Article

A Phonological Sketch of Modo: An Endangered Language in Eastern Indonesia

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ABSTRACT

Modo is an endangered Austronesian language mainly spoken on the islands of Komodo and Rinca in East Nusa Tenggara Province of Indonesia. Despite its status as an endangered language, Modo remains under-documented and understudied. This paper presents a phonological sketch of Modo based on primary data collected from native speakers in our 30-day fieldwork on the two islands. Through careful analysis of recordings from an elicited wordlist and transcription of naturalistic speech, this description covers Modo's consonant and vowel inventories, syllable structure, stress assignment, and morphophonological analysis. Modo exhibits 31 consonants, including eight prenasalized stops, two implosives /ɓ/ and /ɗ/, the dental plosive /d̪/, the labio-dental approximant /ʋ/, and the loan palatal approximant /j/ and labio-dental fricative /f/. Additionally, Modo has six oral vowels, including the mid-central vowel /ə/, and five nasal vowels. The syllable structure of Modo is predominantly open, though it permits the consonants /h/ and /ʔ/ in word-final positions. Stress in Modo is generally assigned to the penultimate syllable, though shifts can occur in more complex phrases and sentences, indicating a nuanced prosodic system. Modo exhibits limited morphophonological processes, with only deletion and assimilation found in compounding. Furthermore, this study includes a brief discussion on practical orthography to enhance the accessibility of Modo's unique phonemic units. We suggest the representation of distinctive phonemes, such as the implosives /ɓ/ and /ɗ/, voiced dental /d̪/, labio-dental approximant /ʋ/, and nasal vowels. This phonological sketch not only contributes to the documentation of an endangered language but also clarifies some phonological issues found in previous works and underscores the intricate linguistic features that characterize the Modo language, paving the way for future research and revitalization efforts.

I. INTRODUCTION

Modo (ISO: 693-3 [kvh]) is an endangered language spoken by approximately 2,000 people, mainly on Komodo Island, located in the western part of the main Flores Island, West Manggarai Regency, Indonesia (see the map in Figure 1). A small number of Modo speakers are also found on the island of Rinca and some other smaller islands around the region. The well-known name of the island, language, and culture, including the large reptile of the *Varanus komodoensis* (komodo dragon), is Komodo. However, the indigenous people self-identify as *ata Modo*, meaning 'people of Modo', and refer to the language as *wana Modo*, meaning 'Modo language'. On the other hand, the komodo dragon is called *ora*. While the historical origin of the name is still unclear, informal accounts suggest that the island's name is Modo, and the appending of the form *ko* is due to the possessive marker in Modo, resulting in the word *komodo*, which literally means that the island belongs to the

Figure 1. Map of languages of East Nusa Tenggara (UBB GMIT, 2018)

Modo people. In this paper, the term *Modo* refers to the language, culture, and people, while the term *Komodo* refers to the island or place.

Modo is one of the smallest Austronesian languages of the Lesser Sunda Islands (Blust, 2013, p. 86), genetically classified within the Bima-Lembata subgroup of the Central Eastern Malayo-Polynesian of the Austronesian family (Fricke, 2019, pp. 229–300). The languages most closely related to Modo are Bima and Manggarai (Fernandez, 1990, 1996; Verheijen, 1987). The Modo people are generally multilingual, speaking Modo and Indonesian, and some are also proficient in Manggarai, Bima, or Bajo. While Modo remains the language of everyday communication, code-mixing with Indonesian, Bima, and Bajo is inevitable on many occasions. Indonesian is the preferred language in formal settings such as schools, wedding ceremonies, and formal meetings at the mosque and village offices. The multilingual situation on Komodo Island is due to the fact that Komodo and its surrounding smaller islands are part of the Komodo National Park, a conservation area for the Komodo dragon and a popular tourist destination (Brandt, 2003). Many young people work as tourist guides and have learned some English.

