

Phonemic Sketch of Dohoi/Kadorih

(Austronesian: Upper Reaches of Kahayan River in Kalimantan, Indonesia)

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This paper provides a description and analysis of the Dohoi/Kadorih sound system which has been depicted only superficially so far (Santoso et al. 1984). First, in §2.1, rules for fronting, prenasalization, and nonrelease will be postulated to explain general allophones. Then, exhibiting (sub-)minimal pairs in several environments, procedures of determining phonemes and allophones (supported by acoustic correlates) follow. Consonant and vowel phonemes will be posited in §2.2–§2.6 and §3 respectively. At the same time, derivations for each allophonic realization will be specified. Distributional deviations of each context-sensitive allophone tell us which segment does not have full status as a phoneme: *l*; *y*; *β*; *d*, *n*; *e*. Diphthong is confirmed by three conditions that define diphthong status, described in §3.2.

Key words: fronting rule, prenasalization rule, nonrelease rule, acoustic correlates, conditions for a diphthong

1 Introduction

1.1 Mapping

This paper deals with an Austronesian language, Dohoi/Kadorih. §1.2 determines how the language name “Dohoi/Kadorih” is used in this paper.

Meyers et al. (2003) is the only literature that documents populations of language communities for each village along the Seruyan river. This survey remarks that speakers of “Sebaun (Dohoi)” reside around the Seruyan-East tributary (Rantau Panjang, Mongohjuoi), and around the Seruyan tributary (Tusuk Belawan, T. (Tumbang) Kalam, T. Bahan, and T. Kasai).

Table 1 summarizes the details about Language Names and demographic information of Meyers et al. (2003), Inagaki (2005), Santoso et al. (1984), Hudson (1967), and

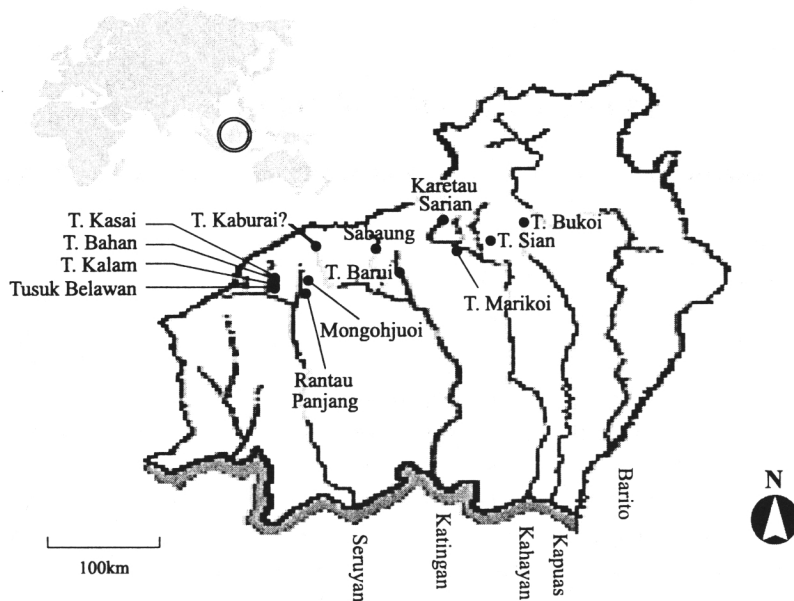


Figure 1 Central Kalimantan, Indonesia

Language Name	Population	Village	River	Researcher
Sebaun	489	Rantau Panjang	Seruyan	Meyers et al. (2003)
	254	Mongohjuoi		
Dohoi, Sebaun	153	Tusuk Belawan		
Dohoi	175	T. Kalam		
	461	T. Bahan		
(Melahoi), Dohoi	212	T. Kasai		
Dohoi/Kadorih	?	Karetan Sarian	Kahayan	Inagaki (2005)
	650?	T. Marikoi		Hudson (1967)
Dohoi	?	T. Sian		Kapuas
Ot Danum		T. Marikoi		
		T. Bukoi	Katingan	
		T. Kaburai		
		Sabaung		
		T. Barui		
Ot Danum Dayak		?		Loing (1916–17)

Table 1 Language Names, demographic information, and Researchers (T. = Tumbang)

Loing (1916–17, in Stokhof 1986: 3–16). If it is true that all language names in Table 1 refer to (certain dialects of) a single language, then the whole upstream region which includes Seruyan-Katingan-Kahayan-Kapuas (from west to east) can be recognized as the area of this single language.

1.2 Language name: Dohoi/Kadorih

People residing in the upstream region of Kahayan refer to their mother tongue by phrases *bahasa Dohoi*, *bahasa Ot Danum*, *bahasa Kadorih*, when speaking Indonesian. Santoso et al. (1984) surveyed in Tumbang Marikoi in which Inagaki (2005) surveyed, but only used the word “Ot Danum” rather than “Dohoi” or “Kadorih”.

“Ot Danum” (Mallinckrodt 1928, Cense and Uhlenbeck 1958, Santoso et al. 1984), and “Dohoi” (Hudson 1967, Wurm and Hattori 1981–83) have been referred to in much of the literatures. Hudson states that “Ot Danum” is an ambiguous term since:

- (1) a. it doesn't have a precise ethnic referent
- b. it had an original pejorative connotation (like “Dayak”)
- c. it isn't used by any group to refer to itself (Hudson 1967: 7)

“Sebaun” is a name of the language which is spoken in the upper Seruyan river. Some of the speakers recognize their language as same as “Dohoi” (Meyers et al. 2003: 11). In this paper, “Sebaun” is counted out because it is impossible to know what this language is (there is no linguistic data available).

Gordon (2005) refers to alternative names other than “Dohoi” for languages such as “Uut Danum, Uud Danum, Malahoi” and for dialects such as “Ulu Ai’ (Da’an), Ot Balawan, Ot Banu’u, Kadorih, Ot Olang, Ot Tuhup, Sarawai (Melawi), Sebaung”. In this list, “Kadorih” and “Sebaung” (probably identical with “Sebaun” in Meyers et al. 2003) are found to be dialects of “Dohoi”, but again no linguistic data of these languages/dialects can be reviewed.

For the language name in this paper, some basic criteria are used. First, *the name by which most of the people residing in the upstream region of Kahayan easily identify the referent*, i.e., *Dohoi, Ot Danum, Kadorih*.^{*1} Second, *the name by which researchers identify the referent without any difficulty*. As noted above, “Dohoi” and “Ot Danum” have been used in several studies. Third, *Hudson’s statement (1a) and (1b) must be considered*. For (1a), *ot danum* ‘source + water’ is recognized as a phrase that has a certain kind of LOCATION property, thus the referent of this phrase is regarded as a

^{*1} Hudson (1967: 7) rejects the name “Ot Danum” because it is “not used by any group” [see (1c)]. However his statement is exaggerated by the word “any”. Thus, at this stage the identifiability of the name “Ot Danum” can be reinforced.

geographical one, not as an ethnic one. For (1b), the element *ot* is associated with another lexical item *uut* ‘primitive, outdated’ that has contemptuous implications, so *bahasa Ot Danum* and *orang Ot Danum* are not preferred.

“Dohoi” is selected as the language name since it does not violate any basic criteria given above, whereas “Ot Danum” and “Kadorih” do. In addition, “Ot Danum” violates the last two criteria, while “Kadorih” that is specialized to refer to the dialect only violates the second criterion. Thus, it may be appropriate to use the name “Kadorih” for a dialect of “Dohoi” (Dohoi/Kadorih).

1.3 A classification of “Barito isolects” in Hudson (1967)

Hudson (1967) classified languages in Southern Kalimantan based on “contrastive sound correspondences” and lexicostatistics. Figure 2 shows a classification of “Barito isolects” and Hudson’s sound correspondences.

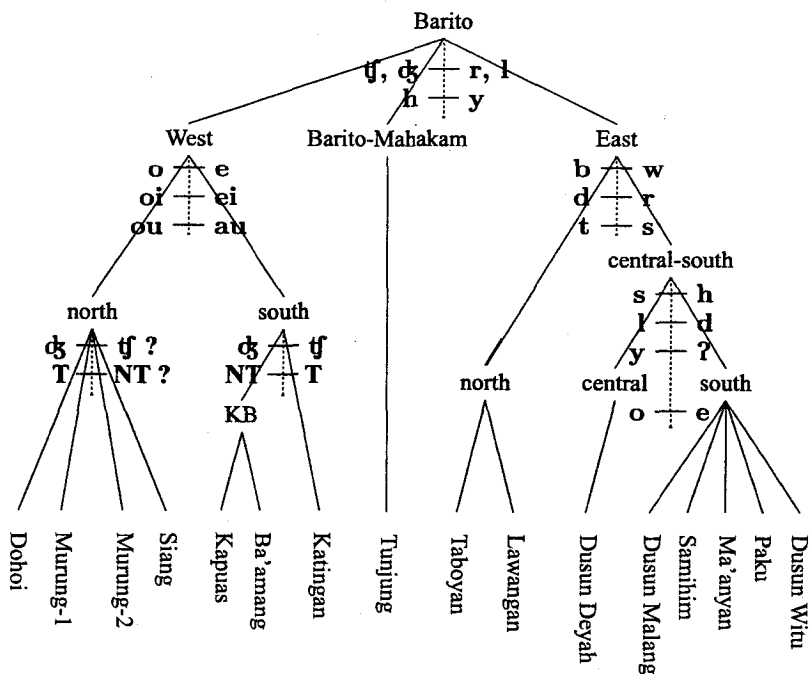


Figure 2 A classification of Barito languages
(with some modification to Hudson 1967: 26)

Hudson’s pioneering classification, however, cannot incorporate some of the exceptions that are inconsistent with his “sound correspondences”. For example, there are

ɕ/ʈ, T/NT correspondences in [Dohoi, Murung-1]/[Murung-2, Siang] which are similar to the ones between KB and Katingan (ɕ/ʈ, NT/T). But the exceptions are seen with the initial ɕ of Murung-2 as in (2a') and with the medial NT of Murung-1 as in (2b').

(2) "Sound correspondences" in "NW-Barito" (a. ɕ/ʈ, b. T/NT)

		[Dohoi	Murung-1]	/	[Murung-2	Siang]
a.	'tongue'	ɕolaʔ	ɕolaʔ	/	ʈolaʔ	ʈolaʔ
a'.	'bad'	ɕaaʔ	—	/	ɕeʔet	ʈeet
b.	'worm'	lukuŋ	—	/	luŋkuŋ	luŋkuŋ
b'.	'sibling'	ɔka	ɔŋka	/	ɔŋkaʔ	ɔŋka

There may be other exceptions that are enough to make "sound correspondences" dubious, but some part of the basic information in Hudson (1967) is presumed by Wurm and Hattori (1981–83) and Uchibori and Shibata (1992) for provisional classifications, which attempted to map languages in Borneo. At this stage, the following mapping of Dohoi/Kadorih is assumed within the scope of these previous studies, although the distinction between [Dohoi, Murung-1] and [Murung-2, Siang] is rejected.

