A grammar of Dhao: An endangered Austronesian language in Eastern Indonesia
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Phonology

2.1. Introduction

Dhao has 23 native consonant phonemes, three loan consonants, and a basic six-vowel system. The consonants include nine plosives, four implosives, two affricates, two fricatives, four nasals, and two liquids. The three loan consonants include one fricative and two approximants. Dhao vowels include two front, two central, and two back vowels. The four implosive sounds make Dhao one of the unique languages of the area since only Dhao and its neighbor, Hawu, have such an amount of implosives. Other languages on the island of Sumba only have two. In contrast, no language on the island of Rote and Timor has implosive sound (see Grimes, 2010). Dhao has an open-syllabic system. The maximum syllable is CV. Codas are not allowed in syllables at all. Stress always falls on the penultimate syllable. Secondary stress occurs only on trisyllabic and quadrisyllabic words.

This chapter deals with the phonological description of Dhao. It begins with the description of segments, in §2.2, which includes the segment inventory, the description of phonemes, minimal pairs, the distribution of phonemes, phonetic evidence of specific consonants, pre-glottalized voiced stop consonants, long vowels, vowel sequences, the mid-central vowel, and vowel harmony. The phonemic symbols presented in the phonetic charts, both the consonants and the vowels, follow the International Phonetic Association (IPA) system. The discussion will be followed by the description of syllables in §2.3, which includes syllable structure, diphthongization, and stress assignment. Reduced forms are discussed in §2.4, and loan words in §2.5. Finally, the explanation of orthographic convention used in this thesis is presented in §2.6.

2.2. Segments
2.2.1. Segment Inventory

The inventory of the 23 native consonant segments of Dhao is presented in Table 2.1 below. The segments indicated within brackets are considered loans.

Table 2.1: Dhao Consonants

	Bilabial	Labio-dental	Alveolar		Palatal		Velar		Glottal
Plosive	p b		t	d	c	ɟ	k	g	ʔ
Implosive	ɓ		ɗ		ʄ		ɠ		
Affricate	b͡β		d͡ʐ						
Fricative		(f)	s						h
Nasal	m		n		ɳ		ŋ		
Trill			r						
Lateral			l						
Approximants	(w)				(j)				

Dhao vowels are presented phonemically in Table 2.2 below. Dhao applies a six-vowel system (cf. Grimes, 2010). Mid and low vowels all are open vowels.

Table 2.2: Dhao Vowels

	front	central	back
high	i		u
mid	ɛ	ə	ɔ
low		a	

2.2.2. Description of Consonants
2.2.2.1.   General Description

Dhao has five bilabial consonants. Articulation of these consonants involves the lips, by which the obstruction of the oral tract is affected: /p, b, ɓ, b͡β, m/. There are eight alveolars, where the tip of the tongue touches the alveolar ridge: /t, d, ɗ, d͡ʐ, s, n, r, l/. Furthermore, Dhao has four palatals, where articulation involves the blade of the tongue briefly pressing against the alveolar ridge: /c, ɟ, ʄ, ɲ/. Four consonants are velars, where the back of the tongue is raised against the soft palate: /k, g, ɠ, ŋ/ There are two glottals, of which sounds are made in the larynx: /ʔ, h/. The three consonants that are analyzed here as loans are the bilabial approximant /w/, the

labiodental /f/, and the palatal approximant /j/ (cf. Grimes, 2010). These three loan consonants are discussed separately in §2.2.2.6.

The bilabial sounds involve four segments when it comes to manner of articulation. The sound realized as [p] is a voiceless bilabial stop. When it is followed by high vowel [u], a small burst is produced that makes it into an aspirated [pʰ]. However, this realization is a speaker specific feature. [b] is a bilabial voiced stop. No other realization of this sound has been identified. The two other bilabial segments are the implosive [ɓ] and the affricate [bβ]. Although the two sounds are less frequent in use, they are listed as separate segments due to the contrast between them and the plain [b]. This is exemplified by minimal pairs (see §2.2.2.2). The implosive [ɓ] in word-initial position is not attested in the corpus, and only very few words indicate its occurrence in medial position. This might indicate a historical linguistic phenomenon where speakers no longer productively produce this sound as of recently. In elicitation tests, active native speakers mostly disagree with the pronunciation of the implosive [ɓ] (see §2.2.2.4 to see evidence). Another bilabial segment is the nasal [m], which is always voiced.

Alveolar sound comprises six segments: the voiceless [t], the voiced [d], the implosive [ɗ], the retroflex-affricate [ɖʐ], the nasal [n], the trill [r], and the lateral [l]. [t] has no aspiration during its production, unless followed by mid-central vowel [ə]. This occurs when the schwa is stressed because of air pressure during the occlusion. The voiced sounds [d], [ɗ], and [ɖʐ] are contrastive in that they have minimal pairs (see §2.2.2.2). Like the bilabial implosive [ɓ], the alveolar implosive [ɗ] also is constrained in use indicating a historical linguistic phenomenon. In rapid speech, the retroflex [ɖʐ] is less obvious in that there is no curling while pressure and friction are evident. This indicates that retroflexion in Dhao is understood as the touching of the post-alveolar region[1] with the underside of the tongue (Hamann & Fuchs, 2010).

The sound realized as [s] is the voiceless alveolar fricative. The other alveolar segments are the voiced nasal [n], the voiced trill [r], and the voiced lateral [l]. The voiceless palatal stop [c], the voiced [ɟ], and the implosive [ʄ] are contrastive; therefore, they are distinguished in the segmental inventory (see §2.2.2.2). Another palatal sound is realized as the nasal [ɲ]. The velar sound has three contrastive segments; the voiceless [k], the voiced [g], and the implosive [ɠ]. The velar nasal is realized as [ŋ]. Dhao has two glottal sounds: an unvoiced stop realized as [ʔ] and a fricative realized as [h]. The glottal stop [ʔ] is listed as a separate segment, as it is contrastive with non-glottal sounds, particularly in word medial position. It also occurs in initial position before vowels. As such, it is analyzed as a phoneme rather than a phonetic realization (see §2.2.3.4 below).

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[1] The retroflex sound corresponds to the proto- segment of Central Malayo-Polynesian languages *d (Hamann & Fuchs, 2010).

2.2.2.2.   Minimal Pairs

In this section, all possible minimal pairs of Dhao consonants are presented in order to demonstrate phonemic contrasts. Whenever no exact minimal pairs are found, near minimal pairs are presented.

(1)   Consonant Minimal Pairs

/p/ ~ /b/ initial position
        /paba:/   'to cheer'
        /bab͡βa/   'gong'

/p/ ~ /b/ medial position
        /kapua/   'tree's foot'
        /kabua/   'price'

/b/ ~ /ɓβ/ initial position
        /baka/   'Ba'a (place name)
        /ɓβaka/   'dull'

/b/ ~ / ɓβ/ medial position
        /babaa/   'block'
        /bab͡βa/   'gong'

/ɓβ/ ~ /ɓ/ medial position
        /bab͡βa/   'gong'
        /baɓa/   'short'

/t/ ~ /d/ initial position
        /təlu/   'three'
        /dəlu/   'womb'

/t/ ~ /d/ medial position
        /kəti/   '1SG.bring'
        /kədi/   'to get up'

/d/ ~ /d͡ʐ/ initial position
        /daɛ/   'land'
        /d͡ʐaɛ/   'yet'

/d/ ~ /d͡ʐ/ medial position
        /tada/   'level'
        /tad͡ʐa/   'sign'

/ɗ/ ~ /d͡ʐ/ initial position
        /ɗɛu/   'to bop on head'
        /d͡ʐəu/   'person'

/c/ ~ /ɟ/ initial position and medial position
        /cəci/   'to make dense'
        /jəji/   'to touch'

/c/ ~ /ʃ/ initial position and medial position
        /caci/   'to chop to make smooth'
        /ʃaʃɪ/   'to become'

/ʃ/ ~ /ɟ/ initial position
        /ʃara/   'manner, way'
        /ɟara/   'horse'

/ʃ/ ~ /ɟ/ medial position
        /ʔaʃa/   'to learn'
        /kaɟa/   'rich'

/g/ ~ /ɠ/ initial position
        /gagɛ/   'ankle'
        /ɠaɠɛ/   'to touch'

/g/ ~ /ɠ/ medial position
        /haga/   'foot'
        /haɠɛ/   'to separate'

/k/ ~ /g/ initial position
        /kai/   'to prohibit'
        /gai/   'to touch lightly'

/k/ ~ /g/ medial position
        /haka/   'to hit'
        /haga/   'foot'

/ʤ/~ /ʔ/ medial position

/haʤɛ/	'to separate'
/haʔu/	'egret'

/ʔ/ ~ /k/ ~ /g/ initial position

/ʔaɛ/	'many'
/kai/	'to prohibit'
/gai/	'to touch lightly'

/ʔ/ ~ /k/ medial position

/kabɛʔɛ/	'humid'
/bɛkɛ/	'to stay up'

/ʔ/ ~ /h/ initial position

/ʔəɲi/	'overlap'
/həɲi/	'areca nut'

/ʔ/ ~ /Ø/ medial position

/luʔu/	'to hide'
/luu/	'high tide'

/s/ ~ /h/ initial position

/səlɛ/	'to plant'
/həlɛ/	'to spread out'
/seli/	'exceed'
/həli/	'to buy'

/s/ ~ /h/ medial position

/masɔ/	'to enter'
/mahɔ/	'shadow'

/m/ ~ /n/ ~ /ŋ/ initial position

/mara/	'low tide'
/nara/	'to get'
/ŋara/	'name'

/ɲ/ ~ /n/ initial position

/ɲama/	'raffia'
/namɛ/	'to pull out'

/ɲ/ ~ /ŋ/ initial position

/ɲiu/	'coconut'
/ŋiʔu/	'body'

/ɲ/ ~ /ŋ/ medial position

/məɲi/	'fatty'
/məŋi/	'blessing'

/l/ ~ /r/ initial position

/lara/	'a fly'
/rara/	'a bit yellow'

/l/ ~ /r/ medial position

/mɛla/	'cramps'
/mɛra/	'flat'

/s/ ~ /ɲ/ initial position

/salɛ/	'wrong'
/ɲalɛ/	'k.o. sea worm'

/s/ ~ /ɲ/ medial position

/pasɔrə/	'aslant'
/paɲɔrə/	'lips'

2.2.2.3. Distribution of Consonants

Dhao is an open syllabic language in which syllables never have codas (see §2.3.1 for details). Therefore, complete distribution in Dhao means that a given phoneme is confined to initial and medial positions. The distribution of consonants is presented following their manner of articulation. Table 2.3 demonstrates the distribution of stops. As is shown, all stop consonants have a complete distribution. However, they differ with regards to their accompanying vowels. Unlike stops that can be followed by any vowel in any position, the velar stops /k/ and /g/ in medial position cannot be followed by the schwa /ə/.