While the Komodo dragon has been studied for centuries (Brandt, 2003), the Modo people and their native language remain understudied. Some aspects of Modo grammar have been reported by Margono

et al. (1987), Troeboes et al. (1987), and Verheijen (1987). However, Modo is still considered an under-documented and under-described language. No significant linguistic-related research on Modo has been conducted within the last three decades. Moreover, there are no written materials for the community to learn how to read and write in their own language, no indigenous language programs in schools, and no literacy resources. Such a situation worsens the language transmission and language learning in the Modo community, which results in the status of Modo as a "threatened" language by Ethnologue (https://www.ethnologue.com/language/kvh/). This paper, as part of a language documentation project, is a response to Modo's language endangerment situation and the lack of language description.

The previous linguistic works focusing on Modo are found in four publications: Verheijen (1987), Troeboes et al. (1987), Margono et al. (1987), and Sugita & Mus (2019). First, Verheijen (1987) presents an ethnographic report of his 1977 fieldwork, which describes the sounds and the basic sentence structure of Modo, as well as its sociolinguistic situation and some historical background related to the people and language of Modo. Verheijen also provides some transcribed folktale texts with their respective Indonesian translation, Modo-Indonesia-English, Indonesian-Modo, and English-Modo wordlists. Both the texts and wordlists are written in an orthographic

script. In his report, Verheijen (1987, p. 59) states that only 26.7% of the words are typical Modo, whereas other words are attested as originating from the related proto-language (34.3%), Bima (16.9%), Manggarai (10.8%), Malay/Indonesian (8.2%), and others (3.1%), including Bugis and Bajo (see also Nuraini, 2010). Second, Margono et al. (1987) present a brief linguistic report, which includes basic descriptions of Modo's phonology, morphology, and syntax. In that report, they also include a practical orthography of Modo. Third, Troeboes et al. (1987) also provide a short linguistic report focusing on the morphology and syntax of Modo. There is no phonological description in this report, not even in the introduction to the language. As they mainly focus on morphology and syntax, they present a brief description of the basic structure of phrases and sentences, similar to the one presented in Margono et al. (1987). Fourth, Sugita & Mus (2019) describe the patterns of antonyms in Modo based on interviews with Modo native speakers. However, their analysis focuses only on the semantic level.

Although the three first-mentioned previous works shed light on some aspects of Modo phonology and morphosyntax, additional works are still needed as some issues remain inevitable. Some discrepancies are found in those works, such as the phonemic inventory and sound patterns. Verheijen (1987) identifies 29 consonants in Modo, whereas Margono et al. (1987) find only 18. While Verheijen (1987) believes that implosive sounds in Modo emerged because of mispronunciation, Margono et al. (1987) claim that implosives are allophones of their stop counterparts, where vowels precede implosives. Furthermore, brief descriptions of the syllable structure and other morphological-related issues are presented without detailed analysis. The superficial analyses and descriptions of Modo phonology, for example, by Verheijen (1987), are basically due to the fact that the sounds are analyzed based on Indonesian pronunciation heard on radio broadcasting (Verheijen, 1987), but not based on a detailed phonetic/phonemic analysis of sounds in Modo itself. Such phonologically analytical gaps trigger us to explore the synchronic phonological features of Modo.

This paper aims to provide a more detailed analysis of the sound system and the phonotactics of Modo based on the synchronic data collected from our fieldwork. It mainly covers the phonemic analysis of the consonants and vowels, syllable structure, and the phonotactic aspects and proposes a practical orthography. Several phonological/phonetic features unique to Modo are highlighted in this paper. This paper begins by outlining the data collection and analysis methods, followed by a description of consonants, vowels, and syllable structure. A brief discussion of the morphophonology is also provided. Subsequently, the notes on the practical orthography are presented. Finally, the discussion, direction for further resesarch, and concluding remarks are presented.

