

# An Illustration of the Phonemic Inventory and Phonology of Bimanese\*

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## 1 Introduction

This paper presents the phonemic inventory and phonology of Bimanese, a vastly understudied Austronesian language, with a focus on the Kolo dialect and the co-occurrence restrictions of sounds, consonantal and vowel combinations in words and their syllable structure.

**1.1 Background** Bimanese is classified as a Central-Eastern Malayo-Polynesian language and is spoken by the Mbojo people on Eastern Sumbawa Island in the Indonesian province of West Nusa Tenggara. In Kolo Bimanese, there are prenasalized, implosive consonants, and homorganic consonant clusters, but there is a dispreference for closed syllables (Klamer 2002).

**1.2 Fieldwork** Research was conducted over a two-week period at the Mataram Lingua Franca Institute in Mataram, Indonesia. The study focuses on the data collected from recording sessions with one male and one female. Both are native speakers of Kolo Bimanese, who also speak Indonesian and English.

We first confirmed the inventory of consonants and vowels found in the language, and then looked at all possible consonant and vowel combinations. Lapel microphone recordings of attested CV and CCV combinations, as well as isolated vowels with two separate consonants, were recorded. All consonants and vowels have been double confirmed by reading their respective spectrograms in Praat.

## 2 Phonemic Inventory

Pulmonic consonants, non-pulmonic consonants, and vowels are presented in the following section. The study does not focus on stress.

**2.1 Pulmonic consonants** Kolo Bimanese consists of 18 pulmonic consonants, summarized below. Where there are pairs of symbols, the one on the right represents a voiced consonant.

Glottal	Velar	Labial-Velar	Palatal	Alveolar-Palatal	Alveolar	Labio-dental	Bilabial	
ʔ	k g		c		t d		p b	Plosive
	ŋ				n		m	Nasal
					r			Trill
h					s	f		Fricative

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					l			Lateral approximant
		w						Approximant
				d͡z				Affricate

Consonants are not allowed in word-final position, but can be found in word-initial and in word-medial positions. The voiceless plosives /p/, /t/, /c/, and /k/ are unaspirated. The voiced plosive /g/ is also unaspirated. There are no plosive allophones, though regional variants may exist.

The nasal consonants /m/, /n/, and /ŋ/ can be found in word-initial and word-medial position. They are also often found in homorganic consonant clusters, shown in (1). These are also known as prenasalized consonant clusters.

- (1) a. [mpaʔa]      *mpa'a*      'to play'  
 b. [ntanda]      *ntanda*      'to watch'  
 c. [ŋgomi]      *nggomi*      'you'

The speakers always pronounced the alveolar rhotic /r/ as a trill. The alveolar trill occurs in both word-initial and word-medial position, but is not found in any consonantal clusters. The voiceless fricative labiodental /f/ occurs both in the word-initial and word-medial positions, as does the voiceless alveolar fricative /s/. Our speakers sometimes pronounced the glottal /h/ with breathy voice. The lateral approximant /l/ is pronounced with the tip of the tongue on the palate and is also found in word-initial and word-medial positions. The voiced labial-velar approximant /w/ and the voiced alveolar-palatal affricate /d͡z/ are found in both word-initial and word-medial positions, but in no consonant clusters.

The glottal stop /ʔ/ occurs only in word-medial position, however, it can be found in consonant clusters preceding implosive consonants. This is illustrated in (2).

- (2) a. [maʔda]      *ma'da*      'a kind of banana'  
 b. [maʔba]      *ma'ba*      'to hit'

**2.2 Non-pulmonic consonants** The consonantal inventory of Bimanese consists of two implosive consonants, summarized below.