Table 2.3: Distribution of stops

	Initial position		Medial position	
/p/	/pacəli/	'to press'	/ləpa/	'to return'
	/pɛni/	'female belt'	/rəpa/	'fathom'
	/pəku/	'fish net'	/kapua/	'trunk'
/b/	/babia/	'burden'	/babia/	'burden'
	/bad͡ʐa/	'animal'	/baboa/	'edge'
	/bəcu/	'be satisfied'	/cabu/	'soap'
/t/	/taba/	'to add'	/batɛ/	'to chase'
	/tada/	'level'	/təlu/	'three'
	/tatai/	'to filter'	/titu/	'to stand'
/d/	/daʄa/	'trade'	/aadɔ/	'be absent'
	/damɛ/	'peace'	/tudi/	'knife'
	/dəb͡βɔ/	'big (wood)	/hudi/	'not care'
/k/	/kaba/	'shell'	/ləka/	'to believe'
	/kəʃi/	'to stab'	/makaɛ/	'be ashamed'
	/koha/	'boat'	/taki/	'to tighten'
/g/	/gala:/	'glass'	/haga/	'foot'
	/gɔa/	'stupid'	/ʔiga/	'to count'
	/gɔrɔ/	'to quit'	/təgu/	'pile up'
/ʔ/	/ʔada/	'custom'	/ʔiʔa/	'fish'
	/ʔaɛ/	'many'	/ɟaʔa/	'1SG'
	/ʔahu/	'dust'	/ʃuʔu/	'grass'

The voiceless palatal /c/ and the voiced one /ɟ/ have complete distribution, as shown in Table 2.4 below. While /c/ cannot be followed by schwa in medial position, /ɟ/ cannot be followed by the vowel /u/ in initial position. Other positions can involve any vowels.

Table 2.4: Distribution of palatals

	Initial position		Medial position	
/c/	/cəci/	'to fill forcefully'	/kab͡βəca/	'muddy'
	/cɛbɛ/	'to spread'	/kabicu/	'corner'
	/cɔŋɛ/	'to open'	/pəci/	'to throw'
/ɟ/	/ɟaʔa/	'1SG'	/ɟeɟi/	'to hit on ground'
	/ɟara/	'horse'	/kaliɟi/	'to peel'
	/ɟəru/	'to carry'	/kaɟa/	'rich'

The distribution of implosive phonemes is presented in Table 2.5 below. As is shown, only the implosive /ɓ/ has an incomplete distribution. It only occurs in word-medial position. There is one bilabial implosive-initial word listed in the previous work of Grimes (2012:49), which is orthographically written as *b'era-b'era* 'along with'. It is, however, not attested as an implosive in the current corpus. In fact, the voiced bilabial [ɓ] which is produced for the word [ˈɓəːːa-ˈɓəːːa] has a small burst of sound outwards rather than inwards. In medial position, /ɓ/ can be followed by any vowel except /e/ and /ə/. Its occurrence in word-medial position is attested only in careful speech. The same happens to the sound production of alveolar implosive /ɗ/ as well. The implosive /ɗ/ cannot be followed by the vowel /i/ in a word-initial position or the schwa /ə/ when in medial position. Both /ɓ/ and /ɗ/ are rare in word-initial positions.

In an initial position, /ʄ/ can only be followed by vowels /a/, /ə/, and /u/, whereas in medial position, it can only be followed by vowels /a/, /e/ and /i/. For the palatal implosive /ʃ/, the word-initial position does not allow the vowels /e/ and /i/ to follow. The velar implosive /ɠ/ has a restricted distribution. In initial position, it is only confined to preceding the vowels /a, e, u/, while only the vowels /a, e, i/ can follow in medial position.

Table 2.5: Distribution of implosives

Initial position			Medial position	
/ɓ/			/baɓa/	'short'
			/kahiɓi/	'goat'
			/luɓu/	'mud'
/ɗ/	/dɔrə/	'thunder'	/gagɛɗə/	'to shake'
	/dara/	'inside'	/kəɗu/	'to hold'
	/dəlu/	'belly'	/lɔɗɔ/	'sun'
/ʄ/	/ʄaru/	'to squeeze'	/daʄa/	'to trade'
	/ʄana/	'right'	/haʄɛ/	'to separate'
/ʃ/	/ʃaga/	'to guard'	/ʔaʃa/	'to learn'
	/ʃala/	'net'	/b͡βəʃi/	'to sleep'
	/ʃəɟɛ/	'to step on'	/kapaʃu/	'octopus'

While the bilabial affricate /b͡β/ has a complete distribution, it cannot be followed by /i/ when it occurs in a word-medial position. Unlike /b͡β/, the retroflex-affricate /ɖ͡ʐ/ can take any following vowel. The realization of these two phonemes is given in Table 2.6 below.

Table 2.6: Distribution of affricates

	Initial position		Medial position	
/b͡β/	/b͡βaka/	'dull'	/ʔab͡βu/	'to get'
	/b͡βarɛ/	'stick'	/bab͡βa/	'gong'
	/b͡βəʃi/	'to sleep'	/bəb͡βɛ/	'to fall'
/d͡ʐ/	/d͡ʐaɛ/	'not yet'	/bad͡ʐa/	'animal'
	/d͡ʐasi/	'sea'	/bəd͡ʐi/	'to jump'
	/d͡ʐəu/	'people'	/b͡βəd͡ʐə/	'to appear'

The distribution of the fricatives and nasals is presented in Table 2.7 below. All have a complete distribution. The distribution of the voiced palatal nasal /ɲ/ has restriction on its accompanying vowels. The initial position is only confined to vowels /i/ and /a/, whereas the medial position can be followed by any vowel except /e/ and /ə/. The occurrence of the palatal nasal /ɲ/ also is not frequent in the corpus. Only two words have been identified for each position. Furthermore, the velar nasal /ŋ/ cannot be followed by the vowel /o/ when it occurs word-initially.

Table 2.7: Distribution of fricatives and nasals

	Initial position		Medial position	
/s/	/saba/	'to work'	/basɛ/	'to wash'
	/sab͡βa/	'palm container'	/busa/	'dog'
	/sɛʔɛ/	PROX.PL	/ʔəsu/	'navel'
/h/	/hadhu/	'rock'	/jihɔna/	'moringa'
	/həba/	'mouth'	/kahadhu/	'brain'
	/hɛka/	'old age'	/kahəi/	'again'
/m/	/mad͡ʐa/	'eye'	/d͡ʐimu/	'east'
	/mahu/	'drunk'	/ʔəmu/	'house'
	/manu/	'chicken'	/ʃami/	'jungle'
/n/	/naɲi/	'to swim'	/pana/	'to cook'
	/nəŋu/	'3SG'	/panutu/	'snout'
	/nid͡ʐu/	'devil'	/tunu/	'to bake'
/ɲ/	/ɲiu/	'coconut'	/məɲi/	'oil'
	/ɲama/	'raffia'	/əɲu/	'tortoise'
/ŋ/	/ŋaʔa/	'1PL.ex.eat'	/b͡βəŋu/	'ridgepole'
	/ŋadɔ/	'to visit'	/dəŋɛ/	'with'
	/ŋutu/	'teeth'	/cɔŋɛ/	'to open'

The liquids, both trill /r/ and /l/, also have complete distribution and have no restriction in taking vowels. Examples of their distribution are presented in Table 2.8 below.

Table 2.8: Distribution of liquids

Initial position			Medial position	
/l/	/lad͡ʑɛ/	'to see'	/təlu/	'three'
	/ləcu/	'to release'	/magələ/	'to chase'
	/lɛkə/	'to bother'	/salɛ/	'wrong'
/r/	/rab͡βi/	'woman's sarong'	/dara/	'inside'
	/rəŋu/	'3PL'	/taraa/	'to cry out'
	/riɲi/	'thanksgiving'	/suri/	'to write'

The data presented above have shown that consonants in Dhao never occur word-finally. I therefore analyze any word in my database that does have a final consonant to be a loan (see §2.5). All consonant segments have a complete distribution except the bilabial implosive [ɓ]. The complete distribution and the minimal pairs of the glottal stop (§2.2.2.2) suggest that the glottal stop is contrastive with all other consonants in initial position, and therefore is analyzed as phonemic in this particular position. Additional evidence from morpho-phonology will be discussed in §2.2.3.4. The realizations of consonants not only depend on their environments but they also are speaker-specific. Voiceless consonants are phonetically lengthened when preceded by mid-central vowel [ə], for example [ŋ] in [ˈrəŋ:u] '3PL'. Voiced consonants that are within such an environment are slightly pre-glottalized (see §2.2.2.5). Such a maneuver occurs naturally since voiced consonant sounds cannot be maintained for a long time.

### 2.2.2.4. Phonetic Evidence of Consonants
The consonants to be discussed here involve implosives, affricates, and the retroflex. The phonetic realization of consonants near a schwa also is demonstrated. The phonetic contrast between the plain [b], bilabial affricate [b͡β], and bilabial implosive [ɓ] is evidenced by the waveforms in (2) below. The waveform of the plain bilabial [b] in (2)a shows a periodic wave before the following vowel is released. The waveform of the affricate [b͡β] in (2)b shows a consistent wave of vibrations until the next vowel is released. Meanwhile, the image of the implosive [ɓ] in (2)c indicates that the release of the sound begins with a little closure before the vibration increases. It signals that there is an inward airflow when the sound is released.

(2)   Plain [b] vs. affricate [b͡β] vs. implosive [ɓ]
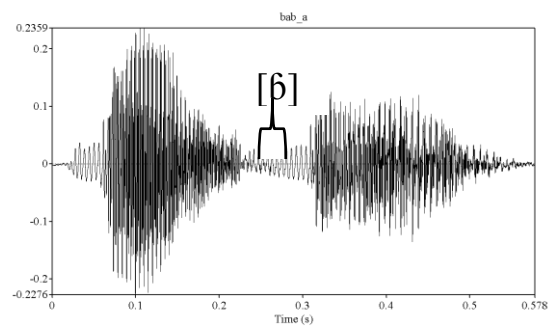
    a.   Plain [b]: [paˈbaː] 'to cheer'
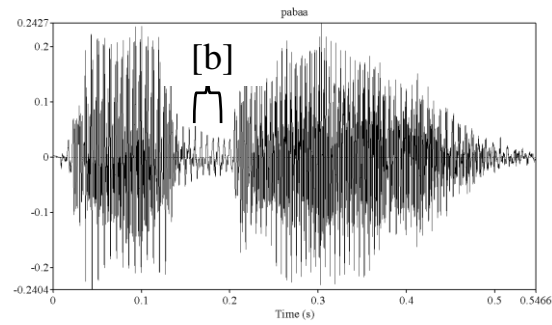
    b.   Affricate [b͡β]: [ˈbab͡βa] 'gong'
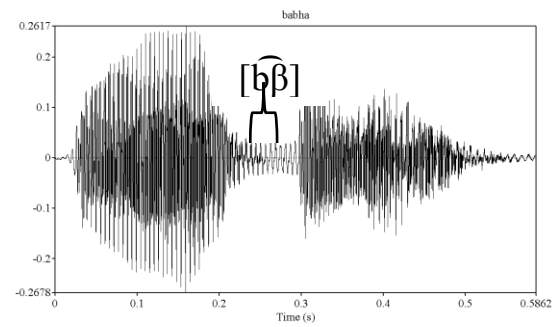

    c.   Implosive [ɓ]: [ˈbaɓa] 'short'

The phonetic contrast between plain [d], retroflex-affricate [ɖ͡ʐ], and implosive [ɗ] is demonstrated by the waveform images in (3) below. The waveform in (3)a shows a plain [d] where there is a typical voice bar followed by a strong burst. Following the burst, the articulators move from the stop articulation to the target of the following
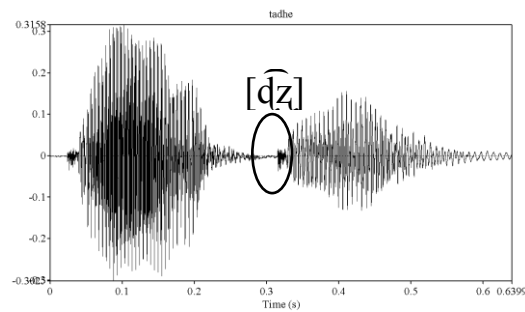
vowel. The waveform image (3)b of [ɖ͡ʐ] shows that there is an aspiration, similar to a fricative, before the following vowel is released. It shares the features of occlusion and burst of a stop and the feature of a hissing sound typically associated with a fricative. The waveform image (3)c of [ɗ] shows an inward airflow preceding the release of the vowel.