II. METHODS

This research is descriptive in nature, in which the data collection, processing, and analysis were conducted based on the language documentation and descriptive linguistic principles explained in Austin (2021), Chelliah & de Reuse (2011), Dixon (2010), and Himmelmann (2006). The data used in this phonological sketch are based on our short fieldwork on the islands of Komodo and Rinca between July and August 2023. The fieldwork was part of a documentation project with the support of the National Research and Innovation Agency (BRIN), Indonesia, in 2023. Data collection focused on the primary data of various genres recorded from native speakers who were available during our fieldwork. A total of 25 Modo native speakers, both male and female, were involved in this documentation project. Three persons were below 20 years old, six were between 20 and 39, eleven were between 40 and 60, and five were older than 60. The language consultants were eight fishermen, six tour guides, three gardeners, and the rest had other professions. Their levels of education ranged from elementary school to vocational school. The data were collected with the speakers' consent and willingness.

We spent approximately 30 days in the field collecting roughly 18 hours of digital audio and/or video recordings, i.e., spontaneous speaking of different stories and procedural texts, a wordlist of 400 words (200 words from the Swadesh list (Appendix 1) and 200 words from the language-mapping questionnaire developed by the Agency for Language Development and Cultivation of Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia), elicited phrases and short sentences, pictures and video stimuli descriptions. The audio recordings, saved

in WAV format with 24bit and 96kHz, are of good quality for digital archiving and phonological/phonetic analysis. About four hours of the recorded data have been transcribed and translated into Indonesian in the ELAN program to produce EAF files. Furthermore, the EAF files were exported to FLEx for detailed annotation/interlinearization of the texts and lexical database management. We also provide phonetic transcriptions of the recorded wordlist and elicited phrases for phonological and phonetic analysis. Some data have been archived at Language Documentation of Indonesia (LADIN) and can be accessed at https://data.brin.go.id/dataverse/Modo.

The data were analyzed using the descriptive methods in Chelliah & de Reuse (2011, pp. 257–273). We identified minimal pairs, the distribution of the sounds, the environments of the sounds, and the variation of the sounds for phonemic analysis. For further analysis, we purposively recorded both rapid and careful speech sounds from a selected native speaker. To support our analysis, we also conducted basic acoustic analyses using the Praat software, especially to identify the unique phonetic features shown by the waveforms and spectrograms in Praat.

III. RESULTS

Consonant inventory

Modo has 31 consonants, including eight prenasalized stops, one denti-alveolar plosive, two implosives, and two loan phonemes /j/ and /f/, as presented in Table 1.

Of the 31 consonants, Modo has two marginal phonemes: the voiced denti-alveolar plosive /d̪/ and the voiced palatal prenasal /ⁿɟ/. The /d̪/ only occurs in three words and the /ⁿɟ/ in two words,

respectively, in our lexical database, as shown in (1).

(1)	/d̪/	/d̪ud̪u/	'blunt'
		/d̪uha/	'sick'
		/ʋod̪o/	'many'
	/ⁿɟ/	/paⁿɟa/	'papaya'
		/taⁿɟa/	'k.o.fish'

The denti-alveolar plosive /d̪/ is analyzed as a distinct phoneme because it contrasts with the plain voiced alveolar /d/, as shown by the examples of contrast in (2) below. Similarly, the prenasalized voiced palatal stop /ⁿɟ/ contrasts with the plain palatal /ɟ/. Although /ⁿɟ/ occurs infrequently, it is considered a phoneme because it fits into the pattern of prenasalized stops, where the voiceless prenasalized palatal stop /ⁿc/ is already attested as a phoneme.

Consonant contrasts

In this section, we first present consonant contrasts of the plain consonants, followed by the prenasalized consonants, compared to the plain consonants. The examples of (near) minimal pairs in (2) below show the plain consonant contrasts.