Alveolar	Bilabial	
d̥	b̥	Implosive

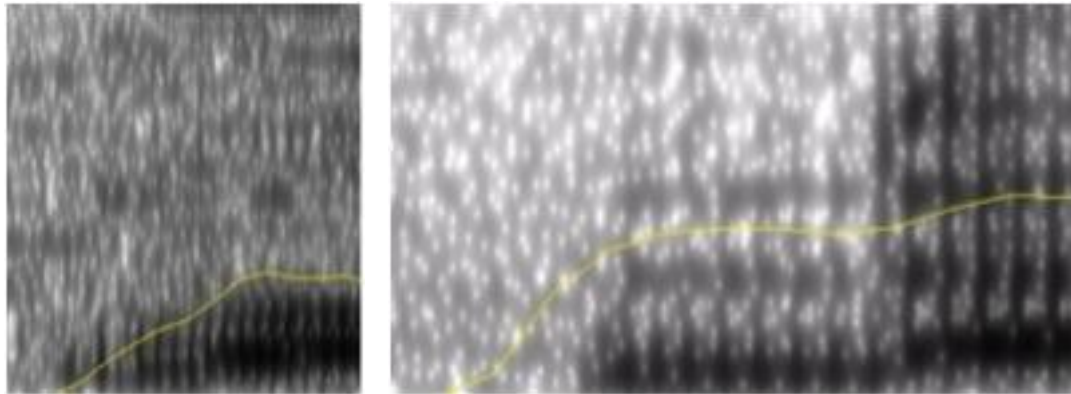
The voiced bilabial implosive /b̥/ and the voiced alveolar implosive /d̥/ are separate phonemes from the voiced bilabial plosive /b/ and the voiced alveolar plosive /d/. Two sounds are phonemes if they are in contrastive distribution; if they appear in identical environments and if the substitution of one sound for another results in a different word (Peng 2013). The examples in (3) show implosive and plosive sounds in contrastive environments.

- (3) a. [bara]      *bara*      'strong wind'      b. [ba]      *ba*      'ball'  
       [ɓara]      *ɓara*      'shinning'      [ɓa]      *ɓa*      'by'  
 c. [doho]      *doho*      'to sit'      d. [duwa]      *duwa*      'paternal aunt'  
       [d̥oho]      *d̥oho*      'all'      [d̥uwa]      *d̥uwa*      'two'

The examples show that these sounds are four separate phonemes, rather than allophones of the same phoneme. Additionally, implosives have a voice bar that becomes louder over time, whereas regular plosives have a voice bar that becomes quieter over time. (4) below shows spectrograms of the bilabial and

alveolar implosives in the word-initial position. The curve of the line follows the change of the voice bar.

- (4) a. [ʃoŋi] *bongi* ‘rice’      b. [dʃa] *da* ‘North’



The implosives /b/ and /dʃ/ were also visually confirmed. In the production of an implosive sound, the larynx always drops. When the male speaker produced an implosive sound, it was clear that his Adam’s apple dropped. This visual was not as clear with the female consultant, whose Adam’s apple was less prominent.

**2.3 Vowels** Bimanese is comprised of five vowels /i/, /u/, /e/, /a/, and /o/. All vowels occur in word-initial, word-medial, and word-final positions, shown in (5). There are only eight monosyllabic words composed of vowel clusters of unidentical vowels. Vowel length, voicing, and devoicing are non-phonemic and may vary across dialects of Bimanese.

(5)	Vowel	Initial	Gloss	Medial	Gloss	Final	Gloss
	/i/	[iu]	‘to fail’	[pidu]	‘seven’	[dʃi]	‘West’
	/u/	[ua]	‘uncle’	[ʃua]	‘ten’	[nu]	‘kiss’
	/e/	[ei]	‘sleepy’	[peke]	‘to fall’	[ele]	‘East’
	/a/	[ai]	‘day, rope’	[lao]	‘to go’	[dʃa]	‘North’
	/o/	[ou]	‘to call’	[dʃo]	‘all’	[dʃo]	‘South’

### 3 Discussion

This section discusses distinctive features of phonemes, consonant and vowel combinations, and co-occurrence restrictions. A complete list of words used in the study is available under request to the authors.

**3.1 Distinctive features** Twenty consonants, eighteen plosive and two implosive, and five vowels make up the phonemic inventory of Bimanese. Syllabic consonants do not exist in Bimanese. The features [±syllabic] and [±consonantal] play a role in the environment these sounds are found in, which is summarized below.

Vowels	[+syllabic]	[-consonantal]
Consonants	[-syllabic]	[+consonantal]

There are prenasalized consonants in Bimanese, which means the features of [±nasal] and [±obstruent] play a role in sound combinations. This is summarized below.

