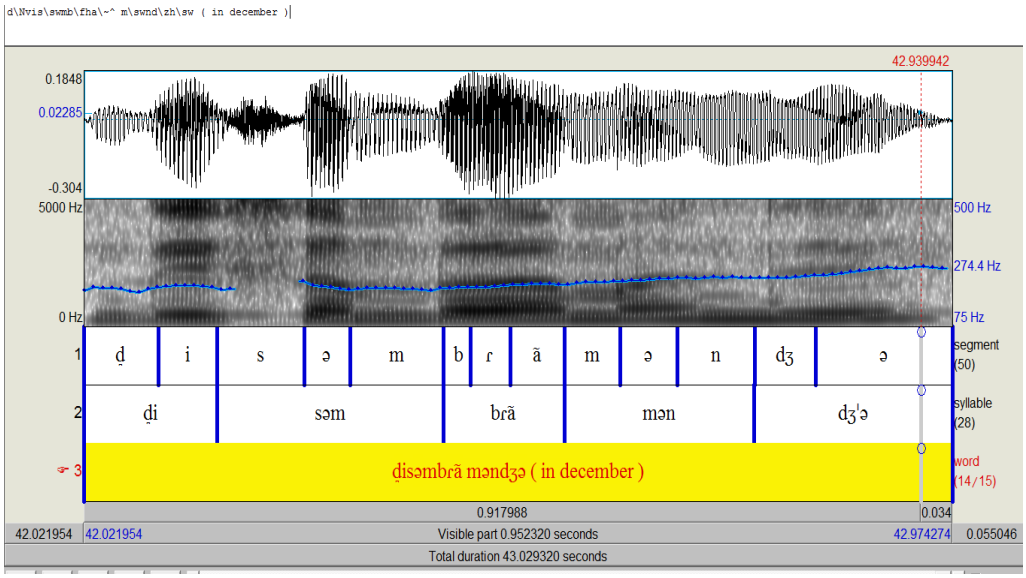
x x x x
dʒə.nəm.d̪^{h}ɛ.ɖ'a (birthday)



6.3.5. Phrases

Phrase - d̪i.səm.brə̃.mən.dʒ'ə (in December)

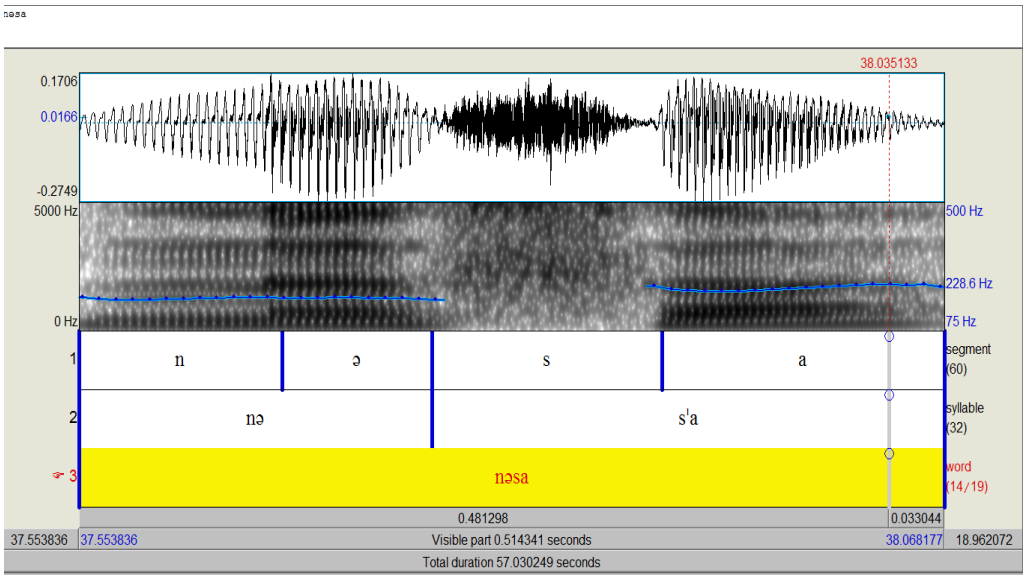
x
x x x x x
d̪i.səm.brə̃.mən.dʒ'ə (in December)

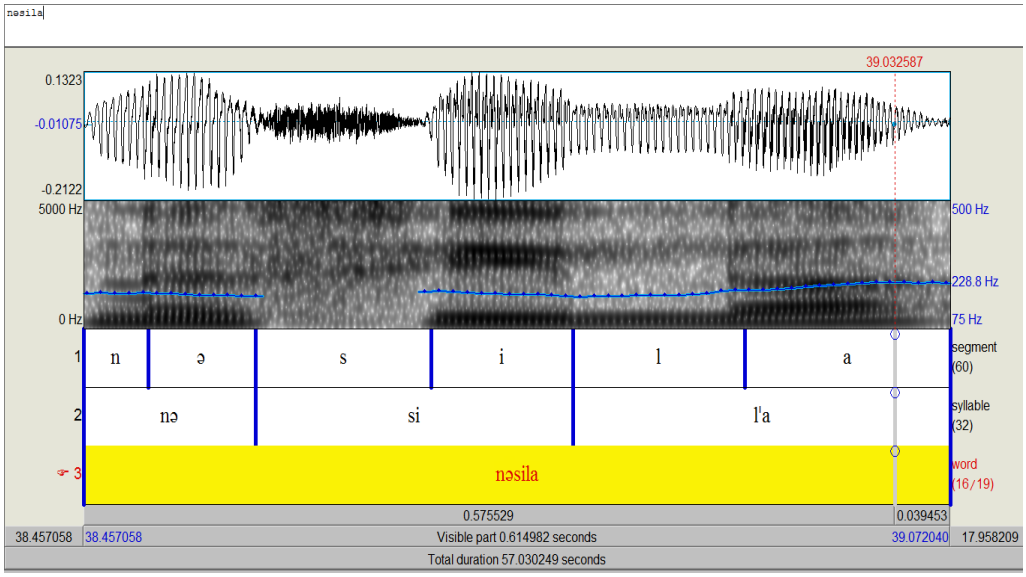


6.4. Left to Right / Right to Left

The directionality of foot construction in Gaddi is from Left to Right as stress travels from Right to Left. This can be seen in the following examples.

Underived word	nə.'sa	'ɾəŋgə	tʃə.'məkə
Derivation 1	nə.s(i)'la	ɾəŋg. 'i:nə	tʃə.mə(k)'da:ɾə
Derivation 2		ɾəŋg.(i)'la	tʃəm.k(i)'la





Thus, we understand from the above examples and their respective spectrograms that Gaddi is a Bounded, Quantity Insensitive IAMB with Right to Left Direction of Stress.

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