(2) Identified (near) minimal pairs of consonants

/ɓ ≠ p/	/ɓana/	[ɓana]	'other'
	/pana/	[pana]	'hot'
/w ≠ ɓ/	/waleʔ/	[walɛʔ]	'return'
	/ɓale/	[ɓale]	'to throw'
/ɗ ≠ d/	/ɗaʔ/	[ɗaʔ]	'bad'
	/da/	[da]	'just'
/l ≠ r/	/ɓale/	[ɓale]	'to throw'
	/pare/	[pare]	'rice field'
/c ≠ ɟ/	/capi/	[capi]	'cow'
	/ɟapi-ɟapi/	[ɟapiɟapi]	'pearlshell'

Table 1. Modo consonants

	Bilabial	Labio-dental	Dental	Alveolar	Palatal	Velar	Glottal
Plosive	p			t	c	k	ʔ
	b		d̪	d	ɟ	g	
Implosive	ɓ			ɗ			
Prenasalized stop	ᵐp			ⁿt	ⁿc	ᵑk	
	ᵐb			ⁿd	ⁿɟ	ᵑg	
Nasal	m			n		ŋ	
Trill				r			
Fricative		(f)		s			h
Lateral				l			
Approximant	w	ʋ			(j)		

/d ≠ ḓ/	/duⁿdu/	[duⁿdu]	'to push'
	/ḓuḓu/	[ḓuḓu]	'blunt'
/ʔ ≠ k/	/cuʔi/	[cuʔi]	'price'
	/ⁿcuki/	[ⁿcuki]	'difficult'
/m ≠ n/	/ʔama/	[ʔama]	'father'
	/ʔana/	[ʔana]	'child'
/h ≠ ʔ/	/galoh/	[galɔh]	'wave'
	/galoʔ/	[galɔʔ]	'square pounding block'
/k ≠ g/	/kalo/	[kalo]	'banana'
	/galoh/	[galɔh]	'wave'

/ⁿt ≠ t ≠ n/	/ⁿtaũ/	[ⁿtaʷũ]	'year'
	/tau/	[tau]	'to make'
	/naũ/	[naũ]	'to take shelter'
/ᵐp ≠ p ≠ m/	/seᵐpa/	[seᵐpa]	'to kick'
	/ⁿcepa/	[ⁿcepa]	'broken'
	/lema/	[lema]	'tongue'
/ⁿc ≠ c ≠ n/	/ⁿcəka/	[ⁿcək:a]	'broken'
	/cəka/	[cək:a]	'to spear'
	/nəŋa/	[nəŋ:a]	'cloudy'
/ⁿɟ ≠ ɟ ≠ n/	/paⁿɟa/	[paⁿɟa]	'papaya'
	/paɟa/	[paɟa]	'large'
	/bana/	[bana]	'different'
/ᵑk ≠ ŋ ≠ k/	/waᵑka/	[waᵑka]	'boat'
	/waŋa/	[waŋa]	'a bit big'
	/wakah/	[waka]	'k.o.grass'
/ᵑg ≠ ŋ/	/ɓuⁿga/	[ɓuⁿga]	'dog'
	/ɓuŋa/	[ɓuŋa]	'wound'

No contrasts are found between /b/ and /ɓ/, or between /w/ and /ʋ/. However, these phonemes can occur in initial and medial positions and be preceded as well as followed by various vowels. This suggests that they are unpredictable, and thus, they are distinct phonemes.

Examples of /b/ versus /ɓ/ and /w/ versus /ʋ/ are presented in Table 2 and Table 3, respectively.

Examples of the prenasalized consonants contrasted with the plain consonants are shown in (3).

(3) Prenasalized and plain consonant contrasts

/ᵐb ≠ m ≠ b/	/ʔaᵐba/	[ʔaᵐba]	'market'
	/ʔama/	[ʔama]	'father'
	/ʔaba/	[ʔaba]	'what'
/ⁿd ≠ n/	/panda/	[paⁿda]	'short, low'
	/pana/	[pana]	'hot'

Plain consonant distributions

Almost all plain consonants occur only in initial and medial onset positions, as shown in Table 4. Modo does not allow codas in medial positions. In the word-final position, Modo only permits the glottal stop /ʔ/ and the glottal fricative /h/ (more details in the following section). The glottal stop sound [ʔ] typically occurs before isolated or initial vowels. However, in word-initial position, it is considered a reflex of strengthened voicing (Garellek, 2012), resulting in an automatic voiced onset rather than being assigned phonemic status. Table 4 below presents the distribution of the consonants.