(3)   Plain [d] vs. retroflex-affricate [ɖ͡ʐ] vs. implosive [ɗ]

a. [ˈtada] 'level'
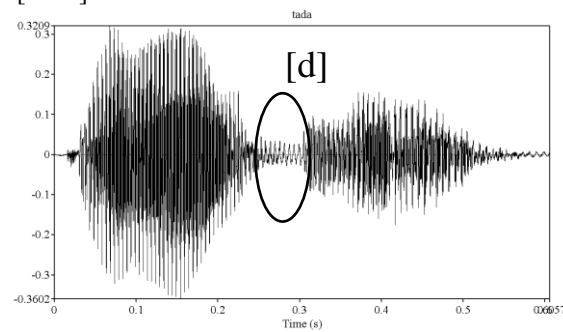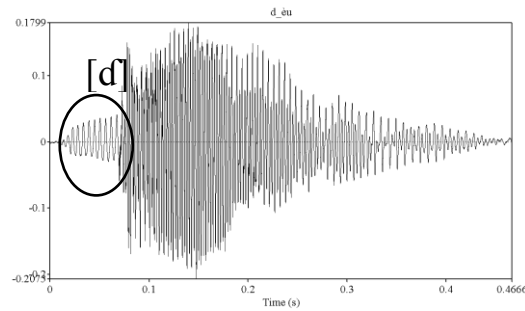

b.   [ˈtaɖ͡ʐɛ] 'to recognize'


c.   [ɗəu] 'to grope'

The phonetic difference between the plain consonants and the lengthened consonants after a schwa is illustrated by the waveform images in (4) below. The waveform image of the plain [t] in (4)a shows that there is a flat line signaling a silence between vowels, as is indicated by the double arrows. The duration of the silence is 0.063 seconds. Meanwhile, the waveform image of the lengthened [t] in (4)b shows a longer silence, of 0.133 seconds. Thus, the lengthened [t] takes 0.07 seconds longer to close the vocal tract than the plain [t], before the following vowel is released.

(4)   Plain [t] vs. geminate [t]

a. Plain [t]: [ˈeta]
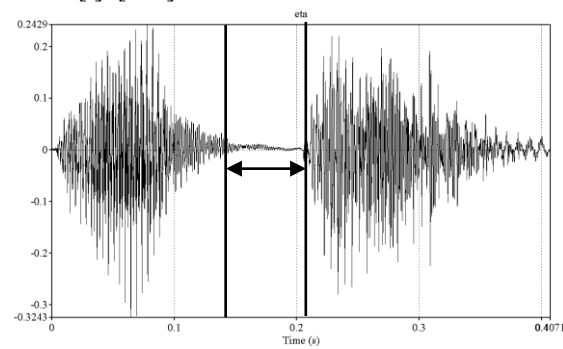
b. geminate [t]: [ˈət:a]
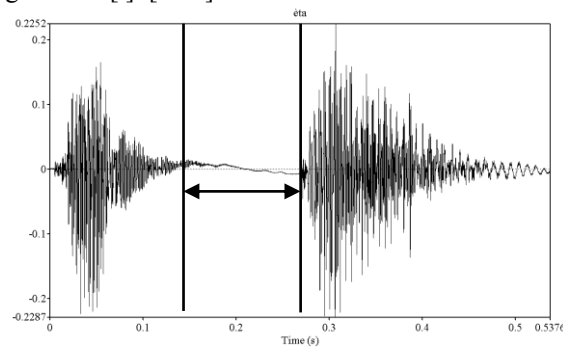
2.2.2.5.   Pre-glottalized Voiced Stop Consonants

Dhao's voiced consonants /b/, /d/, /g/ are pre-glottalized when they occur word-medially. In some other languages in Eastern Indonesia, like Rongga (Arka, 2016: 25-28), preglottalized consonants are analyzed as implosives. In Dhao, implosives have different characteristics (see §2.2.2.1).

Pre-glottalization signals a different feature from implosives in Dhao. Since pre-glottalization has no contrast, it cannot be phonemic. In addition to that, Dhao does not have consonant clusters, because of which it is impossible to analyze [ʔC] combinations as a sequence of phonemes. This kind of pre-glottalization appears to be a consequence of an extreme laryngealization. It may also indicate a sociolinguistic phenomenon. Many speakers claim that it is mostly produced by younger speakers or by people who are new to the language. The following examples show that not only the voiced implosive consonants in (5) are pre-glottalized, but that also non-implosives in (6), such as [ʔb] for [kaˈhiʔbi] 'goat' and [ʔd] for [aːʔdɔ] 'be absent', are pre-glottalized. Pre-glottalization even occurs in loanwords from Indonesian, as shown in [ʔd] in [saˈpeʔda] 'bicycle'. More examples are given in (7), where their non-implosive counterparts are not pre-glottalized.

(5)   Pre-glottalized implosive
        [ˈbaʔɓa]   /baɓa/   'short'
        [baˈbaʔɓa]   /babaɓa/   'shallow water'
        [ˈluʔɓu]   /luɓu/   'mud'
        [ˈɠaʔɠɛ]   /ɠaɠɛ/   'to touch'
        [ˈhaʔɠɛ]   /haɠɛ/   'to separate'

(6)   Pre-glottalized plain voiced consonants
        [saˈpeʔda]   /sapɛda/   'bicycle'
        [aˈːʔdɔ]   /aadɔ/   'be absent'
        [ˈkəʔdu]   /kədu/   '1SG.hold'
        [kaˈhiʔbi]   /kahibi/   'goat'
        [ˈsəʔgi]   /səgi/   'to split'

(7)   Non-pre-glottalized voiced consonants
        [ˈpəgːɛ]   /pəgɛ/   'to cross'
        [ˈtəgːu]   /təgu/   'to pile up'
        [kaˈdəgːɔ]   /kadəgɔ/   'to shake'

2.2.2.6.   Loan Consonants
The loan consonants in Dhao are presented in this separate section, not so much because they are different from Dhao consonants, but rather because they only appear in loan words (see §2.5 for details) and never occur in native Dhao words. Three consonant segments in Dhao are identified as loans: the voiceless labiodental fricative [f], the bilabial approximant [w], and the palatal approximant [j]. The fricative [f] occurs only in loan words from, either local Malay, Standard

Indonesian, or Rote, and in person or family names. In addition to that, it is realized only word-initially as shown in example (8) below.

(8)   [f] in initial position
         /fam/   'family name' (<Kupang Malay
                                                      <Dutch: *familie*)
         /farlaak/   'plastic mat' (<Kupang Malay
                                                      <Dutch: *voorlaken*)
         /fia/   (family name)
         /fina/   (female name)

The approximant /w/ is used in interjections and exclamations in addition to a small number of loan words. Only three words with initial /w/ are found in the corpus, as demonstrated in (9). This approximant /w/ is included in the consonant category because it occurs in consonant position, that is: as an onset in syllables. However, front-back vowel sequences can also include the realization of this sound as a glide. The only content word found in the corpus with an initial /w/ is /waɟa/ 'steel', a loan from Malay /baɟa/ 'steel'. Another alternate form to express the meaning of 'iron' is /haɟa/, which cannot stand independently without the form /bəsi/ 'iron' preceding it. The others are interjections, such as *weh* 'hi' and *wa* 'ooh'.

(9)   /w/ in initial position
         /wa/   'ooh, gosh'   (IND *wah*)
         /waɟa/   'iron'   (IND *baja*)
         /wɛh/   'hey'

The palatal approximant /j/ is obviously phonemic, but it also is a phonetic interlude between vowels. For example, the word [ˌkalaʲiˈjɔʊ] in /kalaijəu/ in (10) below shows that there are vowel sequences with /i/ and /ə/, which trigger the realization of the palatal approximant. The absence of the glide would, of course, result in a complex vowel combination **kalaièu*, which is impossible for Dhao. In this regard, the glide /j/ is used to avoid hiatus.

(10)   /j/ in medial and initial position
         /kalaijəu/   'bamboo'
         /kajaʔu/   'cotton'
         /ja/   'yes' (IND /ja/)

2.2.3. Description of Vowels

2.2.3.1. General Description

As already presented in §2.2.1 above, Dhao has six vowel phonemes: /i, u, ɛ, ə, ɔ, a/. The description of vowels in this thesis is divided into three subsections based on their respective positions (height); high, mid, and low. All vowels have complete distribution regarding their position in a word, except for the central mid vowel /ə/, which can never occur word-finally. The realization of vowels varies depending on the vowel that occurs in the following syllable (see §2.2.3.8). In terms of length, all vowels have the possibility to occur as long vowels (see §2.2.3.5). In addition to that, vowels can also be combined as a sequence (see §2.2.3.6). All vowels in word-initial positions are realized with a glottal stop, except for long vowels (see §2.2.3.4). It will be attested in §2.2.3.4 that the glottal stop is phonemic in this respect, rather than phonetic.

There are two high vowels: one is the front unrounded /i/ and the other one is the back rounded vowel /u/. The vowel /i/ is always realized with palatal glide [j] when followed by the vowels /e/ and /a/, whereas /u/ is always realized with the bilabial glide [w] when followed by other vowels. Dhao has three mid-vowels: front unrounded /e/, central /ə/, and back rounded /o/. There is only one low vowel /a/, which is realized as open and unrounded.

2.2.3.2. Vowel Allophones

All vowels have allophones, except for the low vowel /a/. The changes of vowel sounds are influenced by the sounds in either the same or in the following syllable. The changes are based on height and roundness (see §2.2.3.8). Table 2.9 below shows the occurrences of allophones. The high front vowel /i/ has two allophones: [i] and [ɪ]. [ɪ] occurs only after mid front /ɛ/, whereas [i] occurs elsewhere. The mid front vowel /ɛ/ also has two allophones: [e] and [ɛ]. [e] can never occur word-finally, whereas [ɛ] occurs elsewhere. [e] only occurs word-initially and medially when the following syllable has an /a, i/ or /u/. The most alternating sound is the mid central vowel or schwa /ə/. It has five allophones: [ə, ɜ, ɐ, ɘ, ɵ]. If the vowel in the following syllable contains a high vowel, it is realized as [ə]. If the following syllable has a mid vowel, it is realized as [ɜ]. However, if the following syllable has a low vowel, it is realized as [ɐ]. When it is followed contiguously by the high rounded vowel /u/, it is realized as the rounded [ɵ], but if the adjacent vowel is the high unrounded /i/, it will be realized as [ɘ]. The allophony of the vowel /o/ also follows the rule of changing to the mid front vowel /e/. While the allophone [ɔ] occurs elsewhere, the [o] never occurs word-finally. The occurrence of [o] is predictable, that is: when the following vowel, whether in adjacent position or in the following syllable, is /a, i, u/, [o] occurs. Furthermore, the high back vowel /u/ has

two allophones: [u] and [ʊ]. [ʊ] occurs only when the preceding vowel is the mid front vowel [e], /u/ occurs elsewhere.