(3) A provisional mapping of Dohoi/Kadorih in Austronesian languages

Austronesian,
 Malayo-Polynesian,
 Barito,
 West Barito,
 Northwest Barito
 Dohoi/Kadorih

2 Consonants

Dohoi/Kadorih has eighteen consonant phonemes as in Table 2.

In this section, Dohoi/Kadorih contrastive consonants in three environments (string-initial/intervocalic/string-final) ^{*2} are explored, and phonetic forms are manifested by means of the formalization of generative phonology.

^{*2} In this paper, the term *string* is employed to state the allophonic environments ('['=left edge, '[' '=right edge) rather than "word" since *string* by itself can be referred in terms of purely phonetic/phonological ground, "word" cannot on the other.

This paper does not consider consonant sequence CC entirely at the string-medial position, which is not common to all consonants.

		labial	alveolar	alveopalatal	velar	glottal
vl.	plosive	p	t		k	
vd.		b	d		g	
vl.	affricate			c		
vd.				j		
	fricative	β		s		h
	nasal	m	n	ɲ	ŋ	
	trill		r			
	flap		r			
	approximant			y		

Table 2 Dohoi/Kadorih consonant phonemes (vl. = voiceless; vd. = voiced)

When no minimal pair is known for the relevant segments, a sub-minimal pair is exhibited (marked by #). In addition, each consonant is examined on status as a phoneme from the viewpoint of its distribution.

Santoso et al. (1984) set up seventeen consonant phonemes (i.e., /p, b, t, d, c, j, k, g, s, h, m, n, ñ, ŋ, R, r, w/: there is no /y/ in the inventory). They postulate “/R/” as an archiphoneme /⟨r/1⟩/, even though “phoneme /1/ is not found in Ot Danum” (*ibid.*: 10). By definition, CONTRAST of (at least) two phonemes must be presupposed for explanation of NEUTRALIZATION, which is again presupposed for ARCHIPHONEME. But their discussion does not presuppose CONTRAST between “/r/” and “/1/”, so NEUTRALIZATION cannot be seen with these segments. In fact, (sub-)minimal pairs in (18, 19, 20) below clearly demonstrate the contrast between /r/ and “/R/” (/r/), and the lack of neutralization with these phonemes.^{*3}

Some atypical and highly specific phonetic symbols will be used: (i) CORNER + SUPERSCRIPT L [ˠ] (‘fragile’ occlusion of stops, namely no prominent release and laterally leaking airflow. see the discussion in § 2.1.3); (ii) CURLY TAIL T/D/N [ɬ, ɖ, ɳ] (plosives and nasal with alveolo-palatal fricatives [ç, ʝ] in terms of the articulatory target positions); (iii) SUBSCRIPT DOT [ɹ̣] (slightly retroflexed alveolar consonants. See Ladefoged and Maddieson (1996: 25–27) on “two degrees of retroflexion”); (iv) SUBSCRIPT W [ɸ] (simple labialization without raising of the back of the tongue. See Ladefoged and Maddieson 1996: 356–58).

^{*3} One possible explanation would be that Santoso et al. (1984) analyzed the suspensive allophones of “/R/” in the context of Indonesian phonemic contrast (/r : 1/). If so, however, this archiphonemic analysis must be rejected because the term ARCHIPHONEME can never be associated with a bizarre neutralization found outside the relevant phonemic system.

2.1 Allophones and its relevant rules

Most of allophones derived from the consonant phonemes in Dohoi/Kadorih can be explained using three rules in (4: vd. = voiced, vl. = voiceless).

- (4) a. *fronting rule*: fronted place of articulation, § 2.1.1, (7)
 b. *prenasalization rule*: predictive velic opening of vd. plosives, § 2.1.2, (10)
 c. *nonrelease rule*: unaudible releases of vl. plosives, § 2.1.3, (12)

2.1.1 Fronting rule

Alveolar and alveopalatal consonants have a series of allophones before or after *close front unrounded vowel*. More specifically, *t, d, n, r, ɾ; c, j, s, ɲ* that occur in the environment *__ (D) i* or *i __* are different from those that occur elsewhere. These *i*-adjacent allophones can be described as common in the sense of laminal phones (place of articulation: denti-alveolar; [_α]).

(5) *Alveolar/alveopalatal allophones conditioned by adjacent vowels*

[t]:	<i>tiruh</i> [t _α iruh], <i>arit</i> [ɛrit _α]	‘to sleep’, ‘sickle’
[t]:	<i>taca, tumo, terik, toru</i>	‘bush’, ‘louse’, ‘strong sunshine’, ‘three’
[^h d]:	<i>dian</i> [^h dien]	‘above’
[^h d]:	<i>daha, duhi, dera, doni</i>	‘blood’, ‘thorn’, ‘cannon’, ‘nearby’
[ɲ]:	<i>doni</i> [ɲ _α doni], <i>ohcin</i> [oh _α tɕin]	‘nearby’, ‘fish’
[ɲ]:	<i>naka, nupi, nokuh</i>	‘jackfruit’, ‘(to) dream’, ‘toward’
[ɾ]:	<i>ridu</i> [ɾi ^h du], <i>mihkir</i> [miɰkɾiɾ]	‘afraid, anxious’, ‘to deceive’
[ɾ]:	<i>rami, ruha, renge, rondorondoŋ</i>	‘thronged’, ‘concussion’, ‘to be set’, ‘Be careful!’
[ɾ]:	<i>rimo</i> [ɾimo]	‘five’
[ɾ]:	<i>ragu, rukuy, reh kai, rohi</i>	‘song’, ‘worm’, ‘price’, ‘snake’
[ɲd]:	<i>tandiŋ</i> [tɛɲdɪŋ]	‘proverb’
[ɲd]:	<i>pinda, tonduk, pander, endo</i>	‘below’, ‘horn’, ‘to say’, ‘theirs’
[t ^h]:	<i>cikar</i> [t ^h ɕikɛr]	‘fully loaded’
[t ^h]:	<i>caɕat, cucuk, cehpak, cocuruy</i>	‘underpants’, ‘small torch’, ‘rubber’, ‘funnel’
[^h d ^h]:	<i>jipon</i> [^h d ^h ɕipon]	‘slave’
[^h d ^h]:	<i>jaru, juran, jarak, jora</i>	‘eight’, ‘pot’, ‘light (lamp)’, ‘tongue’
[ɕ]:	<i>sita</i> [ɕitɛ], <i>karis</i> [kɛɾiɕ]	‘to love’, ‘kris’
[ɕ]:	<i>saku, suna, seta, sohu</i>	‘saucer’, ‘onion’, ‘seats (in a boat)’, ‘anchor’
[ɲ]:	<i>ɲihpo</i> [ɲiɰpo]	‘tooth’
[ɲ]:	<i>ɲadap, ɲuhu, ɲokok</i>	‘sap’, ‘to order, command’, ‘to cough’

On the other hand, each velar consonant also has *i*-adjacent allophones, but unlike alveolar and alveopalatal consonants, they are characterized by *advanced place of articulation* ([k̟], [ŋ̟]), not by laminality.

(6) *Velar allophones conditioned by adjacent vowels*

[k̟]:	<i>kiru</i> [k̟iru], <i>koik</i> [koik̟]	'a pair of scales', 'small'
[k]:	<i>kacu</i> , <i>kucan</i> , <i>keter</i> , <i>kotut</i>	'wood', 'thousand', 'cooking pot', 'fart'
[ᵑg̟]:	<i>giniginiᵑ</i> [ᵑgiᵑi.ᵑgiᵑiᵑ]	'inclination to make a hole in something silky smooth'
[ᵑg]:	<i>gambuh</i> , <i>gugugaga</i> , <i>gehtaᵑ</i> , <i>golembuᵑ</i>	'bounce', 'to stammer', 'wrist bracelet', 'balloon'
[ŋ̟]:	<i>ᵑiᵑa</i> [ŋ̟iᵑa], <i>oriᵑ</i> [oriᵑ̟]	'to dance', 'honey'
[ŋ]:	<i>ᵑaat</i> , <i>ᵑuhta</i> , <i>ᵑomo</i>	'bat', 'to vomit', 'to feel'

If allophones in (5) and (6) are transcribed more broadly, then, "fronted" (or "advanced") is abstracted as a common feature within these allophones. Based on this manner of transcription, the allophonic rule in (7) can be postulated concerning the noticeable realization of "frontedness".

(7) *Fronting rule* (applied to /t, d, n, r, ɾ, c, j, s, ɲ, k, g, ŋ/ in __ (D) i or i __)

$$\left[\begin{array}{c} + \text{ cons} \\ - \text{ lab} \end{array} \right] \rightarrow [+ \text{fronted}] / _ \left(\left[\begin{array}{c} + \text{ cons} \\ - \text{ son} \\ - \text{ cont} \\ + \text{ voi} \end{array} \right] \left[\begin{array}{c} - \text{ cons} \\ + \text{ high} \\ - \text{ back} \end{array} \right] \text{ or } \left[\begin{array}{c} - \text{ cons} \\ + \text{ high} \\ - \text{ back} \end{array} \right] _ \right]^{*4}$$

Note that each of the broader phonetic representations derived by the rule (7) corresponds to the narrower phonetic transcriptions, LAMINAL (5: [̟]); alveolar and alveopalatal consonants) on the one hand and ADVANCED PLACE OF ARTICULATION (6: [+]; velar consonants) on the other.

*4 The feature [fronted] is neither general nor formal in generative phonology.

Feature specifications of phonemes in this paper can be assumed as follows.

	p	b	β	m	t	d	n	ɾ	ɾ	c	j	s	ɲ	k	g	ŋ	h	y	i	u	e	o	a
consonantal	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-
sonorant	-	-	-	+	-	-	+	+	+	-	-	-	+	-	-	-	+	+	+	+	+	+	+
continuant	-	-	+	-	-	-	-	+	-	+	+	+	-	-	-	-	+	+	+	+	+	+	+
nasal	-	-	-	+	-	-	+	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-
lateral	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
voice	-	+	+	+	-	+	+	+	+	-	+	-	+	-	+	+	-	+	+	+	+	+	+
labial	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
coronal	-	-	-	-	+	+	+	+	+	+	+	+	+	-	-	-	-	+	+	-	-	-	-
anterior	-	-	-	-	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
distributed	-	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	+	+	-	-	-	-
dorsal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	+	+	+	+	+
high	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	+	+	-	-	-
low	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
back	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	+	-	+	+

2.1.2 Prenasalization rule

There are homorganic prenasalizations of voiced plosives ($[\text{N}^{\text{D}}]$) whose first portion is differentiated from the nasal segment in the sequence $[\text{ND}]$ (which appears only in the middle position) in terms of quantity and quality.