Table 2: Examples with /b/ and /ɓ/

/b/			/ɓ/		
/bae/	[bae]	'to know'	/ɓale/	[ɓale]	'to throw'
/bohõ/	[bohõ]	'to spill'	/ɓokaʔ/	[ɓokaʔ]	'neck'
/beŋke/	[beŋke]	'naughty'	/ɓəɟũ/	[ɓəɟːũ]	'vessel'
/bike/	[bike]	'cracked'	/ɓuri/	[ɓuri]	'take a bath'
/leba/	[leba]	'shoulder'	/liɓa/	[liˀɓa]	'wide'
/laba/	[laba]	'distance'	/kaɓã/	[kaɓã]	'provide for'

Table 3: Examples of /w/ and /ʋ/

/w/			/ʋ/		
/waca/	[waca]	'to wash'	/ʋita/	[ʋita]	NEG
/welaʔ/	[welaʔ]	'flower'	/ʋoḓo/	[ʋoḓo]	'many'
/wise/	[wise]	'to widen'	/ʋiⁿco/	[ʋiⁿco]	'to stab'
/ⁿcawa/	[ⁿcawa]	'sister of wife/husband'	/leʋa/	[leʋa]	'long'
/bəlawo/	[blawo]	'mouse'	/teʋu/	[təʋːu]	'dust'
/ʔawã/	[ʔawã]	'sky'	/wəʋiã/	[wəʋːiã]	'night'

Table 4: Plain consonant distributions

Phoneme	Initial	Medial Onset	Medial Coda	Final
/p/	√	√	-	-
/b/	√	√	-	-
/ɓ/	√	√	-	-
/d/	√	√	-	-
/ɖ/	√	√	-	-
/ɗ/	√	√	-	-
/t/	√	√	-	-
/c/	√	√	-	-
/ɟ/	√	√	-	-
/k/	√	√	-	-
/g/	√	√	-	-
/ʔ/	-	√	-	√
/m/	√	√	-	-
n/	√	√	-	-
/ŋ/	√	√	-	-
/r/	√	√	-	-
/f/	√	√	-	-
/s/	√	√	-	-
/h/	√	√	-	√
/l/	√	√	-	-
/w/	√	√	-	-
/ʋ/	√	√	-	-

Final consonants /h/ and /ʔ/

In Modo, only two consonant phonemes can occur in word-final positions: the glottal fricative /h/ and the glottal stop /ʔ/. The contrasts between these two final consonants are presented in (4), with more examples of word-final consonants in (5) and (6).

(4) Contrasts of final consonants

/ø/ ≠ /h/	/nipi/	[nipi]	'to dream'
	/nipih/	[nipih]	'thin'
/ø/ ≠ /ʔ/	/boa/	[boʷa]	'k.o. caterpillar'
	/boaʔ/	[boʷaʔ]	'tomb'

(5) Occurrence of /ʔ/ in word-final position

/ʔ/	/boaʔ/	[boʷaʔ]	'tomb'
	/daeʔ/	[daɛʔ]	'to sew'
	/ŋesoʔ/	[ŋesɔʔ]	'to sob'
	/susuʔ/	[susuʔ]	'to rub'

(6) Occurrence of /h/ in word-final position

/h/	/mədeh/	[məd:ɛh]	'heavy'
	/uleh/	[ʔulɛh]	'worm'
	/puah/	[puʷah]	'forest'
	/satah/	[satah]	'grass'
	/nipih/	[nipih]	'thin'
	/loh/	[lɔh]	'bay'

The word-final consonant sounds [ʔ] and [h] are typically omitted in phrase-medial positions, except in careful speech. For example, in (7), the final glottal stop [ʔ] in the word [bokaʔ] 'neck' is omitted when it is followed by the word [kuhu] '1sg.poss', resulting in a possessive phrase. The realization of the two consonants in phrase-medial position is illustrated in (7).