Table 2.9: Vowel Allophones

Vowels	Allophones	Phonetic	Phonemic	Glosses
/i/	[i]	[ˈrai]	/rai/	'land'
	[ɪ]	[ˈmeɪ]	/mɛi/	'table'
/ɛ/	[e]	[ˈheka]	/hɛka/	'afterwards'
		[ˈleru]	/lɛru/	'to care for'
	[ɛ]	[ˈmɔnɛ]	/mɔnɛ/	'male'
		[ˈtulɛ]	/tulɛ/	'to push'
		[ˈcuʷɛ]	/cuɛ/	'one'
		[ˈʔɛd͡ʑɛ]	/ʔɛd͡ʑɛ/	'to submerge'
		[ˈʔɛdɔ]	/ʔɛdɔ/	'to grub up'
/ə/	[ə]	[ˈʔətːu]	/ʔətu/	'LOC'
	[ɜ]	[ˈdɜŋːɛ]	/dəŋɛ/	'with'
	[ɐ]	[ˈhɐbːa]	/həba/	'mouth'
	[ə]	[ˈkahəi]	/kahəi/	'again'
	[ɵ]	[ˈd͡ʑɵu]	/d͡ʑəu/	'people'
/a/	[a]	[ˈdara]	/dara/	'inside'
		[ˈlaŋa]	/laŋa/	'stair'
/ɔ/	[o]	[ˈhoi]	/hɔi/	'weeping'
		[ˈb͡βori]	/b͡βɔri/	'to spill'
		[paˈroʷa]	/parɔa/	'to call'
		[ˈboʷa]	/bɔa/	'k.o. tree'
	[ɔ]	[ˌkɔkɔˈtɔː]	/kɔkɔtɔː/	'to crow'
		[baˈbɔrɔ]	/babɔrɔ/	'outside'
		[kaˈsirɔ]	/kasirɔ/	'gun'
/u/	[u]	[ˈhuʷa]	/hua/	'fruit'
	[ʊ]	[ˈneʊ-ˈneʊ]	/neu-neu/	'not sure'

2.2.3.3.   Minimal Pairs

This section presents all possible minimal pairs of vowels. Whenever minimal pairs are not possible, near minimal pairs are provided. Positions in which minimal pairs can be contrasted are indicated as well. In initial positions, /ɛ/~/i/, /ə/~/i/ and /ɛ/~/a/ cannot be contrasted. In medial position /ɛ/~/i/, /ɔ/~/a/, /ɛ/~/a/, and /ɔ/~/u/ cannot be contrasted. Only the pairs /ɛ/~/a/ and /ɔ/~/a/ cannot be distinguished in final

position. All other oppositions can be made elsewhere. Note that /ə/ never occurs word-finally (see §2.3.1).

(11)   Minimal Pairs of Vowels

/ɛ/ ~ /ə/ initial position
        /ʔɛta/   'to drift ashore'
        /ʔəta/   'to tap lontar'

/ɛ/ ~ /ə/ medial position
        /kalɛla/   'ko.ceremony'
        /kaləla/   'k.o.flower'

/ɛ/ ~ /i/ final position
        /ləŋɛ/   'to pass'
        /ləŋi/   'oil'

        /ləmɛ/   'all around'
        /ləmi/   'five'

/ɔ/ ~ /a/ initial position
        /ʔɔka/   'garden'
        /ʔaka/   'unreasonable talk'

/ɛ/ ~ /a/ final position
        /nɛʔɛ/   PROX.SG
        /nɛʔa/   '3SG.to know'

/ɔ/ ~ /u/ initial position
        /ʔɔru/   'to collect'
        /ʔuru/   'in former times'

/ɔ/ ~ /u/ final position
        /d͡ʐətɔ/   'to pound'
        /dətu/   'near'

2.2.3.4.   Initial Glottal: Phonemic Evidence

A glottal stop occurs before all vowel-initial words, except long vowels. The consistency of its occurrence gives a strong indication that glottal stop obligatorily marks word-initial vowels. Nevertheless, the analysis should account for whether the

glottal stop is phonemic or phonetic. It can be treated as phonemic due to the fact that the glottal stop is listed in the consonant inventory as a separate segment. The Dhao syllabification system has an obligatory onset. Examples of the glottal stop preceding vowel-initial words are given in (12) below.

(12)   Pre-glottalized Vowels
        /ʔada/   'custom'
        /ʔaɛ/   'big'
        /ʔahu/   'dust'
        /ʔəʃi/   'rain'
        /ʔəɔ/   'to herd'
        /ʔina/   'mother'
        /ʔinu/   'to wear on neck'
        /ʔoru/   'to collect'
        /ʔɔka/   'garden'
        /ʔudu/   'to pile'
        /ʔunu/   'own'
        /ʔəu/   '2SG'

In contrast to initial glottal stop plus non-long vowel sequences, initial long vowels never have a glottal stop. The contrasts are shown in the examples of minimal pairs in (13) below. The long vowels are indicated by two consecutive vowels in the orthography.

(13)   Initial glottal and vowel contrasts

        /aaɛ/   'big'
        /ʔaɛ/   'to breath'

        /əəna/   'that'
        /ʔəna/   'six'

        /ɛɛlɛ/   'let it be'
        /ʔɛlɛ/   'to lose'

        /iia-iia/   'as usual'
        /ʔia/   'stop'

/iiki/	'small'
/ʔisi/	'volume'
/uusu/	'to draw (water)'
/ʔusu/	'person's name'

The initial glottal stop is retained even when a word takes prefixes. As seen in (14) below, when attaching the prefix *pa-*, the glottal stop appears intervocalically. As such, it does not differ from glottal stops in medial position, such as /kabɛʔɛ/ 'humid', /haʔu/ 'egret', /paʔiɛ/ 'repair fishing net', and /luʔu/ 'to hide'.

(14)   Initial glottal stop with prefix *pa-*

/pa-ʔad͡ʐu/	'to make X hard'
/pa-ʔəi/	'to make liquid, melt'
/pa-ʔɔkɛ/	'to surround'
/pa-ʔəki/	'to tie each other'
/pa-ʔərɛ/	'to pull each other'
/pa-ʔəsɔ/	'to move each other'
/pa-ʔətɛ/	'to cut each other'
/pa-ʔigɛ/	'counting'
/pa-ʔiu/	'to bind each other'
/pa-ʔɔru/	'to collect together'
/pa-ʔəta/	'palm usually tapped'
/pa-ʔuri/	'to look after together'
/pa-ʔalɛ/	'to mention regularly'
/pa-ʔaɛ/	'to multiply'

The glottal stop is also maintained in reduplication (see §4.4.1.1 for details of (C)*a*-reduplication). As such, the glottal stop occurs not only in front the root but also in front of the derived words. This suggests that the distribution of the glottal stop is the same as any other consonant in initial and medial position. Note that Dhao does not allow consonant codas at all.

(15)   Initial glottal stop with partial reduplication

/ʔa-ʔad͡ʐu/	'hard side'
/ʔa-ʔabɔ/	'pounder'
/ʔa-ʔɔkɛ/	'instrument to surround'
/ʔa-ʔəɲi/	'to squash'
/ʔa-ʔɛdɔ/	'to grub up'
/ʔa-ʔb͡ɓu/	'thought, idea'

/ʔa-ʔaʃa/	'lesson'
/ʔa-ʔəra/	'strength'
/ʔa-ʔɛɔ/	'way of shepherd'
/ʔa-ʔɛd͡ʑɛ/	'place to soak'
/ʔa-ʔɔrɔ/	'to look for attentively'

The morpho-phonological processes of prefixation confirm that the initial glottal stop is phonemic, not phonetic. There are four reasons for this claim: (1) the glottal stop has the same distribution as other consonant phonemes, as it can occur intervocally, (2) it can occur in vowel-initial words, like the other consonant phonemes do, (3) it is retained in the process of prefixation, whereas otherwise a glide interlude would appear to avoid hiatus, and (4) initial glottal stops are copied in reduplication. Consequently, the glottal stop is maintained, implying that it is a part of the root.

Long vowel initial words have no glottal stop at all, even when they are prefixed or reduplicated. Reduplication of the word */aapa/* 'bad side' shows that the reduplicant is realized as short vowel [a] while the root vowel remains long. Only few examples of long vowel-initial words are found in the corpus, which all are prefixed or reduplicated. Most of the long vowel-initial words constitute a closed word class.

(16)   Long vowel with prefix *pa-* and reduplication
            [pa-ˈaːɛ]   /pa-aaɛ/   'to make s,t bigger'
            [a-aˈːpa]   /a-aapa/   'bad side'

Phonologically there is no segmental before a long vowel. This is evidenced by the absence of any consonant sound in front of long vowels. Long vowels mostly occur in monosyllabic words. Only very few words contain long vowels in medial position.

Long vowels are preceded by a glide or a glottal fricative /h/ in particular cases. The glottal fricative preceding the long vowel [aː] in [aːdo] 'be absent' might come from a genuine phoneme. However, it can also signal the existence of an onset. In medial position, like in [bayheʔda] 'lazy', the glide is already there but is not treated as onset. It takes /h/ as the onset of the syllable. Interesting data comes from [aːʔi] 'all' which,, does not take fricative /h/ as the onset, but the approximant palatal /j/ even though the word begins with the vowel /a/. This might be triggered by the fact that such a word can be fully reduplicated into [ʲaːʔiˈʲaːʔi] *aa'i-aa'i.*

(17)   Initial vowels with fricative and glide realization
    /aadɔ/   [ˈhaʔdɔ]   'be absent'
    /bajɛɛda/   [bajˈheʔda]   'lazy'
    /aaʔi/   [ˈjaʔi]   'all'

Grimes (2010) argued that the voiced glottal sound marked /ʁ/ is articulated by some speakers as a pharyngeal constriction to a vowel onset, and by other speakers as a lack of a glottal stop onset (contrasting with a glottal stop onset) to a vowel-initial word in a phrase. The description above, in fact, gives strong evidence that initial glottal stop is phonemic, not phonetic.

2.2.3.5.   Long Vowels

All vowels have long vowel counterparts. However, they differ when it comes to distribution. Only the long vowel [iː] occurs in all positions of a word, whereas the others never occur in word medial position. The long schwa [əː] only occurs in word initial position. Examples are provided in (18) below.