(8)	$[\text{N}^{\text{D}}]$	:	$[\text{ND}]$		
	$[\text{m}^{\text{b}}\text{eu}]$	:	$[\text{pemb}\text{eu}]$	'mouth'	: 'window'
	$[\text{d}^{\text{b}}\text{eh}\text{e}]$	:	$[\text{en}^{\text{d}}\text{do}]$	'blood'	: 'theirs'
	$[\text{d}^{\text{b}}\text{u}^{\text{r}}\text{u}]$	:	$[\text{run}^{\text{d}}\text{u}]$	'eight'	: 'lance'
	$[\text{g}^{\text{r}}\text{eh}\text{ek}\text{e}\text{n}]$	:	$[\text{ceng}\text{eu}]$	'omen'	: 'Solanum tarvum'

This articulatory and auditory observation is supported by an acoustic phonetic evidence.

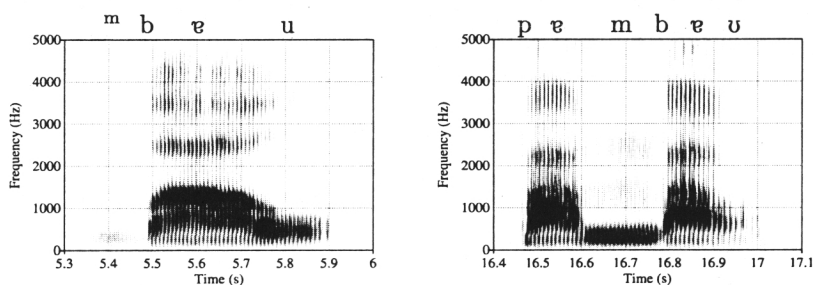


Figure 3 Spectrograms of $[\text{m}^{\text{b}}\text{eu}]$ 'mouth' and $[\text{pemb}\text{eu}]$ 'window'

Figure 3 shows the spectrograms of $[\text{m}^{\text{b}}\text{eu}]$ 'mouth' and $[\text{pemb}\text{eu}]$ 'window'. Both of these words were uttered in almost the same duration, about 600ms. Additionally, $[\text{m}^{\text{b}}\text{eu}]$ consists of a smaller number of segments than $[\text{pemb}\text{eu}]$. Therefore, $[\text{m}^{\text{b}}\text{eu}]$ was produced at a slower speech rate than $[\text{pemb}\text{eu}]$. Despite its slower speech rate, $[\text{m}^{\text{b}}]$ has a shorter duration (115ms) as a nasal segment than $[\text{m}]$ does (170ms).

Furthermore, it is confirmed that the nasal portion of $[\text{m}^{\text{b}}\text{eu}]$ is weaker than that of $[\text{pemb}\text{eu}]$ when the values of amplitude are considered concerning each of the formant poles in Figure 4.

Figure 4 shows spectra of $[\text{m}^{\text{b}}]$ in $[\text{m}^{\text{b}}\text{eu}]$ and $[\text{m}]$ in $[\text{pemb}\text{eu}]$, the former is 'sliced' at 5.4 second-point, the latter at 16.7 second-point, in each form shown in Figure 3. The values of amplitude in each resonance of $[\text{m}^{\text{b}}]$ are lower than those of $[\text{m}]$. This means that $[\text{m}^{\text{b}}]$ has a lower quality as a bilabial nasal consonant than $[\text{m}]$.

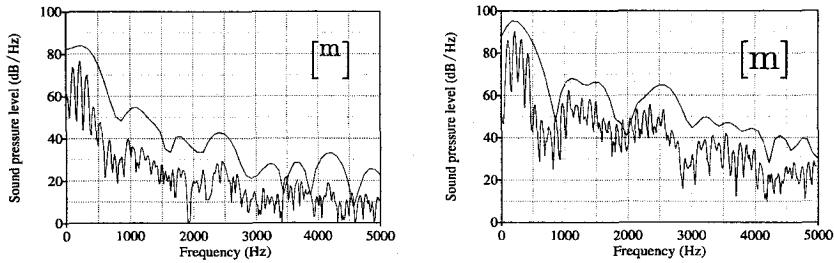


Figure 4 FFT spectra of [m] in [mbɛu] (left: @5.4 sec.) and [m] in [pembɛu] (right: @16.7 sec.) with relative curves of smoothed spectra superimposed.

In Dohoi/Kadorih, the prenasalization is observed both at the string-initial and string-medial positions, and some of the pairs contrast a prenasalized consonant and a sequence of two homorganic consonants as in (9). However, a prenasalized consonant [ʰD] and a non-prenasalized one [D] never contrast.

(9) *String-medial (only)* — b – mb, d – nd, g – ŋg / V __ V

/b/	# : /mb/	<i>tabit</i>	<i>nambit</i>	[tʰɛᵐbitʰ] : [nɛmbitʰ], ‘spiritual counsellor’ : ‘to grip’
/d/	# : /nd/	<i>ɲadap</i>	<i>ɲanda</i>	[ɲɛᵐdɛpʰ] : [ɲɛndɛ], ‘seed’ : ‘to take care of’
/g/	# : /ŋg/	<i>jagau</i>	<i>sangau</i>	[ʰdʰɛᵐgɛu] : [sɛŋgɛu], ‘male (animal)’ : ‘Solanum tarvum’

(9) shows the sub-minimal pairs of /b – mb/, /d – nd/, and of /g – ŋg/. The nasal portions of these strings are also different from each other in terms of their quantity and quality.

In the case of the prenasalization in Dohoi/Kadorih, the velum maintains intermediate positions (i.e., not fully closed or lowered) in which airflow leaks through the velar port. As a result, only a slight nasal leaking is audible. Such prenasalization can be considered to be a phonetic device to support voicing in the allophones of voiced plosive/affricate since there is no contrast between prenasalized allophone ([ʰD]) and its non-prenasalized counterpart ([D]). *⁵

Considering the property of supporting voicing as just mentioned, the allophonic rule in (10) can be postulated concerning the noticeable realization of the nasality.

*⁵ Ohala (1983: 200) points out the fact that some languages utilize prenasalization to maintain voicing contrast on a stop consonant.

- (10) *Prenasalization rule* (applied to string-initial or intervocalic /b, d, j, g/)

$$\left[\begin{array}{l} + \text{ cons} \\ - \text{ son} \\ - \text{ cont} \\ + \text{ voi} \end{array} \right] \rightarrow [+ \text{ prenasal}] / ([- \text{ nas}]) \text{ ___ } *6 \quad \left(\begin{array}{ll} /b/ & \rightarrow [{}^m b] \\ /d/ & \rightarrow [{}^n d] \\ /j/ & \rightarrow [{}^n d^{\frac{1}{2}}] \\ /g/ & \rightarrow [{}^n g] \end{array} \right)$$

Note that no [-^ND-] has been detected. Therefore, the prenasalization rule (10) is stipulated to be inactive against the postnasal /D/, which is already preceded by nasal segment /N/, in other words, ‘already prenasalized’. To put it more technically, (10) does not alter /D/ to [-^ND-] in the context ‘[+nas] ___’, and does elsewhere.

2.1.3 Nonrelease rule

There are string-final voiceless plosives that have a property “no audible release”. The voiceless plosives are only released in the string-initial/medial positions. For example:

- (11) *takip* [təkip^ʔ] ‘ladle’, *kapit* [kəpit^ʔ] ‘twin’, *potik* [potik^ʔ] ‘wasp’

As shown in (11), string-initial and intervocalic *p*, *t*, *k* must be released, while string-final ones cannot be released. The airflow for articulating *p*, *t*, *k* must be unreleased and stopped at each place of articulation in the case of string-final plosives. Thus, the allophonic rule in (12) can be postulated concerning the noticeable “no audible release”.

- (12) *Nonrelease rule* (applied to string-final /p, t, c, k/)

$$\left[\begin{array}{l} + \text{ cons} \\ - \text{ son} \\ - \text{ cont} \\ - \text{ voi} \end{array} \right] \rightarrow [+ \text{ nonrelease}] / \text{ ___ } *7 \quad \left(\begin{array}{ll} /p/ & \rightarrow [p^{\text{ʔ}}] \\ /t/ & \rightarrow [t^{\text{ʔ}}, t^{\text{ʔ}}] \\ (/c/ & \rightarrow [t^{\frac{6}{7}}, t^{\frac{6}{7}}]) *8 \\ /k/ & \rightarrow [k^{\text{ʔ}}] \end{array} \right)$$

It should be noted that phonetic forms of string-final *t* varies depending on their preceding vowels. For example:

- (13) *ucat* [ut^ʔet^ʔ] ‘neck’ *opit* [opit^ʔ] ‘sparrow’
alut [arut^ʔ] ‘canoe’
sapet [səpet^ʔ] ‘to see one’s way to’
usot [uɕot^ʔ] ‘mucus’

*6 The feature [prenasal] is neither general nor formal in generative phonology.

*7 The feature [nonrelease] is neither general nor formal in generative phonology.

*8 This rule application is included in the scope of rule (12), but the occurrence of string-final /c/ is not allowed by Dohoi/Kadorih phonotactics, therefore [t^{6/7}] never occurs.

When a vowel other than *i* precedes *t*, the airflow is incompletely obstructed at the alveolar ridge and leaks from the narrow aperture between the palate and the side of the tongue since such *t* is articulated as apical phone with slight retroflexion ([t̠]). On the contrary, when *i* precedes *t*, the airflow is completely obstructed by the laminal [t] that occludes airflow's path more extensively than apical [t̠] does.

Allophonic realizations are not affected by rule ordering, either (7 then 10 then 12), (12 then 10 then 7) etc. since these rules neither feed nor bleed each other. But if the lateral leaking noted above is taken into account, and a certain kind of rule formalization (e.g. dependency on laminality) is posited, then rule ordering will need to be considered. In this paper, conditions for the realization of [t̠^l] are described as in (14).

(14) *Conditions for the realization of [t̠^l]*

- a. /t/ at the string-final position
- b. /t/ preceded by a vowel other than /i/

2.2 Bilabial consonants

There are only three items which have initial /β/, *βayah* (*tuh*) 'now', *βarisan* 'to inherit', *βadai* 'cake, snack'. But all of these are borrowed items from Ngaju *wayah*, *wadai*, and Indonesian *warisan*. On the other hand, /β/ is widely distributed at the intervocalic position as in (16).