(7) Realization of final consonants in the phrase-medial position

[ʔ]	[bokaʔ]	→	[boka kuhu]
	'neck'		'my neck'
	[sək:iɔʔ]	→	[sək:iɔˀ banũ]
	'a little'		'a little water'
[h]	[wuɛh]	→	[wuɛ lalɛ maẽ nɛ]
	'bad odor'		'bad odor inside'
	[məd:ɛh]	→	[liwa məd:ɛ nɛ]
	'heavy		'too heavy'

Prenasalized consonants and their distributions

Modo exhibits eight prenasalized consonants, whose distributions are shown in Table 5. As indicated, the prenasalized consonants /ⁿɟ/ and /ᵑk/ are restricted to medial onset positions.

Table 5: Prenasalized consonant distributions

Phoneme	Initial	Medial Onset	Medial Coda	Final
/ᵐb/	√	√	-	-
/ᵐp/	√	√	-	-
/ⁿd/	√	√	-	-
/ⁿt/	√	√	-	-
/ⁿc/	√	√	-	-
/ⁿɟ/	-	√	-	-
/ᵑg/	√	√	-	-
/ᵑk/	-	√	-	-

The eight prenasalized consonants presented in this paper are identical to those reported by Verheijen (1987, p. 64). In contrast, Margono et al. (1987, p. 23) analyze these consonant sequences as consonant clusters rather than prenasals. Margono et al. (1987) further categorize these clusters into two types: optional clusters, which allow for schwa [ə] epenthesis, and obligatory clusters, which do not permit epenthetic [ə]. We analyze what Margono et al. (1987) label "obligatory clusters" as prenasalized consonants for two reasons.

First, the sequence of nasal and the obstruent is pronounced as a single sound. Figures 2, 3, and 4 display the duration of the prenasalized stop [ⁿd], plain nasal [n], and plain alveolar stop /d/,

respectively. The duration of the prenasalized stop [^{n}d] is 0.096 seconds, which is slightly longer than the plain nasal [n] (0.092 seconds) and the plain stop [d] (0.091 seconds). The longer duration of the prenasalized consonants due to the brief nasal onset (Cohn & Riehl, 2016).
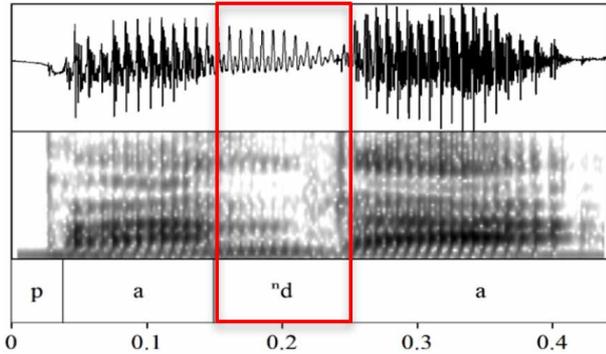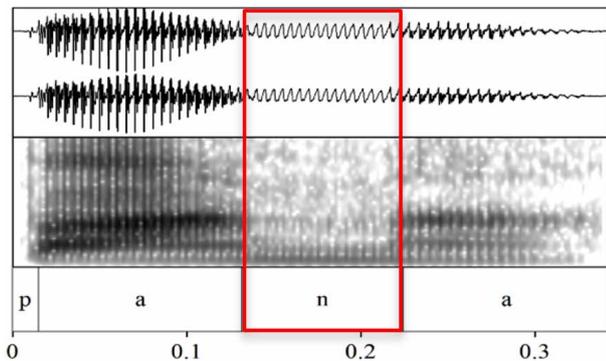

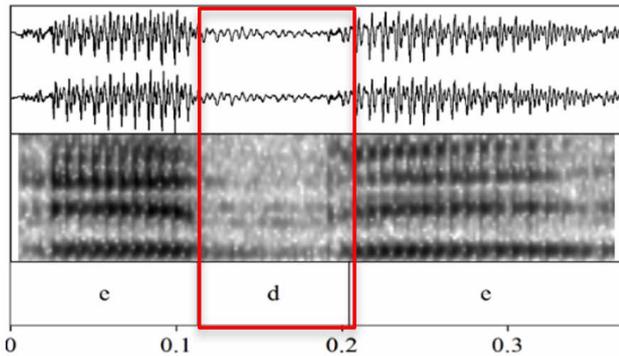**Figure 2. Prenasalized stop /^{n}d/**

Figure 3. Plain nasal /n/

Figure 4. Plain alveolar stop /d/

Second, the reason for analyzing the sequence of a nasal followed by a stop as prenasalized consonants instead of consonant clusters is that no underlying schwa is present between the nasal and the consonant. In the following section, we show consonant clusters are formed due to the deletion of an underlying schwa. A more careful experimental study examining more tokens is needed.