	C <sub>1</sub>	C <sub>2</sub>
[±nasal]	[+nasal]	[-nasal]

[±obstruent]	[-obstruent]	[+obstruent]
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Plosives, affricates, and implosives are all considered obstruents. These are the consonants that are found in consonant clusters with nasals to create prenasalized consonant clusters. C<sub>1</sub> shows the features of the first consonant in the cluster and C<sub>2</sub> shows the second. In these prenasalized consonant clusters, there is a single place of articulation.

**3.2 Syllables** Bimanese has five possible syllable combinations, as shown in (6). A period signifies a syllable break. These combinations can be further pieced together to form longer words.

- (6)
- |    |                                    |         |              |           |
|----|------------------------------------|---------|--------------|-----------|
| a. | CV                                 | [nu]    | <i>nu</i>    | ‘kiss’    |
| b. | C <sub>1</sub> C <sub>2</sub> V.CV | [mbako] | <i>mbako</i> | ‘to cook’ |
| c. | CV <sub>1</sub> V <sub>2</sub>     | [wei]   | <i>wei</i>   | ‘wife’    |
| d. | V <sub>1</sub> V <sub>2</sub>      | [oi]    | <i>oi</i>    | ‘water’   |
| e. | V.CV                               | [ele]   | <i>ele</i>   | ‘East’    |

Three of the combinations can occur as monosyllabic words, as illustrated in examples (6a), (6c), and (6d). Monosyllabic words of a single vowel or consonant do not exist.

It is clear from these examples that Bimanese does not allow a consonant in the word-final position. This is a rule unique to Bimanese and affects loanwords that have a consonant in the word-final position, deleting the final consonant so that the word ends with a vowel. A pragmatically driven phenomenon of word-final vowel deletion does occur, however. This phenomenon is discussed in section 5.

**3.3 Co-occurrence restrictions** Bimanese does not allow geminate consonants. Consonant clusters, however, are allowed. Long vowels are not allowed, and vowel clusters must be made of unidentical vowels. There are no word-final consonants.

Though almost all CV combinations are attested, there are three consonants of this combination worth discussing: /b/, /g/, and /d͡z/. The chart below shows attested and unattested combinations of these consonants and vowels in the CV pattern.

	i	u	e	a	o
b	-	-	-	√	-
g	√	(-)	√	√	√
d͡z	√	√	-	√	√

The voiced bilabial plosive /b/ is found only preceding /a/, such as in [ba] ‘ball’ in this pattern. A likely explanation for this is that the consonant is used only for loanwords. This, however, is not the case. In [mbo͡d͡zo] ‘Mbojo’, we see a CCV combination where /b/ precedes the vowel /o/ and in [mbako] ‘to cook’, /b/ precedes the vowel /a/. Thus, it seems that more voiced bilabial plosive combinations are allowed in consonant clusters followed by a vowel. The consonant /d͡z/ is not allowed preceding the vowel /e/ in any environment.

In the Kolo dialect, /g/ cannot precede /u/. The study notes, however, that the CV combination exists in a word from the Wera dialect. The word [nan̩gu] /nanggu/ ‘fishing’ exists in the Wera dialect but not in Kolo. This shows that the consonant /g/ can be followed by all vowels in Bimanese, but the words themselves differ between different dialects.

There are eight monosyllabic words composed of vowel clusters in Bimanese, which are shown below. V<sub>1</sub> along the y-axis signifies the first vowel in the cluster and V<sub>2</sub> along the x-axis signifies the second, so a combination from the chart is read as V<sub>1</sub>V<sub>2</sub>.

V <sub>1</sub> \ V <sub>2</sub>	i	e	a	u	o
i	-	-	-	√	√
e	√	-	-	-	-
a	√	-	-	√	-
u	-	-	√	-	-
o	√	-	-	√	-

Not all monosyllabic vowel clusters are allowed, as is evident from the data. The vowel /i/ can only be followed by the round vowels, /u/ and /o/. No clusters of identical vowels are allowed, that is, V<sub>1</sub> and V<sub>2</sub> cannot be the same vowel.

**3.4 Consonant clusters** Bimanese allows homorganic consonant clusters. The table below lists all possible clusters. C<sub>1</sub> along the y-axis signifies the first consonant in the cluster; C<sub>2</sub> along the x-axis signifies the second consonant. All clusters, with the exception of those beginning with the glottal /ʔ/, can occur word-initially.