(15) *String-initial* — p, b, m, β / [__

/p/	: /b/	<i>puru</i>	<i>buru</i>	[puru] : [ᵐburu], 'ten' : 'body hair'
	: /m/	<i>pira</i>	<i>mira</i>	[pire] : [mire], 'how many' : 'when'
	: /t/	<i>pahi</i>	<i>tahi</i>	[pehɪ] : [tehɪ], 'ray' : 'long (time)'
/b/	: /m/	<i>bohɪt</i>	<i>mohɪt</i>	[ᵐbohɪt̠] : [mohɪt̠], 'scabies' : 'salty'
	: /d/	<i>baha</i>	<i>daha</i>	[ᵐbɛhɛ] : [ᵑdɛhɛ], 'tumor' : 'blood'
/m/	: /n/	<i>muap</i>	<i>nuap</i>	[muep̚] : [ɲuep̚], 'to open (pot cover)' : 'to yawn'

(16) *Intervocalic* — p, b, m, β / V __ V

/p/	#: /b/	<i>tapih</i>	<i>tabit</i>	[tepiχ] : [teᵐbiᵗ̠], 'sarong' : 'spiritual counselor'
	: /m/	<i>ɲopi</i>	<i>ɲomi</i>	[ɲopi] : [ɲomi], 'to hit (child discipline)' : 'to smile'
	: /β/	<i>ɲapa</i>	<i>ɲaβa</i>	[ɲepe] : [ɲeβe], 'to carry (back)' : 'to talk in sleep'
	#: /t/	<i>opan</i>	<i>otaɲ</i>	[opeɲ] : [oteɲ], 'bait' : 'sarong used as a sling'
/b/	#: /m/	<i>kabun</i>	<i>amun</i>	[keᵐbun] : [ɛmun], 'garden' : 'if'
	#: /β/	<i>bibit</i>	<i>biβih</i>	[ᵐbiᵐbiᵗ̠] : [ᵐbiβiχ], 'seed' : 'lip'
	#: /d/	<i>kabain</i>	<i>kadarah</i>	[keᵐbein] : [keᵑdɛreh], 'because of' : 'thin, meager'

/m/	# : /β/	<i>mama</i>	<i>maβak</i>	[məmɐ] : [mɐβɛk ¹],	‘uncle’ : ‘to bite’
	# : /n/	<i>ɲomi</i>	<i>ɲonih</i>	[ɲomi] : [ɲonix ¹],	‘to smile’ : ‘to hear’
/β/	: /s/	<i>uβi</i>	<i>usi</i>	[uβi] : [uɕi],	‘sweet potato’ : ‘flesh’

Of the four bilabial consonants /p, b, β, m/, only /p/ and /m/ can occur at the string-final position.

(17) *String-final* — p, m / __]

/p/	# : /m/	<i>parap</i>	<i>karam</i>	[pɐɐp ¹] : [kɐɐm],	‘cock-fighting’ : ‘liquid formed during decomposition of body’
	# : /t/	<i>tahap</i>	<i>kahat</i>	[tɐhɐp ¹] : [kɐhɛt ¹],	‘flat sieve (rice)’ : ‘pinang’
/m/	# : /n/	<i>mondam</i>	<i>pondan</i>	[monɔm] : [ponɔn],	‘to be feverish’ : ‘bat’

The contrastive bilabial consonants and relevant rules are postulated in Table 3. Note that the phoneme of voiced bilabial fricative /β/ has a very low status as a phoneme because it occurs only at the intervocalic position.

/p/	—	↗ [p ¹] ↘ [p]	/ (12) / els.	‘vl. bilabial unreleased stop’ ‘vl. bilabial plosive’
/b/	—	↗ [b] ↘ [m̥b]	/ [+nas] — / (10)	‘vd. bilabial plosive’ ‘vd. bilabial prenasalized plosive’
/β/	—	→ [β]		‘vd. bilabial fricative’
/m/	—	→ [m]		‘vd. bilabial nasal’

Table 3 Bilabial consonants and the relevant rules
(els. = elsewhere, vl. = voiceless, vd. = voiced)

2.3 Alveolar consonants

In the environment [__ i (the string-initial position followed by *i*), *t*, *r* and *r* can occur freely, but occurrences of *d* and *n* are restricted (only three items: *dikdikan* ‘to hop’; *diag* ‘upper, above’; *dindig* ‘wall’).

(18) *String-initial* — t, d, n, r, r / [__

/t/	: /d/	<i>turay</i>	<i>duray</i>	[tʉɐŋ] : [ᵀdʉɐŋ],	‘bone’ : ‘wok’
	: /n/	<i>tapa</i>	<i>napa</i>	[tɐpɐ] : [ᵀpɐpɐ],	‘cheek (outside)’ : ‘to make, do’
	# : /r/	<i>tiŋay</i>	<i>riŋan</i>	[tiŋɐŋ] : [ᵀriŋɐŋ],	‘hornbill’ : ‘wound’
	: /r/	<i>toβu</i>	<i>roβu</i>	[toβu] : [roβu],	‘sugarcane’ : ‘village’
	# : /c/	<i>tapa</i>	<i>capat</i>	[tɐpɐ] : [ᵀcɐpɐt ¹],	‘cheek (outside)’ : ‘fast’

/d/	: /n/	<i>duŋo</i>	<i>nuŋo</i>	[ⁿ ɖuŋo] : [ɳuŋo],	'to sit (relaxed)'	: 'to nod'
	Ƀ : /t/	<i>duhi</i>	<i>ruha</i>	[ⁿ ɖuhi] : [ruha],	'thorn'	: 'shaking'
	: /r/	<i>doŋan</i>	<i>roŋan</i>	[ⁿ ɖoŋən] : [roŋən],	'companion'	: 'attic'
	: /j/	<i>duɾaŋ</i>	<i>juɾaŋ</i>	[ⁿ ɖureŋ] : [ⁿ ɖ ^ɹ ureŋ],	'wok'	: 'pot'
/n/	: /r/	<i>nataŋ</i>	<i>rataŋ</i>	[nɐtəŋ] : [rɐtəŋ],	'to weave'	: 'basket'
	: /r/	<i>noβoŋ</i>	<i>roβoŋ</i>	[noβoŋ] : [roβoŋ],	'to cut down'	: 'grave'
	: /ŋ/	<i>nondu</i>	<i>ŋondu</i>	[nɔŋɖu] : [ŋɔŋɖu],	'to crow (cock)'	: 'to hiccup'
/t/	: /r/	<i>ragu</i>	<i>ragu</i>	[re ^ɹ gu] : [re ^ɹ gu],	'worried, anxious'	: 'song'
	Ƀ : /y/	<i>ratai</i>	<i>yakat</i>	[rɐtɐi] : [jɐkɐt ^ɹ],	'necklace'	: 'Get in!'
/t/	Ƀ : /y/	<i>rakep</i>	<i>yakat</i>	[rekep ^ɹ] : [jɐkɐt ^ɹ],	'trap'	: 'Get in!'

(19) Intervocalic — t, d, n, r, ɹ / V __ V

/t/	: /d/	<i>ratɪŋ</i>	<i>radɪŋ</i>	[rɛtɪŋ] : [rɛ ⁿ ɖɪŋ], ‘raft’ : ‘knife’	
Ƀ	: /n/	<i>ataŋ</i>	<i>anan</i>	[ɛtɛŋ] : [ɛnɛŋ], ‘birds of prey’ : ‘there’	
	: /r/	<i>moɾoŋ</i>	<i>moronɟ</i>	[moɾoŋ] : [moroŋ], ‘to make a knot’ : ‘straight’	
	: /r/	<i>otu</i>	<i>oru</i>	[oɾu] : [oru], ‘ghost’ : ‘although’	
	: /c/	<i>utaŋ</i>	<i>ucaŋ</i>	[uɾɛŋ] : [uɾ ^c ɛŋ], ‘debt’ : ‘deer’	
/d/	Ƀ	: /n/	<i>radok</i>	<i>ranon</i>	[rɛ ⁿ ɖok ^ɹ] : [rɛnɔŋ], ‘dagger’ : ‘awake’
	Ƀ	: /r/	<i>ɳuduk</i>	<i>ɳurug</i>	[ɳu ⁿ ɖuk ^ɹ] : [ɳurug], ‘to cut, slash’ : ‘flood’
	: /r/	<i>paɖɪŋ</i>	<i>paɹɪŋ</i>	[pɛ ⁿ ɖɪŋ] : [pɛɹɪŋ], ‘metal waistband’ : ‘most’	
Ƀ	: /j/	<i>kadarah</i>	<i>kajaraŋ</i>	[kɛ ⁿ ɖɛrɛh] : [kɛ ⁿ ɖ ^ɹ ɛrɛŋ], ‘thin, meager’ : ‘swallow’	
/n/	: /r/	<i>ŋonih</i>	<i>ŋorih</i>	[ŋonɪx] : [ŋorɪx], ‘to hear’ : ‘to drink’	
	: /r/	<i>kana</i>	<i>kara</i>	[kɛnɛ] : [(kɛhtɪp ^ɹ) kɛrɛ], ‘hit, touched’ : ‘scorpion’	
	: /ŋ/	<i>poɳaŋ</i>	<i>poɳaŋ</i>	[poɳɛŋ] : [poɳɛŋ], ‘hand + forearm’ : ‘small accessory’	
/t/	: /r/	<i>marom</i>	<i>marom</i>	[mɛrom] : [mɛrom], ‘brown’ : ‘yesterday’	
Ƀ	: /y/	<i>iroh</i>	<i>iyo</i>	[iroh] : [ijo], ‘they’ : ‘then’	
/t/	Ƀ	: /y/	<i>baras</i>	<i>bayar</i>	[^m bɛrɛɟ] : [^m bɛjɛr], ‘formative (numerals)’ : ‘to pay’

Of the five alveolar consonants /t, d, n, r, ɹ/, /t/, /n/, /r/ and /r/ can occur at the string-final position, only /d/ cannot occur.