(18)   Distribution of Long Vowels

    Initial position: all vowels
    [ˈaːɛ]   /aaɛ/   'big'
    [ɛˈːlɛ]   /ɛɛlɛ/   'be away'
    [əˈːnːa]   /əəna/   DIST.SG
    [iˈːki]   /iiki/   'small'
    [ɔˈːʔdɛ]   /ɔɔdɛ/   'very'
    [uˈːsu]   /uusu/   'to draw (water)'

    Medial position: only [i] and [e]
    [paˈʸiːɛ]   /paiiɛ/   'be careful'
    [huʷaˈiːʸa]   /huaiia/   'honorable'
    [bayˈeːda]   /bay ɛɛda/   'lazy'

    Final position, except [ə]
    [ˈliː]   /lii/   'voice'
    [ˈŋɛː]   /ŋɛɛ/   'to think
    [ˈŋaː]   /ŋaa/   'what'
    [okaˈhɔː]   /ɔkahɔɔ/   'road'
    [kaˈnuː]   /kanuu/   'squid'

The contrasts between short and long vowels are presented in Table 2.10 below. Each long vowel is contrasted to a short vowel.

Table 2.10: Contrast between Short and Long Vowels

[aː] ~ [a]	[ˈaːɛ]	/aaɛ/	'big'
	[ˈʔaɛ]	/ʔaɛ/	'to breath'
	[ˈŋaː]	/ŋaa/	'what'
	[ˈŋaʔa]	/ŋaʔa/	'3SG.eat'
	[ˈraː]	/raa/	'blood'
	[ˈraʔa]	/raʔa/	'3PL.eat'
[əː] ~ [ə]	[əˈːnːa]	/əəna/	DIST.SG
	[ˈʔənːa]	/ʔəna/	'six'
[ɛː] ~ [ɛ]	[ˈɛːlɛ]	/ɛɛlɛ/	'let it be'
	[ˈʔɛlɛ]	/ʔɛlɛ/	'lose'
[iː] ~ [i]	[ˈiːʸaˈiːʸa]	/iia-iia/	'as usual'
	[ˈʔiʸa]	/ʔia/	'stop'
	[ˈiːki]	/iːki/	'small'
	[ˈʔisi]	/ʔisi/	'content'
	[paˈiːɛ]	/paiiɛ/	'be careful'
	[paˈhia]	/pahia/	'to sell'
[uː] ~ [u]	[ˈsuː]	/suu/	'tip'
	[ˈsuʔu]	/suʔu/	'k.o.tree'
[ɔː] ~ [ɔ]	[kaˈb͡βɔː]	/kab͡βɔɔ/	'k.o.tree'
	[kaˈb͡βɔʔɔ]	/kab͡βɔʔɔ/	'falling sound'

The contrast between long and short vowels clearly evidences that they have distinct phonological properties. On one hand, long vowels can be analyzed as a single unit of one syllable. Due to this, they count as having two moras, resulting in heavy syllabic words. On the other hand, long vowels can be analyzed as a sequence of two identical short vowels, which means that each vowel heads its own syllable. Observe the waveform between the word [ˈaːe] and [ˈʔae] below. The image in (19)a represents the waveform of [aː] in *aae* 'great, big', which has a duration of 0.1973 seconds, whereas the image of [a] in *ae* 'many' has a duration of 0.1489 seconds. Referring to stress assignment on words containing long vowels (§2.3.3), where the

main stress is on penultimate syllable, long vowels are analyzed here as two identical vowels each of which belongs to a different syllable.

(19)   a.   [a:] in *aae* 'great, big'
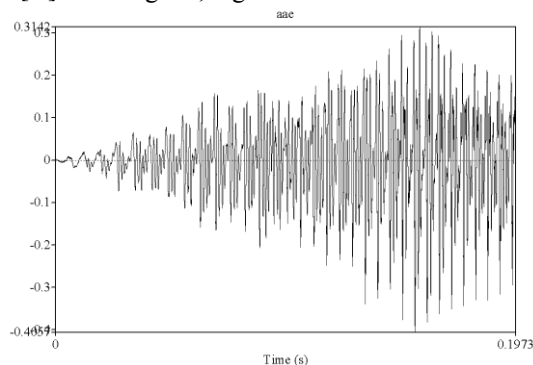
   b.   [a] in *ae* 'many'
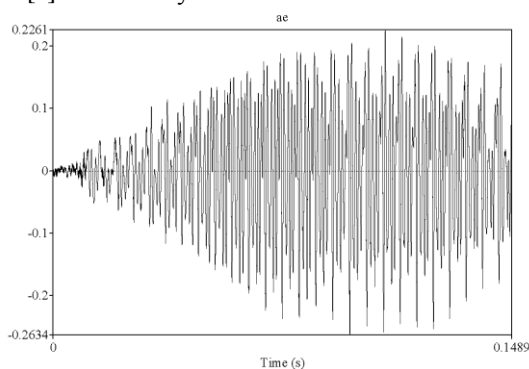
2.2.3.6.   Vowel Sequences

All possible vowel combinations are shown in Table 2.11 below. With a couple of restrictions, all vowels would be able to form sequences. As shown, the schwa [ə] can only be followed by the high vowels [i] and [u], which create diphthongs in turn (see §2.3.2). The impossibility of [ə] following a vowel explains why it would never occur in word-final position. Back vowel sequences are constrained. For example, the combination of [ɔ] and [u] is impossible. The glide [w] is always inserted when words involve vowels [ɔ] and [u]. Meanwhile, the glide [j] occurs when a combination involves the front high vowel [i] unless the preceding vowel is [ɛ]. Other combinations do not result in glide insertion. Examples of vowel sequences are given in (20) below.

Table 2.11: Vowel Sequences

	i	ɛ	ə	a	ɔ	u
i		+	-	+	+	+
ɛ	+		-	+	+	+
ə	+	-		-	-	+
a	+	+	-		+	+
ɔ	+	+	-	+		-
u	+	+	-	+	-	

(20)   Vowel Sequences

/ua/	[ˈbuʷa]	/bua/	'boil over'
/ue/	[ˈcuʷɛ]	/cuɛ/	'a, one'
/ui/	[daˈd͡ʐuʷi]	/dad͡ʐui/	'k.o. yoke'
/iu/	[ˈkiʷu]	/kiu/	'to scratch'
/au/	[ˈkaʷu]	/kau/	'rice'
/oa/	[ˈgoʷa]	/gɔa/	'stupid'
/oi/	[ˈhoʷi]	/hoi/	'weeping'
/ie/	[kaˈb͡βiʲɛ]	/kab͡βiɛ/	'pressed with s.t. heavy'
/ia/	[ˈbiʲa]	/bia/	'heavy'
/ai/	[ˈdaʲi]	/dai/	'enough'
/ei/	[ˈmeɪ]	/mɛi/	'table'
/ea/	[maˈnea]	/manɛa/	'eagle'
/eu/	[ˈneʊ-ˈneʊ]	/nɛu-nɛu/	'not sure'
/eo/	[ˈcɛɔ]	/cɛɔ/	'nine'
/ae/	[ˈhaɛ]	/haɛ/	'flow'
/ao/	[ˈgaɔ]	/gaɔ/	'to take'
/oe/	[ˈbɔɛ]	/bɔɛ/	'no, not'
/əi/	[ˈbəi]	/bəi/	'grandma'
/əu/	[kaˈb͡βθu]	/kab͡βəu/	'k.o. beam'

2.2.3.7. Mid-Central Vowel (Schwa)

The schwa in Dhao has two characteristics; (1) it is sensitive to vowel harmony (see §2.2.3.8 below), and (2) it is extremely short. In Dhao syllable structure, the schwa lacks length in a nucleus position. Consequently, it never occurs word-finally, as has been demonstrated in the minimal pairs in §2.2.3.3 above. Since it is short in length,

it attracts the lengthening of its following consonants (Grimes, 2010:259). The syllable structure will be presented in §2.3.1. When a schwa occurs in a final syllable, it requires high vowels to follow it. In this regard, the schwa and the following high vowel create a single unit in the syllable, a diphthong (see §2.3.2 below). The schwa cannot be followed by a glottal stop, a glottal fricative, or a bilabial implosive. Observe the distribution of consonants presented in §2.2.2.3 above.

2.2.3.8.   Vowel Harmony

This section is concerned with vowel harmony that occurs within a word. This analysis will show how and what type of harmony may occur for vowels in Dhao. As has been presented previously, Dhao has six vowels, [i, ɛ, ə, a, ɔ, u]. Each vowel is a syllable nucleus, with stress falling on the penultimate vowel in VV sequences, regardless whether the two vowels are the same or different (see 2.3.3). Dhao does not have coda and does also not allow consonant clusters. Therefore, consonant clusters in loanwords are broken up by an intervening vowel or are deleted in final position (see §2.5). As has been explained in §2.2.3.6, the high vowels [u] and [i] can only be preceded by the schwa [ə], but not vice versa. Vowels in Dhao can take on features of the neighboring vowel in terms of vowel combination or a feature of the vowel in the following syllable.

The realization of schwa [ə] is illustrated in (21) below. The feature of [ə] remains unchanged when the vowels in the following syllable are low, like [ə] in [ˈdəb:ɔ] 'wooden stick'. When the following vowel is high and rounded [u], it is realized as a high and rounded [ɵ], such as in [ˈʤɵu] 'person', and when the following vowel is high but unrounded [i], it is realized as unrounded [ə], like in [ˈbəi] 'grandmother'. The data shows that [ə] is harmonized not only in height but also in roundness.

(21)   Vowel Harmony
        [ˈbəi]   'grandmother'
        [ˈdəb:ɔ]   'wooden stick'
        [ˈʤɵu]   'person'
        [ˈhəb:a]   'door'
        [kaˈɹɵu]   'far'
        [paˈrəi]   'to wake up'
        [ˈʔɵu]   '2SG'

A different phenomenon is shown through the data in (22) below. Vowel harmony is from left to right, never the other way around. High vowels are always

lowered when the preceding vowel is low. Therefore, when the preceding vowel is [e], the vowel [i] is realized as [ɪ], and [u] is lowered to [ʊ]. When the preceding vowel is [a], the vowel [o] is lowered as [ɔ]².

(22)   Vowel Harmony
         [ˈʔɛɔ]   'to herd'
         [ˈnɛɔ]   'to want'
         [ˈbɔɛ]   'not'
         [ˈtaɔ]   'to make'
         [ˈcuʷɛ]   'a, one'
         [ˈmeɪ]   'table'
         [ˈneʊ-ˈneʊ]   'not sure'
         [ˈtɛŋɛ]   'to look for'

As shown, harmony is triggered by vowel height. Preceding low vowels lower subsequent the high vowels. Apart from that, the harmonized feature is taken from the preceding vowel, by which t harmony is considered progressive.

       When the vowel combination does not influence backness, frontness, or height, no alternation occurs. Therefore, the combination of [o] and [i] does not affect any change of the vowel features respectively, due to both vowels being high vowels. Meanwhile, a combination of other vowels seems to follow the specification of backness and frontness. Knowing that the low vowel [a] is open, it can combine without constraint with other vowels.

(23)   Vowel Combination
         [ˈhoi]   'weeping'
         [ˈhuʷa]   'fruit'
         [paˈroʷa]   'to call'
         [ˈraʸi]   'land'
         [ˈhiʸa]   'to give'
         [maˈdea]   'dizzy'

Vowels in Dhao also undergo long distance harmony: the realization of a vowel sound assimilates with the vowel of the next syllable. Examples are given in (24) below. The mid-central vowel [ə] in /səmi/ is realized as [ɵ] [ˈsɵm:i] when the next syllable has a high vowel [i], but it is realized as [ə] when the following syllable has

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² However, such a rule would be violated by the fact that, when the preceding vowel is [u], the following vowel is not raised, as is shown by the word [cuʷɛ] 'a'. One explanation is that the harmony is blocked by the glide interlude as suggested by Rose (2011).

an [ɔ], like in [ˈdəb:ɔ] 'wooden stick'. This alternation is in line with the vowel combination as discussed in §2.2.3.6 above. In this regard, the harmony does occur due to vowel height rather than roundness. It can be seen in the example [taˈtək:u] 'k.o. belt for weaving' which has the round vowel [u].