C <sub>1</sub> \ C <sub>2</sub>	p	b	t	d	c	dz	k	g	ʙ	dʰ
m	√	√	-	-	-	-	-	-	-	-
n	-	-	√	√	√	√	-	√	-	-
ŋ	-	-	-	-	-	-	(-)	√	-	-
ʔ	-	-	-	-	-	-	-	-	√	√

Consonant clusters with /m/, /n/, and /ŋ/ show that post-nasal neutralization exists in Bimanese. The bilabial and alveolar nasals are in complementary distribution with each other with regards to consonant clusters. This is due to the nature of consonant clusters. Bimanese allows homorganic clusters, or clusters of sounds that share the place of articulation in the mouth. The bilabial nasal is found only preceding both voiced and voiceless plosives; the alveolar nasal is found preceding the voiced and voiceless alveolar plosives.

The velar nasal /ŋ/ precedes /g/ only, as shown in (7) below. Both of these sounds are velar, thus follow the homorganic cluster requirement for Bimanese. Blust (2008) writes that the /ŋk/ consonant cluster also exists. This study records no such examples with the speakers, but the cluster could exist in other dialects of Bimanese.

(7) [ŋgomi]                      nggomi                      ‘you

Glottal consonant clusters are restricted to word-medial position, because glottal stops are disallowed in the word-initial position. Only the implosive sounds /b/ and /d/ are found following the glottal stop. This is due to the manner of articulation of both sounds. Though the glottal stop is pulmonic and the implosive sounds are non-pulmonic, both are occlusive. This means that they are produced by obstructing airflow in the vocal tract. Airflow is blocked entirely in producing the glottal stop, and in producing implosive sounds, the glottis is pulled downward to remove the air in the vocal tract before the stop is released. Though the nasal stops are also considered occlusive, the place of articulation is far too forward in the mouth.

#### 4 Syllable Structure

The consonant and vowel combinations in (6) can be further pieced together to form longer words with syllable breaks, which has been recorded following the subject’s native speaker intuition. The distribution of syllables is also subject to restrictions. Examples in (8) below show which word positions - initial, medial, and final - each of the combinations are found in. Syllables highlighted in bold exemplify a particular syllable type in one of the three positions.

(8) **Type**    **Initial**            **Gloss**            **Medial**            **Gloss**            **Final**            **Gloss**

a.	CV	<b>la.ko</b>	‘dog’	<b>pa.ŋa</b> .ha	‘cake’	<b>wa.wi</b>	‘pig’
b.	CCV	<b>mba.ko</b>	‘to cook’	<b>sa.mpu</b> .ru	‘ten’	<b>d̥zi.mba</b>	‘sick’
c.	CVV	***		***		***	
d.	VV	***		***		***	
e.	V	<b>a.fi</b>	‘fire’	***		<b>la.o</b>	‘to go’

Both CV and CCV appear without restriction in all word positions. The CVV and VV type syllables are found only in monosyllabic words and thus can not be considered as found in one of the three positions. Bimanese does not allow word-medial syllabic vowels. As is shown in (8e), a word-final syllabic vowel does exist in the word ‘to go’, however, the consultants have clarified that the word is monosyllabic in isolated speech but bisyllabic in conversation. The Arabic name ‘Zakaria’, shown in (9), is syllabified with a word-final syllabic vowel, but this is a loanword and not native to Bimanese.

(9) [d̥za.ka.ri.a]      *jakaria*      ‘Zakaria’

Codas are not allowed, which means Bimanese syllables are open syllables, composed of onset and rime. Onsetless words exist, as monosyllabic vowel cluster words and (8e) show. The word with the highest amount of syllables recorded was five, shown in (10).

(10) [sa.mpu.ru.ri.wu]      *sampururiwu*      ‘ten thousand’

Bimanese also has syllable-internal unit requirements. Since codas are disallowed, we discuss only the onset and rime requirements. Monosyllabic vowel cluster words and (8e) show that the onset is not obligatory. (8b) shows that if there is an onset, it is made up of at most two segments, a consonant cluster CC. (8a) and (8c) show that an onset can also be made up of one simple segment C. These observations are shown in (11).