(20) String-final — t, n, r, ɹ / __]

/t/	: /n/	<i>ucat</i>	<i>ucan</i>	[uʔ ^c et ^ɹ] : [uʔ ^c en],	'neck' : 'rain'	
	Ƀ	: /t/	<i>capat</i>	<i>tapar</i>	[t ^c epet ^ɹ] : [tɐpar],	'fast' : 'slap'
	Ƀ	: /t/	<i>bakat</i>	<i>pamakar</i>	[^m beket ^ɹ] : [pemekel],	'anchor' : 'village head'
		: /k/	<i>rout</i>	<i>rouk</i>	[rouɾ ^ɹ] : [rouk],	'betel' : 'mixed'
/n/	Ƀ	: /r/	<i>aβan</i>	<i>naβar</i>	[ɐβen] : [nɐβer],	'mark, spot' : 'to bargain'
	Ƀ	: /r/	<i>garakan</i>	<i>pamakar</i>	[^ɹ gereken] : [pemekel],	'omen' : 'village head'
		: /ŋ/	<i>nosan</i>	<i>nosat</i>	[noʃen] : [noʃen],	'to forge, weld' : 'to knit'
/t/	Ƀ	: /t/	<i>cikar</i>	<i>pamakar</i>	[t ^c iker] : [pemekel],	'fully loaded' : 'village head'

#: /s/ *suar* *huas* [cʊər] : [hʊəç], ‘lamp (hunting)’ : ‘cylinder’

The phone [ɭ] appears only at the string-final position. This phone can be determined to be an allophone of /r/ for the reason that [-ɭ] of *hayar* (‘dream, fantasy’) is altered to [-r-] when suffixed as *hayar-an* (‘dream, imagination’). In addition, [r] and [ɭ] are distributed complementarily, and the flap [ɾ] is a similar phone to the lateral approximant [ɭ] in terms of being liquids.

The contrastive alveolar consonants and the relevant rules are postulated in Table 4. Note that /d, n/ have comparatively low status as phonemes because they scarcely occur in the environment [__ i].

/t/ ↙	/ (12)	↘ [t̚]	/ (7)	‘vl. laminal alveolar unreleased stop’	*
		↘ [t̚ʰ]	/ els.	‘vl. apical alveolar unreleased stop’	
	/ els.	↘ [t]	/ (7)	‘vl. laminal alveolar plosive’	
		↘ [t̚]	/ els.	‘vl. apical alveolar plosive’	
/d/ ↙	/ [+nas] —	↘ [d̚]	/ (7)	‘vd. laminal alveolar plosive’	
		↘ [d̚]	/ els.	‘vd. apical alveolar plosive’	
	/ (10)	↘ [ᵈd̚]	/ (7)	‘vd. laminal alveolar prenasalized plosive’	
		↘ [ᵈd̚]	/ els.	‘vd. apical alveolar prenasalized plosive’	
/n/ —		↘ [ᵈ̃]	/ (7)	‘vd. laminal alveolar nasal’	
		↘ [ᵈ̃]	/ els.	‘vd. apical alveolar nasal’	
/r/ —		↘ [ɾ]	/ (7)	‘vd. advanced alveolar trill’	
		↘ [r]	/ els.	‘vd. alveolar trill’	
/ɾ/ ↗	/ [__]	→ [ɭ]		‘vd. apical alveolar lateral approximant’	
	/ els.	↘ [ɾ]	/ (7)	‘vd. advanced alveolar flap’	
		↘ [ɾ]	/ els.	‘vd. alveolar flap’	

Table 4 Alveolar consonants and the relevant rules (els. = elsewhere, vl. = voiceless, vd. = voiced, * = plus laterally leaking airflow)

2.4 Alveopalatal consonants

As regarding initial /y/, there are only two items *yo* ‘Yes!’, *yakat* ‘Get in!’, and furthermore these items are semantically contentless.

(21) *String-initial* — c, j, s, ŋ, y / [__

/c/	#: /j/	<i>caβat</i>	<i>jaβau</i>	[t̚ʰeβet̚ʰ] : [ᵈd̚ʰeβeʊ], ‘underpants’ : ‘cassava’
	#: /s/	<i>curuk</i>	<i>suruh</i>	[t̚ʰuruk] : [cʊruḥ], ‘torch’ : ‘bud’
	#: /ŋ/	<i>caβat</i>	<i>ŋaβot</i>	[t̚ʰeβet̚ʰ] : [ŋeβot̚ʰ], ‘underpants’ : ‘to ask for’

	# : /y/	<i>capat</i>	<i>yakat</i>	[tʰɛpɛtʰ] : [jɛkɛtʰ], ‘fast’ : ‘Get in!’
	# : /k/	<i>caβat</i>	<i>kaβah</i>	[tʰɛβɛtʰ] : [kɛβɛh], ‘underpants’ : ‘big pot’
/j/	# : /s/	<i>jara</i>	<i>sara</i>	[ʰdʰɛrɛ] : [ɛrɛ], ‘net’ : ‘wrong’
	# : /ŋ/	<i>jara</i>	<i>ŋarau</i>	[ʰdʰɛrɛ] : [ŋɛrɛu], ‘net’ : ‘to stick one’s tongue out’
	# : /y/	<i>jaat</i>	<i>yakat</i>	[ʰdʰɛtʰ] : [jɛkɛtʰ], ‘bad’ : ‘Get in!’
	# : /g/	<i>jambu</i>	<i>gambuh</i>	[ʰdʰɛmbu] : [ʰgɛmbuh], ‘Eugenia’ : ‘bounce’
/s/	# : /ŋ/	<i>saβut</i>	<i>ŋaβot</i>	[ɛβutʰ] : [ŋɛβotʰ], ‘fibrous root’ : ‘to ask for’
	# : /y/	<i>sout</i>	<i>yo</i>	[ɛoutʰ] : [jo], ‘bamboo spikes’ : ‘Yes!’
	# : /h/	<i>sama</i>	<i>hama</i>	[ɛmɛ] : [hɛmɛ], ‘alike, similar’ : ‘termite’
/ŋ/	# : /y/	<i>ŋakahak</i>	<i>yakat</i>	[ŋɛkɛhɛkʰ] : [jɛkɛtʰ], ‘spit out phlegm’ : ‘Get in!’
	# : /ŋ/	<i>ŋanda</i>	<i>ŋandah</i>	[ŋɛndɛ] : [ŋɛndɛh], ‘to pawn’ : ‘happy’

There are only five items that possess intervocalic /y/: *bayar* ‘to pay’; *hayar* ‘to dream’; *iyō* ‘then’; *kabaya* ‘a long-sleeved blouse’; *rayar* ‘sail’.

(22) Intervocalic — c, j, s, ŋ, y / V __ V

/c/	# : /j/	<i>taca</i>	<i>tajak</i>	[tɛtʰɛ] : [tɛʰdʰɛkʰ], ‘bush’ : ‘spade’
	# : /s/	<i>tocah</i>	<i>tosan</i>	[tɔtʰɛh] : [tɔɛn], ‘dry’ : ‘metalwork’
	# : /ŋ/	<i>bacaj</i>	<i>maŋan</i>	[mɛtʰɛɛ] : [mɛŋɛn], ‘top’ : ‘eaglewood’
	# : /y/	<i>bacaj</i>	<i>bayar</i>	[mɛtʰɛɛ] : [mɛjɛr], ‘top’ : ‘to pay’
	# : /k/	<i>bacaj</i>	<i>bakaj</i>	[mɛtʰɛɛ] : [mɛkɛn], ‘top’ : ‘spider’
/j/	# : /s/	<i>puji</i>	<i>pusit</i>	[puʰdʰi] : [puɛtʰ], ‘ever’ : ‘shattered’
	# : /ŋ/	<i>ŋujum</i>	<i>muŋuŋ</i>	[ŋuʰdʰum] : [muŋuŋ], ‘to stick one’s tongue in one’s cheek’ : ‘to sharpen to a point’
	# : /y/	<i>ijo</i>	<i>iyō</i>	[iʰdʰo] : [ijo], ‘COMPLIMENTIZER’ : ‘then’
	# : /g/	<i>pajak</i>	<i>pagar</i>	[pɛʰdʰɛkʰ] : [pɛʰgɛr], ‘tribute’ : ‘fence’
/s/	# : /ŋ/	<i>kasou</i>	<i>kaŋou</i>	[kaɛou] : [kaŋou], ‘rafters, joist’ : ‘head hunter’
	# : /y/	<i>isou</i>	<i>iyō</i>	[iɛou] : [ijo], ‘chopper’ : ‘then’
	# : /h/	<i>osu</i>	<i>sohu</i>	[oɛu] : [ɛohu], ‘grandchild’ : ‘to move downstream’
/ŋ/	# : /y/	<i>maŋan</i>	<i>bayar</i>	[mɛŋɛn] : [mɛjɛr], ‘eaglewood’ : ‘to pay’
	# : /ŋ/	<i>maŋan</i>	<i>maŋan</i>	[mɛŋɛn] : [mɛŋɛn], ‘eaglewood’ : ‘red (pepper)’

It should be clarified how the affricate [tʰɛ] differs from the plosive [t] and the fricative [ɛ] in terms of the plosive- and fricative-like portion of the affricate.

In Figure 5, the sound associated with closure for the [t] can be seen between 4.7–4.93 sec. in the leftmost panels, and for its release burst between 4.93–4.94 sec. In comparison, the release burst of the [tʰɛ] in the middle panels (12.45–12.47 sec.) is modified as a prolonged frication whose spectrogram activity is similar to that of the sound associated with the [ɛ] in the rightmost panels (5.03–5.17 sec.).

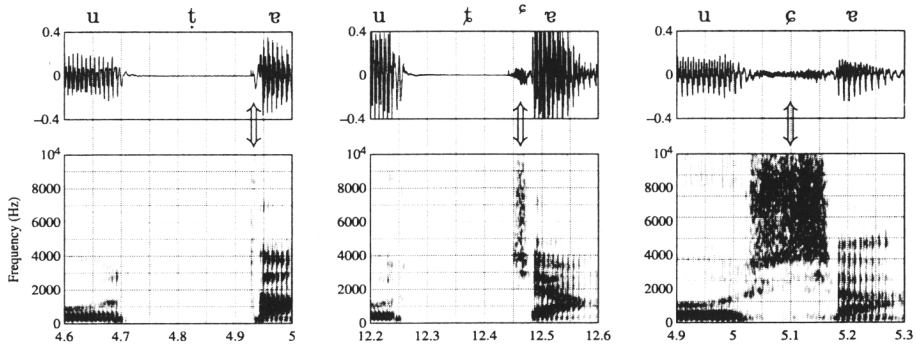


Figure 5 [uɬɐ], [uɬʰɐ], and [uɕɐ]: expanded portions of the waveforms (upper panel) and spectrograms (lower panel) cut out from the words *utaŋ* ‘debt’, *ucaŋ* ‘deer’, and *susah* ‘poor’.

There are two reasons to construe the affricate as a single unit. First is that the portion of frication in an affricate is not of as much duration as in a fricative so that the portion of frication depends on the preceding segment [t] as the release burst of a plosive does. Second is that the sequence such as plosive–fricative (e.g. [tɕ]) does not otherwise occur in Dohoi/Kadorih.

The affricate /c/ does not occur at the string-final position, thus this phoneme is included in a subset of obstruents different from voiceless plosives and fricatives which occur at the string-final position (/p, t, k; s, h / __]).