(24)   Long distance harmony

[ˈsəm:i]	/səmi/	'as, like'
[taˈtək:u]	/tatəku/	k.o belt for weaving
[ˈhʁb:a]	/həba/	'door'
[ˈtət:ɛ]	/tətɛ/	'cut'
[ˈdəb:ɔ]	/dəbɔ/	'wooden stick'
[ˈtɛɖɛ]	/təɖɛ/	'stone fence'
[kaˈkɛhɔ]	/kakɛhɔ/	'to stir'
[ˈmɔnɛ]	/mɔnɛ/	'male'
[laˈlɔb͡βu]	/lalɔb͡βu/	'to spread'
[ˈded͡ʐa]	/dɛd͡ʐa/	'above'
[ˈtulɛ]	/tulɛ/	'to push'

2.3.   Syllables
2.3.1. Syllable Structure

The maximum syllable in Dhao is CV. There are no codas. There always is a possibility for syllables to have an onset. The onset can have one consonant at most. Intervocalic consonants are syllabified as the onset of the following syllable. ʔV sequences in word-initial position clearly show that onsets are obligatory in morpheme-initial position in Dhao syllable structure. The onset can be any consonant, including the glottal stop.

The description gives a clear evidence that (1) Dhao is an open syllabic language, (2) onsets are obligatory, whereas codas are not, and (3) the syllable is of the CV type. Furthermore, investigations were done on the maximum syllable of lexical words in Dhao. In this case, lexical words are the bases for morphological processes. Most lexical words in Dhao are disyllabic and trisyllabic. Only a few content words are monosyllabic. Although some quadrisyllabic words are found in Dhao, those words are historically derived from compound forms. In disyllabic words, the initial syllable always bears the main stress (S for stress) rather than stress being put on the final syllable.

Before discussing the syllable structure of Dhao, some examples of possible syllables are presented below. The monosyllabic morphemes are presented in (25) below, where the syllable merely contains a CV. Many monosyllabic morphemes

are function words, such as /hɔ/ 'so that' and /ma/ 'toward', yet there are a number
of content words, such as /ha/ 'lung'.

(25)   Monosyllabic words
          /ca/   'a, one'
          /dɔ/   'or'
          /d͡ʐu/   REL
          /ha/   'lung'
          /hɔ/   'so that'
          /ʃɔ/   'rather'
          /ka/   PART
          /ma/   'toward'
          /na/   PART
          /rɛ/   'through'
          /si/   tag
          /tɛ/   'because, as, but'

A disyllabic word template is given in (26) and examples are in (27) below.
Disyllabic words generate one trochaic foot, wherein main stress falls on the initial
syllable. The stressed syllable is bolded.

(26)   Disyllabic template
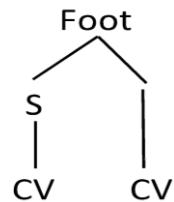
(27)   Disyllabic words
          /**ba**.ɓa/   'short'
          /**ba**.ki/   'grandfather'
          /**ca**.bu/   'soap'
          /**da**.ga/   'trade'
          /**da**.ra/   'inside'
          /**ga**.mɛ/   'to hit'
          /**ha**.ha/   'below'

/**hu**.ni/	'to hide'
/**ʃa**.mi/	'jungle'
/**ka**.kɔ/	'to walk'
/**ko**.ha/	'boat'
/**la**.d͡ʑɛ/	'to see'
/**ma**.d͡ʑa/	'face, front'
/**ŋa**.ra/	'name'
/**pa**.ɟi/	'flag'

In trisyllabic words, the initial syllable has no stress and the main stress falls on the penultimate syllable. The template for trisyllabic words is given in (28) and the examples are in (29).

(28) Trisyllabic template

(29) Trisyllabic words

/ba.**bɔ**.rɔ/	'outside'
/de.**de**.na/	'same age'
/ʃi.**ho**.na/	'moringa'
/ka.**ka**.ra/	'chest'
/ka.**lɛ**.tɛ/	'bridge'
/ka.**ta**.ŋa/	'cover'
/la.**lu**.d͡ʑu/	'uncooked rice'
/li.**mu**.ri/	'latter'
/ma.d͡ʑ**a**.sa/	'ripe'
/na.**nɛ**.nɛ./	'to listen'
/pa.d͡ʑ**a**.nɛ/	'to bury'
/pa.**ʃu**.ʃu/	'to point'
/sa.**gɔ**.rɔ/	'hot'
/ta.**ŋa**.ɗa/	'anchor'

Quadrisyllabic words generate two trochaic feet. However, when four syllables come together, main stress falls on the penultimate syllable (see 2.3.3). The stress on the initial syllable becomes secondary in this given context. In this thesis, I qualify the first foot as weak and the second foot as strong. The penultimate syllables that have main stress are bolded.

(30)   Quadrisyllabic template
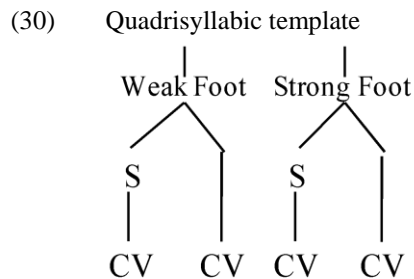
(31)   Quadrisyllabic words

/hɔ.lɔ.**nɔ**.ri/	'word of God'
/ka.ba.**ra**.i/	'public'
/ka.ba.**lɔ**.si/	'snail'
/pa.ta.**bu**.li/	'to release'
/pa.ka.**sɛ**.ti/	'to force'
/da.ra.**ma**.ga/	'quay'
/ca.pa.**ɟi**.li/	'be amused'

In this thesis, those quadrisyllabic words are analyzed as words that were compounds originally, because their semantic properties are related to other disyllabic words. For instance, the word *kabarai* /ka.ba.**ra**.i/ 'public' is derived from two forms: *kaba* 'shell' and *rai* 'land/region'. The word *holonori* /hɔ.lɔ.**nɔ**.ri/ 'word of God' is derived from *holo* 'advice' and *nori*. The form *nori* can be interpreted in two ways: firstly, as a loan from Rotenese that means 'lesson', and secondly, it may have developed from the Dhao word *muri* 'to live' which has undergone a phonological change through assimilation.

Syllabification of vowel sequences, diphthongs, and long vowels in Dhao pose some complications. A vowel sequence may come with or without glides. For those with no glides, such as [aɛ] in [ˈdaɛ] 'shore' and [aɔ] in [kaˈbaɔ] 'water buffalo', the syllabification is simple. That is, the second vowel is syllabified into the following syllable. This is proven by the fact that the stress assignment is on the preceding CV, indicating the penultimate position. Examples are given in (32) below.

(32)   Syllabification of vowel sequence without glides

CV.V	/**da**.ɛ/	'shore'
	/**lɔ**.ɛ/	'cave'
	/**hɛ**.ɔ/	'aglow'
CV.CV.V	/ka.**dɛ**.a/	'yarn roller'
	/ba.**da**.ɛ/	'north'
	/ka.d͡ʐɔ.ɛ/	'to hang'
	/pa.d͡ʐa.ɛ/	'to speak'
	/ka.**ba**.ɔ/	'water buffalo'
CV.V.CV	/ma.ɛ.na/	'to hope'

The existence of glides in vowel sequences can result in two different forms of analysis. First, glides appear as onsets, and second, glides appear as codas. In (34) below, these two different forms of analysis are termed Pronunciation I and Pronunciation II respectively. For example, in [ˈ**bi**.ʲa] 'heavy' the glide [j] appears as an onset, while in [**na**w] 'clump' the glide [w] appears as a coda. However, as presented previously, Dhao has an open syllabic system, which implies that a coda would be impossible. The only way of analyzing the syllabification of the latter is to treat the glide [w] as an onset and the vowel [u] as the nucleus, resulting in [ˈ**na**.ʷu]. As a result, the analysis in Pronunciation II in (34) applies, and not Pronunciation I.

(33)   Syllabification of vowel sequence with glides

CV.CV	[**bi**.ʲa]	*bia*	'heavy'
	[**bo**.ʷa]	*boa*	'k.o.tree'
	[**cu**.ʷɛ]	*cue*	'one'
CV.CV.CV	[pa.**lo**.ʷa]	*paloa*	'liken'
	[ka.**b͡βi**.ʲɛ]	*kabhie*	'to press'
	[ka.**bu**.ʷi]	*kabui*	'pea'
CV.CV.V.V	[ko.ʷ**a**.aɔ]	*koaao*	'be arrogant'
CV.CV.CV.V	[hu.ʷa.**la**.a]	*hualaa*	'gold'

(34)   Syllabification of vowel sequence with glides

Pronunciation I	Pronunciation II	Meaning
[**na**w]	[**na**.ʷu]	'clump, group'
[d͡ʐ**ɨ**w]	[d͡ʐɨ.ʷu]	'to leave'
[pa.**ŋa**w]	[pa.**ŋa**.ʷu]	'be mine'
[pa.**d͡ʐa**w]	[pa.**d͡ʐa**.ʷu]	'to divide'
[pa.**ka**j]	[pa.**ka**.ʲi]	'to hook'

[ka.lay.**ŋe**.la]	[ka.la.ʲi.**ŋe**.la]	'k.o.plant'
[la.ʔi.**a**ː.ɛ]	[la. ʔi.ʲ**a**ː.ɛ]	'guy'
[ka.ba.**ray**]	[ka.ba.**ra**.ʲi]	'island'
[**da**j]	[**da**.ʲi]	'enough'

When the schwa /ə/ appears in the penultimate syllable of lexical words, it is always followed by high vowel [i] or [u], which fills the nucleus position. As such, they are mapped into one syllable unit, as demonstrated by the syllable tree in (35) below. The syllabification applies for the examples in (36).

(35)   Syllable template with diphthong
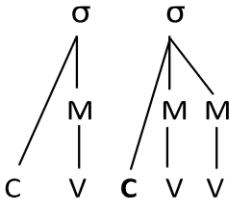
(36)   Diphthongs

Monosyllabic	[bəi]	/bəi/	'grandmother'
	[dəi]	/dəi/	'to like'
	[həi]	/həi/	'also'
	[kəi]	/kəi/	'to dig'
	[nəi]	/nəi/	REM.SG
	[səi]	/səi/	REM.PL
	[rɵu]	/rəu/	'leaf'
	[ʔɵu]	/ʔɔu/	'2SG'
Disyllabic	[ta.nəi]	/tanəi/	'intestine'
	[ka.rəi]	/karəi/	'to question'
	[ka.ɹɵu]	/kaɹəu/	'far'
	[ka.hɵu]	/kahəu/	'injury'
	[ma.rəi]	/marəi/	'wake up'
	[pa.rəi]	/parəi/	'to wake s.o.up'

Syllabification in Dhao correlates with length and stress, where stress always falls on the penultimate syllable. Long vowels are confined to trochaic feet that also maintain stress on the penultimate position. Long vowels in Dhao are considered to be two identical vowels. Each vowel is mapped onto a different syllable. For

example, [ˈʔuː] 'to kiss' is syllabified as [ˈʔu.u], where the first [u] is syllabified into the first syllable with [ʔ] as its onset. Meanwhile, the other [u] is syllabified into the following syllable. The examples of syllabification of long vowels are given in (37) below. The stressed syllables are in bold.