- (11) Onset requirements of Bimanese
- a. Onset is optional
  - b. Onset is made up of at most two segments: CC

The rime of a syllable excludes the onset and groups the nucleus and coda into one unit. We have already concluded that codas are not allowed and discuss only the nucleus of the rime. The data in (8a-e) show that the nucleus must have as a minimum a single vowel, such as a in (8e), and syllabic consonants do not exist. The nucleus allows at maximum two segments, forming a vowel cluster VV. The requirements of rimes are summarized in (12).

- (12) Rime requirements of Bimanese
- a. Rime has a minimum of one segment: V
  - b. Rime is made up of at most two segments: VV

These observations conclude the restrictions of syllable-internal units in Bimanese and explain the word-final consonant deletion rule of loanwords, which is discussed in the following section.

## 5 Bimanese Sound Deletion

A loanword that enters a language typically undergoes adaptations in order to conform to the structural requirements of the language it has been borrowed into. Bimanese does not allow word-final consonants and the study has observed that loanwords with word-final consonants are adapted to follow this requirement. The example below shows this change from the Indonesian words in (13a) and (13b) to Bimanese words in (14a) and (14b).

- (13) Indonesian  
 a. [mataram] *mataram* ‘Mataram’  
 b. [nol] *nol* ‘zero’
- (14) Bimanese  
 a. [matara] *matara* ‘Mataram’  
 b. [no] *no* ‘zero’

This word-final consonant deletion rule for loanwords is shown in (15) below. The symbol # marks the word boundary and Ø represents ‘zero’ or ‘nothing’. Thus, (15) means that C is deleted if it is in the word-final position.

- (15) Word-final Consonant Deletion Rule for Loanwords  
 $C \rightarrow \emptyset / \_ \#$

The study also noticed a pragmatically driven word-final vowel deletion rule. This may seem to dispute the conclusion that Bimanese does not allow word-final consonants, however, the rule only affects words in impolite speech. This includes conversations between friends and spouses, but not in restaurants or within the classroom, where normal or polite speech is used. An example of this phenomenon is shown in (16).

- (16) Word-final Vowel Deletion in (a) Normal versus (b) Impolite Speech  
 a. *Tabe lao kaimu*  
 where go you  
 ‘Where have you been?’  
 b. *Tabe lao kaim*  
 where go you  
 ‘Where have you been?’

The word-final vowel /u/ in ‘you’ is deleted in (16b). From this example above, we illustrate the word-final vowel deletion rule in (17).

- (17) Word-final Vowel Deletion Rule in Impolite Speech  
 $V \rightarrow \emptyset / \_ \#$

According to the speakers, this rule affects clitics and affixes, however, (17) here shows that it also affects pronouns such as ‘you’.

## 6 Perspectives for Further Research

A comprehensive study of the phonology and phonetics of Kolo Bimanese, but also of other dialects, requires a much longer period of time as well as a greater amount of speech samples from a higher number of speakers. Further research could show the dialectal differences amongst the various dialects of Bimanese, and lead the way in understanding the development and causes of these differences. It could still be difficult, however, to improve the recording sound quality as the soundscape of the environment changes

all the time in the field. Finding a place to record that minimizes echo and external sounds would be optimal.

## 7 Conclusion

This study provides evidence that the Kolo dialect of Bimanese consists of 20 consonants, including two implosives, and five vowels. The roundness of a vowel plays a role in the co-occurrence of these sounds, and no clusters of identical vowels are allowed. There are five possible syllable types: CV, CCV, CVV, VV, and V. Consonants are not allowed to be doubled or occur in the word-final position, however, a pragmatically driven rule allows word-final vowel deletion in speech during informal situations within the same generation of speakers. This generates a coda in a language that otherwise restricts codas, but this phenomenon occurs only between very specific interlocutors.

Almost all CV combinations are attested, though there are special cases regarding /b/, /g/, and /d͡z/. Bimanese allows homorganic clusters, or clusters of sounds that share the place of articulation in the mouth. There are some exceptions, however, such as glottal consonant clusters. These are restricted to word-medial position, because glottal stops are disallowed in the word-initial position. Bimanese does not allow word-medial syllabic vowels. Both CV and CCV syllable structures appear without restriction in all three word positions, whereas the CVV and VV type syllable are found only in monosyllabic words.

The data and discussion presented in this study are a result of intense sessions with speakers while in the field, but also of further contact with speakers, professors, and advisors. Bimanese is worth delving into further to understand the nuances of its phonology, but also to understand the people who speak it.

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