Of the five alveopalatal consonants /c, j, s, ɲ, y/, only /s/ can occur in string-final position. There are only three items which have the final /-is/ sequence, *karis* ‘kris’, *kumis* ‘moustache’, and *pariŋgis* ‘trowel’. On the contrary, /-as/, /-us/, and /-os/ occur extensively at the string-final position.

(23) *String-final* — s / __]

/s/	ɬ: /h/	<i>haus</i>	<i>auh</i>	[hɐuɕ]: [ɐuh], ‘thirsty’: ‘voice’
		<i>bahkas</i>	<i>ahkah</i>	[^m bɐhkɐɕ]: [ɐhkɐh], ‘male (human)’: ‘spiraling upward’
		<i>manas</i>	<i>panah</i>	[mɐɲɐɕ]: [pɐɲɐh], ‘bead’: ‘bow’

The approximants [ɕ] and [ç] can appear only at the string final position, and they are in free variation with canonical allophonic realization of the fricative /s/ ([ɕ], [ç]). For instance, *poros* ‘ache, ill’ is pronounced as [poroɕ] or [poroç]. Spectrograms covering frequency upto 10,000Hz is represented in Figure 6.

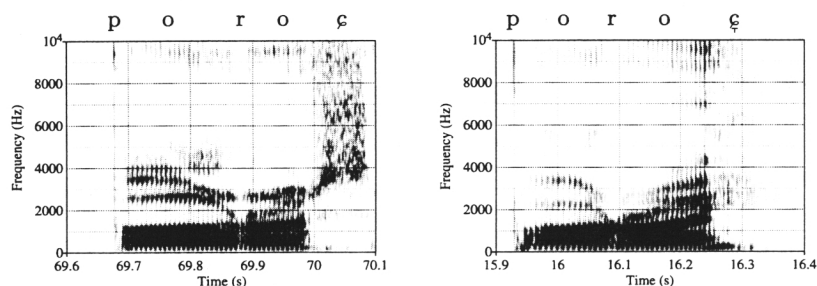


Figure 6 Spectrograms of [poroɕ] and [poroʃ] ('ache, ill': in free variation)

The spectrogram activity (especially 4,000–8,000Hz) of [ɕ] in the right panel in Figure 6 is clearly weaker than the one of [ɕ] in the left panel.

The contrastive alveopalatal consonants and the relevant rules are postulated in Table 5. Note that the phoneme /y/ has little status because there are only seven items for /y/.

/c/	_____	↘	[tʃʰ]	/ (7)	'vl. laminal alveopalatal affricate'	
			[tʃ]	/ els.	'vl. alveopalatal affricate'	
/j/ ↘	/ [+nas] —	↘	[dʃʰ]	/ (7)	'vd. laminal alveopalatal affricate'	
			[dʃ]	/ els.	'vd. alveopalatal affricate'	
	/ (10)	↘	[ʲdʃʰ]	/ (7)	'vd. laminal alveopalatal prenasalized affricate'	
			[ʲdʃ]	/ els.	'vd. alveopalatal prenasalized affricate'	
/s/ ↘	/ —]	↘	[ɕ]	/ (7)	'vl. laminal alveopalatal approximant'	*
			[ɕ]	/ els.	'vl. alveopalatal approximant'	*
	/ els.	↘	[ɕ]	/ (7)	'vl. laminal alveopalatal fricative'	
			[ɕ]	/ els.	'vl. alveopalatal fricative'	
/ŋ/	_____	↘	[ɲ]	/ (7)	'vd. laminal alveopalatal nasal'	
			[ɲ]	/ els.	'vd. alveopalatal nasal'	
/y/	_____	→	[j]		'vd. alveopalatal approximant'	

Table 5 Alveopalatal consonants and the relevant rules

(els. = elsewhere, vl. = voiceless, vd. = voiced, * = optional rule)

2.5 Velar consonants

There are three velar consonants, namely /k, g, ŋ/.

(24) *String-initial* — k, g, ŋ / [__

/k/	# : /g/	<i>kambut</i>	<i>gambuh</i>	[kembuʔ ¹] : [ʔgembuh ^h],	'woven bag' : 'bounce'
	: /ŋ/	<i>kaβuk</i>	<i>ŋaβuk</i>	[keβuk ^ʔ] : [ŋeβuk ^ʔ],	'iguana' : 'to pile up'
	: /p/	<i>kariŋ</i>	<i>pariŋ</i>	[keɾiŋ] : [peɾiŋ],	'to lie down' : 'most'
/g/	# : /ŋ/	<i>garakan</i>	<i>ŋarakup</i>	[ʔgereken] : [ŋerekup],	'omen' : 'to clench one's fist'
	# : /b/	<i>garaŋ</i>	<i>baraŋa</i>	[ʔgereŋ] : [ʔbərəŋe],	
					'bracelet' : 'earthenware cooking pot'
/ŋ/	# : /m/	<i>ŋorom</i>	<i>moron</i>	[ŋorom] : [moron],	'to brood' : 'straight'

(25) *Intervocalic* — k, g, ŋ / V __ V

/k/	: /g/	<i>oko</i>	<i>ogo</i>	[oko] : [o ^h go],	'old' : 'grandfather'
	: /ŋ/	<i>bokon</i>	<i>boŋon</i>	[ʔbokon] : [ʔboŋon],	'Not!' : 'all by oneself'
	: /p/	<i>naka</i>	<i>napa</i>	[neke] : [nepe],	'jackfruit' : 'to make, do'
/g/	# : /ŋ/	<i>ogo</i>	<i>roŋo</i>	[o ^h go] : [roŋo],	'grandfather' : 'arm'
	# : /b/	<i>nugas</i>	<i>cuba</i>	[nu ^h geɾ] : [t ^h u ^m be],	'to give power' : 'hey, say'
/ŋ/	: /m/	<i>riŋan</i>	<i>riman</i>	[riŋen] : [riman],	'scar' : 'approximately (food)'

At the string-final position, /k/ and /ŋ/ can occur while /g/ cannot occur.

(26) *String-final* — k, ŋ / [__]

/k/	: /ŋ/	<i>turak</i>	<i>turaŋ</i>	[turek ^ʔ] : [tureŋ],	'to go' : 'bone'
	: /p/	<i>dorak</i>	<i>doraβ</i>	[ʔdorek ^ʔ] : [ʔdorep ^ʔ],	'flower' : 'spleen'
/ŋ/	: /m/	<i>borak</i>	<i>boram</i>	[ʔboreŋ] : [ʔborem],	'itching powder' : 'palm wine'

The contrastive velar consonants and the relevant rules are postulated in Table 6.

/k/	/ (12)	↙	[k ^ʔ]	/ (7)	'vl. advanced velar unreleased stop'
			[k ^ʔ]	/ els.	'vl. velar unreleased stop'
	/ els.	↘	[k]	/ (7)	'vl. advanced velar plosive'
			[k]	/ els.	'vl. velar plosive'
/g/	/ [+nas] __	↙	[g]	/ (7)	'vd. advanced velar plosive'
			[g]	/ els.	'vd. velar plosive'
	/ (10)	↙	[ʔg]	/ (7)	'vd. advanced velar prenasalized plosive'
			[ʔg]	/ els.	'vd. velar prenasalized plosive'
/ŋ/	_____	↙	[ŋ]	/ (7)	'vd. advanced velar nasal'
			[ŋ]	/ els.	'vd. velar nasal'

Table 6 Velar consonants and the relevant rules

(els. = elsewhere, vl. = voiceless, vd. = voiced)

2.6 Glottal consonant

The glottal consonant /h/ is labialized to [h̠] adjacent to /u/, and altered to advanced velar fricative [x̠] adjacent to /i/. [h̠] and [x̠] appears either at the string-final position or before a voiceless plosive/affricate T. Before *i*, [x̠] is not realized, alternatively the glottal fricative [h̠] is realized, and at the same time, the succeeding *i* is realized with a slightly retracted tongue root.

(27) Glottal allophones conditioned by adjacent vowels

[h(i)]:	<i>hiay</i> [hɾeŋ]	'great-great-grandparents'
[h̠(u)]:	<i>huay</i> [h̠ueŋ]	'will, shall'
[h]:	<i>hajo</i> , <i>henda</i> , <i>horas</i>	'big', 'turmeric', 'sweat'
[(i)x̠]:	<i>doi<i>h</i></i> [ⁿdoi̠x̠], <i>ihco</i> [ix̠t̪ⁿo]	'needle', 'one'
[(u)h̠]:	<i>auh</i> [euh̠], <i>puhti</i> [puht̪i̠]	'voice', 'white'
[h]:	<i>buah</i> , <i>bele<i>h</i></i> , <i>amoh</i>	'Yes!', 'youth', 'where'

With attention to the allophonic realization in (27), contrastive pairs concerning the adjacent *i* and *u* are considered (28, 29, 30).

(28) String-initial — h / [__ , [__ i, [__ u

/h/	#: /k/	<i>haβun</i>	<i>kaβuk</i>	[hɛβuŋ] : [kɛβuk̚],	'tomorrow' : 'iguana'
/hi/	#: /ki/	<i>hira</i>	<i>kitap</i>	[hire] : [kirep],	'in the direction of' : 'lightning'
	#: /si/	<i>hira</i>	<i>siran</i>	[hire] : [sireŋ],	'in the direction of' : 'foot + lower leg'
/hu/	#: /ku/	<i>hureŋ</i>	<i>kurat</i>	[hureŋ] : [kureŋ],	'sloping' : 'mushroom'
	#: /su/	<i>huay</i>	<i>suar</i>	[hureŋ] : [suar],	'will, shall' : 'lamp (hunting)'
	#: /pu/	<i>huay</i>	<i>puan</i>	[hureŋ] : [puen],	'will, shall' : 'durian-size fruit with persimmon taste'

(29) Intervocalic — h / V __ V, V __ i, V __ u

/h/	#: /β/	<i>mahay</i>	<i>maβak</i>	[mehɛŋ] : [mɛβek̚],	'hard' : 'to bite'
	: /k/	<i>bahai</i>	<i>bakai</i>	[ᵐbeheɪ] : [ᵐbek̚eɪ],	'shoulder' : 'not yet finished'
/hi/	: /βi/	<i>bahiu</i>	<i>baβiu</i>	[ᵐbehɪu] : [ᵐbeβiɪu],	'air, wind' : 'female (animal)'
	#: /ki/	<i>tahi</i>	<i>takip</i>	[tɛhi] : [tɛkip̚],	'long (time)' : 'ladle'
	#: /si/	<i>muhi</i>	<i>musit</i>	[muhi] : [muçit̪ⁿ],	'to wash up' : 'to shatter, hatch'
/hu/	: /βu/	<i>tohun</i>	<i>toβun</i>	[toɦuŋ] : [toβuŋ],	'middle' : 'sugarcane-LINKER'
	: /ku/	<i>duhuŋ</i>	<i>dukuŋ</i>	[ⁿduɦuŋ] : [(ⁿduku).ⁿdukuŋ],	'thunder' : 'to sit (with the knees bent to one side)'
	#: /su/	<i>pohuk</i>	<i>osuk</i>	[poɦuk̚] : [oçuk̚],	'female (bipedal)' : 'my grandchild'
	#: /pu/	<i>nahuay</i>	<i>napunan</i>	[neɦueŋ] : [nepuŋeŋ],	'to want something' : 'to collect up'