(37)   Syllabification of long vowels (VV)

[**a**.a]	/aa/	'and'
[**ʔu**.u]	/ʔuu/	'to kiss'
[**ŋa**.a]	/ŋaa/	'what'
[**ra**.a]	/raa/	'blood'
[a.**a**.dɔ]	/aadɔ/	'be absent'
[ma.ta.**ri**.i]	/matarii/	'nurse'
[ma.ta.**rɔ**.ɔ]	/matarɔɔ/	'boat crew'
[pa.i.**i**.a]	/paiia/	'make peace'
[pa.i.**i**.ɛ]	/paiie/	'be careful'

Any consonant following schwa [ə] must be lengthened. Consequently, an example, such as [ˈkəpːɛ] 'to catch', may be possibly analyzed in three ways, as shown in (38) below.

(38)   Syllabification of lengthened consonants
(a)   [ˈkə | pːɛ]
(b)   [ˈkəp | pɛ]
(c)   [ˈkə p̲ː ɛ]

In order to account for the syllabification of words containing lengthened consonants, the distribution of a possible nucleus should be explicated first. In §2.2.3.7 above, it has been explicated that a schwa would only occur in initial and medial position and never in final position. In this respect, the syllable in (38)a is impossible. The syllabification as in (38)b implies that the lengthening counts as two segments, one in each syllable. If so, it would create a coda in the first syllable, which would be impossible because Dhao does not have codas at all. In this thesis, the phenomenon of consonant lengthening is analyzed as a strategy to fulfill syllable weight. In this regard, the syllabification is analyzed based on morae, rather than CV structure. The lengthened consonants after the schwa [ə] must be analyzed as ambisyllabic unit that has two moras (Duanmu, 2008:57); it belongs to two syllables at the same time. Therefore, the analysis in (38)c is the best possible structure of this type of syllable. This is explicated in the syllable tree in (39) below. Examples are given in (40).

(39)   Syllable template with lengthened consonants
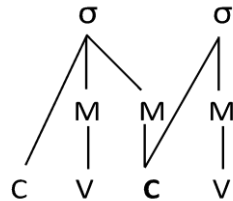
(40)   Lengthened consonants

[ˈʔət̪:a]	/ət̪a/	'to tap'
[ˈʔɜr̪:ɛ]	/ər̪ɛ/	'to pull'
[ˈʔət̪:u]	/ət̪u/	LOC
[ˈnəŋ:u]	/nəŋu/	'3SG'
[ˈɟət̪:u]	/ɟət̪u/	'to pick'

2.3.2. Diphthongization

The following examples show diphthongs in the final syllable. Because the schwa cannot stand independently as a nucleus in a final position, it requires high vowels /i/ and /u/ to follow. Therefore such a unit of sound is regarded as a diphthong. This kind of diphthong never occurs in word medial position. An exception is the word [ˈhəiʸa] 'then, afterwards'.

(41)   Diphthongs

[bəi]	/bəi/	'grandmother'
[dəi]	/dəi/	'to like'
[səi]	/səi/	REM.PL
[həi]	/həi/	'also'
[kəi]	/kəi/	'to dig'
[nəi]	/nəi/	REM.SG
[ʔɵu]	/ʔəu/	'2SG'
[rɵu]	/rəu/	'leaf'

2.3.3. Stress Assignment

Dhao has fixed stress, which is on penultimate syllables. Stress placement does not distinguish meaning, therefore, it is not necessary to mark stress in the orthography. As mentioned previously, stress is predictable on the penultimate syllable (see Walker, 1982; Grimes, 2010). In section (§2.3.1), it has been demonstrated that words with more than two syllables distinguish a primary and a secondary stressed

syllable. In this section, the discussion focuses on stress on both word as well as phrase level.

One way to account for stress assignment is to adopt a representation in which the feature [stress] is attached to syllables rather than to vowels. The stress on the penultimate syllable can be seen in trisyllabic or quadrisyllabic words. This interpretation leads the analysis that long vowels are actually two identical vowels, each of which belongs to a different syllable. Take the example [ˈɔːˀdɛ] 'very' that applies an initial long vowel. It follows the stress rule as seen in (42)a below. The final long vowel, such as [kaˈnuː] 'squid' is visualized as in (42)b.

(42)　　Stress Assignment

a) [ɔ ɔ d ɛ]_{word}

$$\sigma \rightarrow [+\text{stress}] / \underline{\quad} \quad \sigma \,]_{\text{word}}$$

b) [k a n u u]_{word}

$$\sigma \rightarrow [+\text{stress}] / \quad \underline{\quad} \quad \sigma \,]_{\text{word}}$$
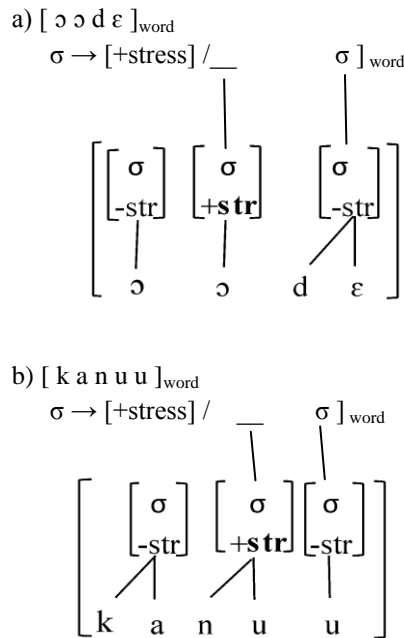
The analysis above confirms that Dhao has fixed stress. Stress is not contrastive. Disyllabic roots have stress on the first syllable which is retained when roots take prefixes or are partially reduplicated in a morphosyntactic process. The examples of roots taking the prefix *pa-* are shown in (43) below. As is shown, the main stress is retained on the initial syllable of bisyllabic roots, as in the word [ˈʔad͡ʐu] 'hard' > [pa-ˈʔad͡ʐu] 'cause X hard'. For trisyllabic roots, the main stress falls on the penultimate syllable and is retained when prefixed with *pa-*, as in the word [maˈmuri] 'alive' > [ˌpa-maˈmuri] 'make X alive'. In such a context, the antepenultimate syllable gets secondary stress. More examples with the fixed stress are evidenced by partial reduplication as shown in (44) below.

(43)   Stress assignment and prefixation

    [ˈʔad͡ʐu]   'hard'   >   [pa-ˈʔad͡ʐu]   'cause X hard'

    [ˈguri]   'to collapse'   >   [pa-ˈguri]   'to make X collapse'

    [ˈɟˈər:a]   'to suffer'   >   [pa-ɟər:a]   'cause X suffer'

    [ˈkakɔ]   'to walk'   >   [pa-ˈkakɔ]   'to run X'

    [maˈnahu]   'to fall'   >   [ˌpa-maˈnahu]   'to cause X fall'

    [maˈmuri]   'alive'   >   [ˌpa-maˈmuri]   'make X alive'

(44)   Stress assignment and reduplication

    [ˈˈʔab͡βu]   'to get'   [ʔa-ˈʔab͡βu]   'thought, idea'

    [ˈʔaʃa]   'to learn, teach'   [ʔa-ˈʔaʃa]   'lesson'

    [ˈʔər:a]   'be strong'   [ʔa-ˈʔər:a]   'strength'

    [ˈʔɛɔ]   'to herd'   [ʔa-ˈʔɛɔ]   'way of shepherd'

    [ˈɟər:a]   'difficult'   [ɟa-ɟər:a]   'difficulty,
                                                                                      affliction, in labor'

    [ˈlahɔ]   'be destroyed'   [la-ˈlahɔ]   'powder'

    [ˈmahɔ]   'be cold'   [ma-ˈmahɔ]   'shade'

    [ˈpəd:a]   'be sick'   [pa-ˈpəd:a]   'sickness'

    [ˈd͡ʐoka]   'only'   [d͡ʐo-ˈd͡ʐoka]   'only'

    [ˈŋa:]   'what'   [ŋa-ˈŋa:]   'anything'

2.4. Reduced Forms

The reduced forms frequently are found in demonstratives, prepositions, numerals, and personal pronouns. The schwa always gets avoided in this reduction, as it lacks syllable weight (see §2.2.3.7). As demonstrated in (45), a penultimate schwa is removed from bisyllabic forms, which then result in monosyllabic forms. This reduction may simply result in CV syllables, such as /əci/> /ci/ 'one' and /ətu/ > /tu/ 'LOC'. Alternatively, it may create new monosyllables by removing the penultimate schwa and the subsequent onset, such as /nəŋu/> /nu/ '3SG' and /səra/> /sa/ 'DIST.PL'. For monosyllabic forms with schwa, the schwa is simply removed, like in /nəi/ > /ni/ 'REM.SG' and /səi/> /si/ 'REM.PL'. The reduction of /əd͡ʐi/> /ti/ '1PL.in' is constrained perhaps due to a building block where the form *ti* has been used as its corresponding clitic. The schwa in /əu/ '2SG' is simply reduced to /u/.[3]

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[3] It is unproductive, although some speakers admit its existence.

(45)   Reduction of forms with schwa
         /ʔəci/   >   /ci/   'one'
         /ʔəd͡ʐi/   >   /ti   '1PL.in'
                                 (/d͡ʐi/)
         /əːna/   >   /na/   DIST.SG
         /ʔətu/   >   /tu/   LOC
         /ʔəu/   >   (/ʔu/)   '2SG'
         /nəi/   >   /ni/   REM.SG
         /nəŋu/   >   /nu/   '3SG'
         /ŋəti/   >   /ti/   'from'
         /rəŋu/   >   /ru/   '3PL'
         /səi/   >   /si/   REM.PL
         /səra/   >   /sa/   DIST.PL

The examples in (46) below demonstrate that the reduction of bisyllabic forms
without schwa is always based on a CV syllable. This may be the final syllable, such
as /ʔasa/ > /sa/ 'to' or initial syllable, such as /miu/ > /mi/ '2PL'.

(46)   Reduction of forms with no schwa
         /ʔasa/   >   /sa/   'to'
         /ɟaʔa/   >   /ɟa/   '1SG'
         /ɟiʔi/   >   /ɟi/   '1PL.ex'
         /miu/   >   /mi/   '2PL'
         /nɛʔɛ/   >   /nɛ/   PROX.SG
         /sɛʔɛ/   >   /sɛ/   PROX.PL

The examples in (47) show reduction of words consisting of three and four syllables.
Three syllables are reduced to two syllables, such as /karara/ > /rara/ 'yellow'[4],
whereas four syllables are reduced to three syllables, such as /tasamia/ > /samia/
'how'. Other words, like /kanana/ 'betel' and /lɔɗɔ/ 'sun' can only be reduced on
phrase level. No rule has been found to account for the reduction in this regard.

(47)   Reduction of other forms
         /karara/   >   /rara/   'yellow'
         /lamusi/   >   /musi/   'seed'
         /tasamia/   >   /samia/   'how'
         /kapɛpɛ   kanana/   >   /kapɛpɛ nana/   'betel-nut container'
         round-like betel

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[4] The reduced form *rara* denotes 'a bit yellow', so there is a meaning shift here.