(30) *String-final* — $h / _]$, $i _]$, $u _]$

/h/	#: /k/	<i>nembah</i>	<i>nembak</i>	[nembəh] : [nembək],	‘to worship’ : ‘to shoot’
/ih/	: /ik/	<i>rahpih</i>	<i>rahpiḱ</i>	[rəhpix̥] : [rəhpik̚],	‘flat’ : ‘sleeping mat’
	#: /is/	<i>gorih</i>	<i>karis</i>	[gorix̥] : [keriḱ],	‘to drink’ : ‘kris’
/uh/	#: /uk/	<i>puhpuh</i>	<i>muhpuk</i>	[puhpux̥] : [muhpuk̚],	‘buttocks’ : ‘to wash (clothes)’
	#: /us/	<i>auh</i>	<i>haus</i>	[euh̥] : [heuḱ],	‘voice’ : ‘thirsty’
	#: /up/	<i>nokuh</i>	<i>gakup</i>	[nokux̥] : [gəkup̚],	‘toward’ : ‘in the hand’

String-final *h* is indispensable for distinguishing some pairs, for example:

(31)	<i>tari</i> [təɾi]	‘rope’	<i>tarih</i> [təɾix̥]	‘taro’
	<i>muhka</i> [muhkə]	‘to open’	<i>muhkah</i> [muhkəh]	‘to throw’
	<i>danda</i> [ᵀdɛndɛ]	‘fine, penalty’	<i>dandah</i> [ᵀdɛndɛh]	‘slow, late’

It must be noted here that there are consonant sequences such as [glottal fricative]–[voiceless plosive/affricate] *hT* as Hudson has suggested.^{*9} Most of the sequence *hT* is in free variation^{*10} with the segment *T* as in (32), but contrasts can be seen in certain items as in (33).

(32) *T ~ hT in free variation*

<i>p ~ hp</i> :	<i>nipo</i>	[ᵀipo] ~ [ᵀix̥po]	‘tooth’
<i>t ~ ht</i> :	<i>ḡamuto</i>	[ḡemuto] ~ [ḡemuht̚o]	‘to shut the eyes’
<i>c ~ hc</i> :	<i>nocot</i>	[noḱ ^ᵀ ot̚ ^ᵀ] ~ [noht̚ ^ᵀ ot̚ ^ᵀ]	‘to shiver’
<i>k ~ hk</i> :	<i>borakəḡ</i>	[ᵀborekəḡ] ~ [ᵀborehkəḡ]	‘to sell’

(33) *T : hT in contrast (not in free variation)*

/t/	: /ht/	<i>puti</i>	<i>puhti</i>	[put̚i] : [puht̚i]	‘banana’ : ‘white’
		<i>noto</i>	<i>nohto</i>	[noḱo] : [noht̚o]	‘(personal name)’ : ‘to see’
/k/	: /hk/	<i>bakai</i>	<i>bahkai</i>	[ᵀbəkai] : [ᵀbɛhkai]	‘unfinished’ : ‘monkey’

If a given Dohoi/Kadorih lexical item lacks *h* before *T*, and at the same time, it is in homonymic relation with an Indonesian lexical item, then it is more likely to be pronounced in the *hT* form.

^{*9} “Dohoi is distinctive among all the Barito isolects for its medial preaspirated voiceless stops and affricate” (Hudson 1967: 53).

^{*10} The realization of *hT* is restricted only to the position before string-final vowel:

<i>nakapu</i> [ᵀəkəpu] ~ [ᵀəkəhp̚u]	‘to carry’		× [ᵀəhkəpu], × [ᵀəhkəhp̚u]
<i>nokacuk</i> [ᵀəkək̚ ^ᵀ uk̚ ^ᵀ] ~ [ᵀəkəh̥ ^ᵀ uk̚ ^ᵀ]	‘to spring, jump’		× [ᵀəhkək̚ ^ᵀ uk̚ ^ᵀ], × [ᵀəkək̚ ^ᵀ uh̥k̚ ^ᵀ]

(34)	Indonesian		Dohoi/Kadorih	
	‘when?’	<i> kapan </i>	<i> kahpan </i>	‘thick’ [kehpen] × [kepen]
	‘we (inclusive)’	<i> kita </i>	<i> kihta </i>	‘sap, resin’ [kixtɛ] × [kitɛ]
	‘shop’	<i> toko </i>	<i> tohko </i>	‘there are’ [tohko] × [toʔko]

The allophones of the phoneme /h/ are derived by rules in Table 7.

/h/	[x]	/ i _] or i _ T	‘vl. advanced velar fricative’
	[h]	/ u _], or u _ T or _ u	‘vl. simply labialized glottal fricative’
	[h]	/ elsewhere	‘vl. glottal fricative’

Table 7 Glottal consonant and the relevant rules (vl. = voiceless, T = vl. plosive/affricate)

3 Vowels

Santoso et. al. (1984) assumes five vowel phonemes /a, e, i, u, o/ with references to six minimal pairs and provides examples concerning each distribution, string-initial/-medial/-final (pp. 19–22). In addition, it exhibits diphthongs /ay, oy, aw, uy, ow/ as the phonemes in “Ot Danum”, although “the diphthongs occur only at the string-final position” (pp. 22–23).

In § 3.1, (sub-)minimal pairs of monophthongs are exhibited to account for each phonemic status of vowels. In § 3.2, three conditions for a diphthong will be specified, then, the diphthongs in Dohoi/Kadorih are not phonemic but predictable.

3.1 Monophthongs and their acoustic spaces

(35) String-first vowels

/a/	: /i/	<i> ahi </i>	<i> ihi </i>	[ɛhi] : [ihi], ‘there’ : ‘that’
		<i> aai </i>	<i> iai </i>	[ɛɛi] : [iei], ‘Not!’ : ‘who’
: /u/		<i> ataj </i>	<i> utaj </i>	[ɛtɛj] : [utɛj], ‘birds of prey’ : ‘debt’
		<i> baru </i>	<i> buru </i>	[^m bɛru] : [^m buru], ‘widow’ : ‘body hair’
: /e/		<i> ataj </i>	<i> etaj </i>	[ɛtɛj] : [etɛj], ‘birds of prey’ : ‘single strap’
		<i> bahon </i>	<i> behon </i>	[^m bɛhon] : [(^m ɛmbɛt ¹) ^m bɛhon], ‘cinder’ : ‘handbag’
: /o/		<i> aru </i>	<i> oru </i>	[ɛru] : [oru], ‘pounder’ : ‘although’
		<i> aka </i>	<i> oka </i>	[ɛkɛ] : [okɛ], ‘number symbols’ : ‘older sibling’
/i/	: /u/	<i> mia </i>	<i> mua </i>	[mie] : [mue], ‘shy, ashamed’ : ‘to bear fruit’
		<i> riou </i>	<i> ruou </i>	[ɾiou] : [ruou], ‘soul, ghost’ : ‘swamp, lake’
: /e/		<i> iku </i>	<i> eku </i>	[iku] : [eku], ‘tail’ : ‘mine’

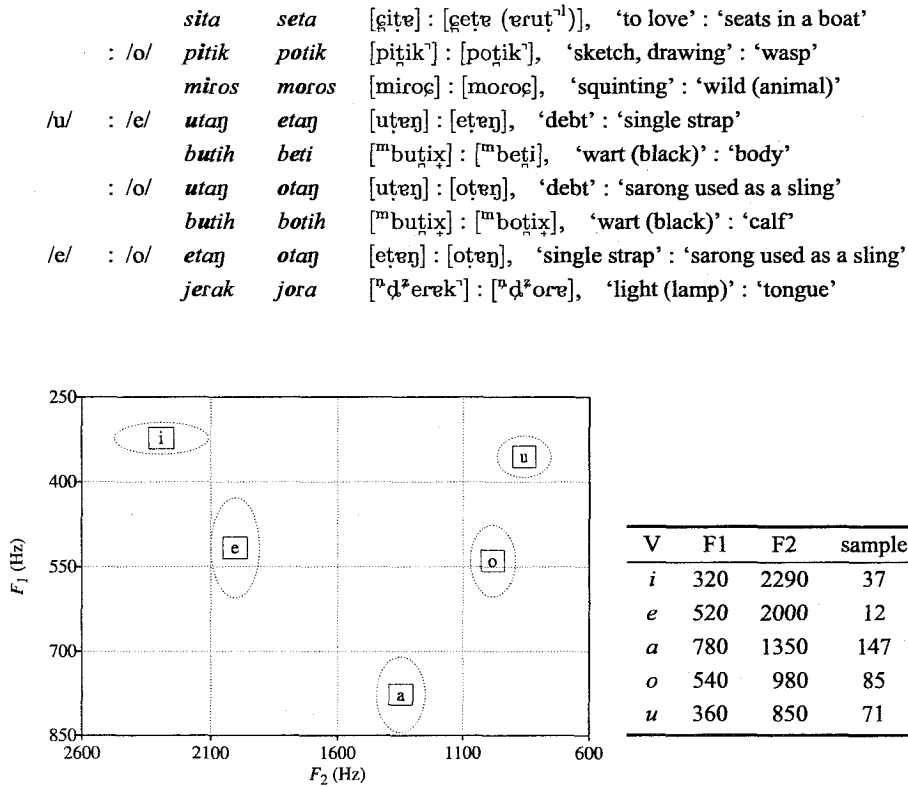


Figure 7 Formant plots of string-first vowels (left), average values of the first and second formant frequencies of each first vowel (right)

Figure 7 represents formant plots of string-first vowels (352 vowels), F1 on the y-axis and F2 on the x-axis. No vowel space overlaps. This fact implies that there are explicit acoustic inter-distinctions among the five vowels at the string-first position.

(36) String-second vowels

/a/	/i/	<i>ara</i>	<i>ari</i>	[er̪e] : [er̪i], ‘Don’t!’ : ‘younger sibling’
	/u/	<i>ora</i>	<i>oru</i>	[ore] : [oru], ‘sago flour’ : ‘although’
	/e/	<i>beraŋ</i>	<i>bereŋ</i>	[^m ber̪eŋ] : [^m bere). ^m ber̪eŋ], ‘measles’ : ‘round’
	/o/	<i>oka</i>	<i>oko</i>	[oke] : [oko], ‘older sibling’ : ‘elder’
/i/	/u/	<i>siki</i>	<i>siku</i>	[çik̪i] : [çiku], ‘narrow’ : ‘elbow’
	/e/	<i>soriŋ</i>	<i>soreŋ</i>	[çor̪iŋ] : [çoreŋ], ‘smoothness’ : ‘to understand’
	/o/	<i>ŋomi</i>	<i>ŋomo</i>	[ŋomi] : [ŋomo], ‘to smile’ : ‘to feel’
/u/	#: /e/	<i>sarut</i>	<i>sareta</i>	[çerut̪ ¹] : [çeret̪e], ‘flow, stream’ : ‘bean’

- : /o/ *tikus* *tikos* [t̥ikuɕ] : [t̥ikoɕ], 'rat, squirrel' : 'riddle'
 /e/ ʃ : /o/ *sohpɛŋ* *sohpɔt* [sohpɛŋ] : [sohpɔt^h], 'conch shell' : 'blow-pipe'

There are only a few items which possess *e* (around 7% in 1000 items) in comparison to items composed of other vowels.

Vowel and glide (-like) consonant are contrastive to each other.

- (37) /u/ : /β/ *baui* *baβi* [ᵐbɛui] : [ᵐbɛβi], 'lid, cap' : 'female'
 /i/ : /y/ *io* *yo* [io] : [jo], '(s)he' : 'Yes!'

3.2 Diphthongs

There is a series of falling diphthongs whose second portions are the gliding high vowels, *i* or *u* (['] and [˘] indicate *high* and *low* pitch respectively).

- (38) /ai/ *amai* [émɛi] 'father' /au/ *ucau* [úɕ^hɛù] 'bamboo, shoot'
 /oi/ *ahtoɪ* [éhɔi] 'liver' /ou/ *isou* [íɕóù] 'chopper'
 /ɛu/ *ruteu* [rúɕɛù] 'prostitute'
 /ui/ *ahpui* [éhpúi] 'fire' /iu/ *ohciu* [óht^híù] 'animal'

A diphthong must at least meet three conditions.

The first condition is that *the second portion of a diphthong must be a high vowel*. If the second portion is a high vowel, a falling pitch is realized in the vowel sequence (V́V́). In contrast, the pitch realization of vowel sequences *ao*, *ua*, *uo*, whose second portions are not high vowels, is different from the pitch realization in (38). In this case, a slight falling pitch is realized in the second portion of a vowel sequence (39: V́V́˘).

- (39) /ao/ *ɣatao* [ɣétɛ́ó˘], 'to laugh' /uo/ *somuo* [cómúó˘]
 /ua/ *bahua* [ᵐbéhúé˘], 'new' 'sebum in pores of nose'

The second condition is that *a diphthong must occur at the string-final position*. If a vowel sequence occurs with a succeeding consonant, then the pitch realization is the same as the pitch curves as in (39), where the pitch falling starts at the second element position of the vowel sequence.

- (40) /ai/ *kabaim* [ké^mbéim] 'because of you'
 /au/ *haramauŋ* [héré^mméúŋ] 'tiger'
 /ou/ *torous* [tóróúɕ] (1.1.1) 'deer'
 /iu/ *hasium* [hé^ggiúm] 'to kiss each other'

The third condition is that *a diphthong cannot compose a string by itself*. If a string is composed only of a bi-vowel sequence, the pitch pattern in (39, 40) appears again.

- (41) /ai/ *rai* [réí`] ‘rudder, helm’      /au/ *bau* [ᵐbéú`] ‘mouth’
 /oi/ *toi* [tóí`] ‘faeces’      /ou/ *tou* [tóú`] ‘to be allowed’
 /iu/ *riu* [ríú`] ‘rainbow’

The observations of falling pitch in (38) and (41) are supported by the following paired acoustic analysis which compares the F0 curve of *bau* ‘mouth’ to that of *pambau* ‘window’ (F0: fundamental frequency).

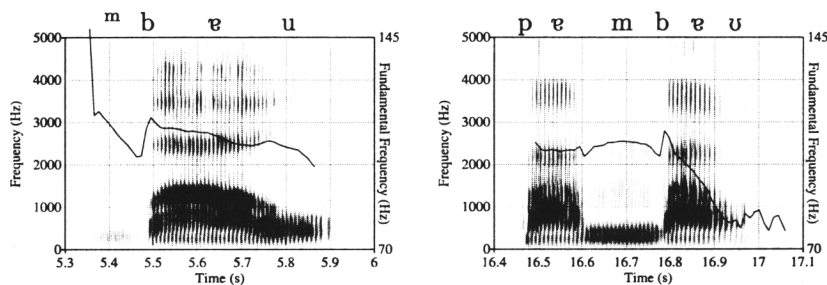


Figure 8 Spectrograms of [ᵐbéú`] ‘mouth’ and [pəmbéù] ‘window’ with each fundamental frequency (F0) curve

Every sequence composed of three vowels appears as single monophthong + diphthong, not as diphthong + monophthong.

- (42) *bau* ‘lid, cap’ *ui* [ᵐbéúì] **au* *ᵐbéui
jou ‘toad’ [ᵐdʒóúì] **ou* *ᵐdʒóui
pakaraiu ‘the last’ *iu* [pékéréíù] **ai* *[pékéreru]

In sum, a vowel sequence is not a diphthong but a vowel hiatus (i) if the second portion of a sequence is not a high vowel, and/or (ii) in the context __ C] or __ V], and/or (iii) if a vowel sequence is the only vocalic part in the relevant string.

It must be noted that there is a contrast between *true diphthong* and *fake diphthong* as shown in (43).

- (43) *true vs. fake diphthong* (VV vs. V+V)
 [ᵐbóróù] : [ᵐbóróú`], ‘fruit for food (slang)’ : ‘hungry’

Certain kinds of lexical specification such as a syllable boundary between *o* and *u* in *borou* ‘hungry’ are required for the distinction of *true* and *fake diphthong* pair. In this paper, the underlying form for the *fake diphthong*, /borou/ is assumed, in which the mark /`/ represents “non-finality of its own string”.

The contrastive vowels and the relevant rules are postulated in Table 8. These rules predict allophonic realizations of diphthongs (or complex vowel sequence) as well as monophthongs. Note that the phoneme /e/ has a very low status as a phoneme because it scarcely occurs in strings.

/i/	—	↙	[ɪ]	/ V _] or h _ *	'near-close near-front unrounded vowel'
			[i]	/ els.	'close front unrounded vowel'
/u/	—	↘	[ʊ]	/ V _]	'near-close near-back rounded vowel'
			[u]	/ els.	'close back rounded vowel'
/e/	—	→	[e]		'semi-close front unrounded vowel'
/o/	—	→	[o]		'semi-close back rounded vowel'
/a/	—	→	[ə]		'near-open central unrounded vowel'

Table 8 Vowels and the relevant rules (* see (27), els. = elsewhere)

4 Conclusion

Santoso et al. (1984) only listed items which have a phoneme. In this paper, new description and analysis of the Dohoi/Kadorih sound system are provided.

The contribution of this paper can be summarized by the following five points. This paper (a) demonstrates allophones of each phoneme and some of the acoustic correlates of them (specifically, prenasalization versus nasal portion of ND sequence, the approximantization of /s/ as a free variation, plosive-affricate-fricative contrast, formant plots of vowels, and F0 curves of a hiatus versus a diphthong), (b) organizes (sub-) minimal pairs and refers strictly to contrasts, resulting in twenty three phonemes (Table 9, 10 in **Appendix**), (c) clarifies the status of each phoneme by indicating distributional deviations (*l* string-final only; *y* just seven items; *β* intervocalic only; *d, n* none */ [_ i; *e* extremely few), (d) postulates generative phonological rules for each phonemic segment (most allophones are derived by *fronting rule*, *prenasalization rule*, and *nonrelease rule*), and (e) states three conditions for a diphthong (*high vowel second*, *string-final position*, *no string by itself*). Diphthongs are predictable by the rules for vowels.

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Appendix: Phonemic inventories

	labial	alveolar	alveopalatal	velar	glottal
vl. plosive	p [p~p']	t [t~t'~t ^h ~t']		k [k~k'~k ^h ~k']	
vd.	b [^m b]	d [ⁿ d~ ⁿ d]		g [^u g~ ^u g]	
vl. affricate			c [t ^h ~t ^h ']		
vd.			j [t ^h d ^h ~ ⁿ d ^h ']		
fricative	β [β]		s [s~s'~s ^h ~s']		h [h~h'~h ^h ~h']
nasal	m [m]	n [n~n']	ɲ [ɲ~ɲ']	ŋ [ŋ~ŋ']	
trill		r [r~r']			
flap		ɾ [ɾ~ɾ'~ɾ ^h ~ɾ']			
approximant			y [j]		

Table 9 Consonant inventory of Dohoi/Kadorih

In the context '[+nas] __', [b, d, ɖ, d^h, g] instead of [m^b, n^d, n^ɖ, n^{d^h}, g^u] respectively. (vl. = voiceless, vd. = voiced)

	front	central	back
close	i [i~ɪ]		u [u~ʊ]
mid	e [e]		o [o]
open		a [a]	

Table 10 Vowel inventory of Dohoi/Kadorih

ドホイ/カドリ語音素の概要

(オーストロネシア諸語: インドネシア、カリマンタン、カハヤン川源流)

稲垣 和也 (INAGAKI Kazuya)

Abstract

本論文によるドホイ/カドリ語の新たな記述と分析は、以下の音声学的、音韻論的側面を明らかにすることによって、Santoso et al. (1984) の音素についての素描の全体を補う。

- I. おおのの音素の異音に関する調音音声学的な記述と音響音声学的な相関物 (前鼻音と同器官的鼻音、自由変異としての /s/ の接近音化、破裂-破擦-摩擦の対比、母音のフォルマントプロット、母音連続と二重母音の F0 曲線)
- II. (準-)最小対を整理することで対立に厳密に言及したのちの二十三の音素
- III. 分布的な偏りを根拠とする各音素のステータス (音列末尾のみの *ʔ*、七項目のみに現れる *y*、音列中間のみに現れる *β*、/[__*i* の環境で生起しない *d* と *n*、極端に少数の *e*)
- IV. 子音音素の異音を導出する規則 (大半の異音は前方化規則 (*fronting rule*)、前鼻音化規則 (*prenasalization rule*)、無開放規則 (*nonrelease rule*) によって導かれる)
- V. 二重母音であるための三つの要件 ([i] 第二要素狭母音、[ii] 音列末尾位置の生起、[iii] それのみで音列を構成しない) と、母音音素の異音を導出する規則