/lɔɗɔ pana/   >   /lɔ pana/   'sunny (hot)'
  sun hot

As has been explained in §2.3.1, syllable units always are trochaic, consisting of one stressed syllable (primary stress) and another unstressed syllable (secondary stress). This template is used for the reduction of words. The examples in (48) are frequently reduced forms of phrases or compounds. For instance, the phrase *doe ne'e* 'today' is pronounced with two trochees [ˈdɔɛˈnɛʔɛ]. The initial foot reduces the vowel [ɛ] and and the second foot reduces the glottal and then lengthens the vowel [ɛ]. This reduction results in one single trochee [dɔˈnɛː], preceded by an unstressed syllable. Meanwhile the phrase [ˌdɛɔˈəːnːa] 'just now' is reduced to one single trochee [ˈdɔːˌna] followed by an unstressed syllable. The same also applies to the four syllable word [ˌboʷaˈraka] 'box for clothes' where the vowel [a] is reduced [boˈraka]. The phrase *sangae èèna* [saŋaɛəːnːa] 'that is all' and *kacui aai* [ˈkacuʷiˈʸaʸi] have heavy vowels in inter-phrasal position. Such a heavy vowel is reduced and retains only one vowel to satisfy the nuclei and form a trochee.

(48)   Metrical feet

    [ˌdɔɛˈnɛʔɛ]   >   [dɔˈnɛː]   'today'
    doe ne'e   *do ne*

    [ˌdɛɔˈəːnːa]   >   [ˈdɔː na]   'just now'
    deo èèna   *doo na*

    [ˌsəmːiˈəːnːa]   >   [səˈmənːa]   'be like that'
    sèmi èèna   *sèmèna*

    [ˌhuʷaˈiːʸa]   >   [huˈʷiʸa]   'honorable'
    hua iia   *huʷia*

    [ˌboʷaˈraka]   >   [boˈraka]   'box for clothes'
    boaraka   *boraka*

    [ˌsaŋaɛˈəːnːa]   >   [saˈŋənːa]   'that is all'
    sangae èèna   *sengèna*

    [ˌkacuʷiˈʸaʸi]   >   [ˈkacuˈʷaʸi]   'hand'
    kacui aai   *kacu ai*

2.5. Loan Words

The analysis of Dhao syllable structure in §2.3.1 above showed that Dhao has an open syllabic system. Table 2.12 shows Kupang Malay/Indonesian examples that include person names and content words where original final codas are deleted. Not only are simplex codas deleted, such as /s/ in [ˈto.mas] > [ˈto.ma], complex codas such as /ks/ in [ˈʔalɛks] > [ˈʔalɛ] are deleted as well. Codas in word-medial position are also omitted, as shown by the example of /m/ in [ˈʔam.pun] > [ˈʔa.b͡βɔ] 'forgiveness' and /n/ in [ˈban.tu] > [ˈba.tu] 'to help'.

Table 2.12: Deletion of codas in all position

Malay/Indonesian	Dhao	gloss
[ˈʔam.pun]	[ˈʔa.b͡βɔ]	'forgiveness'
[ˈban.tu]	[ˈba.tu]	'to help'
[ˈber.nat]	[ˈbe.na]	'person name'
[ˈcon.toh]	[ˈcɔ.tɔ]	'example'
[ˈgun.tiŋ]	[ɟu.tɛ]	'to cut with scissors'
[ˈkam.puŋ]	[ˈka.b͡βɔ]	'village'
[ˈmam.pu]	[ˈma.pu]	'be able to'
[pe.ˈrin.tah]	[pa.ˈre.d͡ʐa]	'to govern, command'
[ˈsam.po]	[ˈsa.pɔ]	'shampo'
[ˈsum.pah]	[ˈsu.b͡βa]	'oath'
[ter.ˈba.lik]	[ta.ˈba.lɛ]	'be upside down'
[ter.ˈboŋ.kar]	[ta.ˈbo.ka]	'be uncovered'
[ˈtiŋ.kat]	[ˈti.ka]	'level'
[ˈto.mas]	[ˈto.ma]	person name
[ʔus]	[ʔu]	person name
[ˈʔalɛks]	[ˈʔalɛ]	Person name

There are, however, loans in Dhao where codas are found still, particularly in person names and content words. Table 2.13 below shows that these loan words have been adapted to the native phonology of Dhao, but they nevertheless retained their codas. In this context, codas are not only preserved in word-medial position but also in word-final position. Take the word [far.ˈlaːk] 'plastic mat', for example. The loan fricative phoneme /f/ has been adapted as a voiceless stop /p/ in an onset position, and the coda of the final syllables /k/ has been deleted. The coda of the initial syllable /r/ has been preserved. A comparable though different strategy occured in the word [ˈprɔ.jɛk] 'project', where the original consonant cluster onset is broken up through vowel epenthesis, but the coda of the final syllable /k/ still is maintained.

The same applies to codas in person names. The name [ˈja.rit] contains an alveolar voiced stop coda /d/, which has become a voiceless /t/ in word final position[5]. The Indonesian palatal approximant *j* /j/ also is preserved, which Dhao lacks otherwise.

Table 2.13: Loans with coda

Malay/Indonesian	Dhao	gloss
[far.ˈla:k]	[par.ˈla:]	'plastic mat'
[ˈprɔ.jɛk]	[pa.ˈrɔ.jɛk]	'project'
[ˈja.rid]	[ˈja.rit]	person name
[Cen]	[Cen]	person name

I consider these loan words an incomplete adaptation as consequence of intense language contact between Dhao and Kupang Malay. The data obviously show that consonant clusters are broken by an epenthetic /a/. So far no other vowel is found in the corpus in relation to this epenthetic phenomenon.

Table 2.14: Vowel Epenthesis

Malay/Indonesian	Dhao	gloss
[blɛk]	[baˈlɛ:]	'can'
[ˈboslak][6]	[ˌbosaˈla:]	'mattress'
[kris]	[kaˈri:]	'kris'
[seˈtrika]	[ˌsataˈrika]	'iron'

The adaptation of loan words in Dhao also involves vowel lengthening. As seen in Table 2.15, vowels are lengthened when they occur in final syllables. The lengthened vowels are not directly adapted from corresponding vowels in loan words. Rather, the adaptation was originally borrowed from Indonesian through Kupang Malay, the local *lingua franca* of the region, (see chapter 1). In Kupang Malay, vowels in the final syllable tend to be lengthened because of stress when the previous syllable of the original Indonesian word contains a schwa (Jacob, 2001; Jacob & Grimes, 2006).

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[5] This realization typically follows the typology of Indonesian phonology.

[6] A loan from Dutch *bultzak* through local Malay.

Table 2.15: Vowel Lengthened

Malay/Indonesian	Dhao	gloss
[ge.ˈlaːs]	[ga.ˈlaː]	'glass'
[blɛk]	[ba.ˈlɛː]	'can'
[far.ˈlaːk]	[far.ˈlaː]	'plastic mat'
[kris]	[ka.riː]	person name
[saˈndaːl]	[sa.ˈd͡ʐaː]	'slippers'

The adaptation of consonants is shown in Table 2.16 below. Dhao replaces all non-native consonants in borrowings with their own corresponding native consonants. Sometimes, Dhao uses more than one adaptation strategy that would logically be possible. Take the consonant cluster [mb], which is adapted as a plain bilabial [b] or a bilabial affricate [b͡β]. The fricative [f] is adapted as [p] or [h]. The adaptation may also take place through simplification, where /nC/ clusters are simplified into affricated consonants. For example, the cluster [nd] and [nt] are simplified into an alveolar affricate [d͡ʐ], as shown by the words /tanda/>/tad͡ʐa/ 'sign' and /perintah/>/pared͡ʐa/ 'govern, command'.

Table 2.16: Consonant Adaptation

			Malay/ Indonesian	Dhao	gloss
/mb/	>	/b/	/tembaga/	/tabaga/	'copper'
		/b͡β/	/tambah/	/tab͡βa/	'to add'
/nd/	>	/d͡ʐ/	/tanda/	/tad͡ʐa/	'sign'
/t/			/perintah/	/pared͡ʐa/	'govern, command'
/ŋg/	>	/g/	/taŋgung/	/tago/	'responsible for'
/j/	>	/ʃ/	/jola/	/ʃola/	person name
/f/	>	/p/	/farlaak	/parlaa/	'plastic mat'
		/h/	/kɔrbafə/	/kɔrɔbahɔ/	place name in Rote

2.6. Orthography

The orthography of Dhao has been in development since 2000 when SIL International began their Bible translation project under *Unit Bahasa dan Budaya* (UBB) GMIT[7] *Kupang*. A practical orthography has been worked out and has been tested within the Dhao community ever since (Grimes, 2009; 2012). Its basic

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[7] GMIT stands for *Gereja Masehi Injili di Timor* (Evangelical Church of Timor).

principle is that all sounds that are contrastive in a language should be represented with distinct symbols (Cahill & Karan, 2008). This section only concerns some important points in respect to the orthography system used in this thesis. As proven in §2.2.2.3 and §2.2.3.4 above, the glottal stop /ʔ/ is obviously phonemic, and not phonetic. As such, it needs to be represented by a grapheme in the orthography of Dhao. Following the writing system of Indonesian, the national language, the glottal stop is represented with the apostrophe ('). Therefore, a Dhao word such as /ɟaʔa/ with a glottal stop in medial position is written as *ja'a* '1SG'. However, when the glottal stop occurs word-initially, such as in /ʔada/, it cannot be written as *'ada* 'custom'. In Indonesian languages the apostrophe is never used word-initially. In this thesis, glottal stops are orthographically represented only in medial position. The reason is that all simple vowels that occur word-initially have glottal stops; therefore, it is regarded as the default.The apostrophe (') is also used to mark implosive sounds, for instance the bilabial implosive /ɓ/ is represented as *b'*. Take the word /baɓa/: it is written as *bab'a* 'short'. The following four consonants use digraphs to represent them:

/b͡β/ = *bh*	/ɲ/ = *ny*
/ɗ͡ʐ/ = *dh*	/ŋ/ = *ng*

As already explicated previously, all vowels can be realized as long and they occur only word-initially and word-finally, except for the word *paiie* 'be careful'. As such, long vowels should be distinguished from short vowels in a Dhao orthography. Following (Grimes, 2010; 2012), long vowels are written as two consecutive vowels, so a word like /aːɛ/ is written as *aae* 'great, big'. A significant sound to mention in particular is the schwa /ə/. Since it is contrastive with /e/, it should also be distinguished in writing. In this thesis, I use the symbol /è/ to represent the schwa, a symbol that was already established in Walker (1982) and Grimes (2010; 2012). Fourth, whereas geminated consonants are phonetically long, too, there is no need to write them as two consecutive consonants, which would burden legibility too much. For example, the word /ˈkəpːɛ/ 'to catch' may be written as *kèppe* or *kèpe* alternatively. More complex words, such as [ˈnəŋːu] '3SG' would be too tiresome to read when written as *nèngngu* because there are two velar nasals. It is much easier to represent the velar nasal geminate by using a single digraph *ng,* as in *nèngu*. In addition to this, gemination is a consequence of the schwa, and therefore predictable in the phonological analysis of Dhao.