Consonant clusters and their distributions

Consonant clusters in Modo consist of a maximum of two consonants, as shown in (8) below. These consonant clusters are driven by phonological processes in which the mid-central vowel (schwa) [ə] and the mid-low vowel [a] are deleted. Consequently, the clusters phonotactically create a heavy CCV onset pattern (to be discussed further below). In such a case, we analyze these clusters as underlyingly having vowels, and the vowels get deleted, resulting in consonant clusters. In careful speech, the vowels are still pronounced, making these clusters optional. The clusters are permitted only in the word-initial position, except for /ks/ and /^{m}bl/, which can also occur in word-medial positions. In each sequence, the first consonant may be one of two voiced and four voiceless consonants /b, g, k, p, t, s/, while the second consonant may be one of three voiceless and four voiced consonants /k, l, s, r, n, m, ^{m}b/. Additionally, in loanwords from Indonesian, such as *proyek* 'project' and *stok* 'stock', the speakers insert an epenthetic schwa, pronouncing them as [pəroyɛʔ] and [sətːɔʔ].

(8)	[bl]	[blawo]	/bəlawo/	'mouse'
	[^{m}bl]	[^{m}blo]	/^{m}bəlo/	'be sunk'
	[gl]	[gloso]	/gəloso/	'k.o. sea snail'
	[gr]	[groso]	/gəroso/	'soursop'
	[kl]	[klaĩ]	/kəlaĩ/	'sand'
	[kn]	[knobo]	/kənobo/	class (thing)
	[km]	[kmoɟo]	/kəmoɟo/	'to suck'
	[kr]	[kraʋo]	/kəraʋo/	'ashes'
	[ks]	[^{n}taksã]	/^{n}takəsã/	'chin'
	[pl]	[plai]	/pəlai/	'to run'
	[pr]	[pre]	/pəre/	'congested'
	[pr]	[prate]	/pərate/	'to kill'
	[sk]	[skide]	/sakide/	'a little'
	[s^{m}b]	[s^{m}bele]	/səmbele/	'to kill'
	[sr]	[sru^{m}bu]	/səru^{m}bu/	'body'
	[tr]	[tru^{n}gu]	/təru^{n}gu/	'k.o. stone'

Vowel inventory

Six basic phonemic vowels are attested in Modo, including a mid-central vowel /ə/. In addition, Modo has five nasal vowels. Table 6 below shows all vowels in Modo.

Table 6. Modo Vowels

	Front	Central	Back
High	i ĩ		u ũ
Mid	e ẽ	ə	o õ
Low		a ã	

The vowel /e/ can be realized as [ɛ] and [e], and the vowel /o/ can be realized as [ɔ] and [o]. The lower vowels [ɛ] and [ɔ] tend to appear before a word-final consonant, as illustrated in the examples in (9). Examples in (10) show cases of /e/ and /o/ occurring in open syllables.

(9) /duᵐpeʔ/   [duᵐpɛʔ]   'short'
     /kideʔ/   [kidɛʔ]   'small'
     /mədeh/   [məd:ɛh]   'heavy'
     /loh/   [lɔh]   'bay'
     /ntodoh/   [ⁿtɔdɔh]   'mountain'
     /ikoʔ/   [ʔikɔʔ]   'tail'

(10) /ate/   [ʔate]   'heart'
     /ɓale/   [ɓale]   'to throw'
     /ᵐbole/   [ᵐbole]   'to hit'
     /ⁿdore/   [ⁿdore]   'to lie down'
     /nəpe/   [nəp:e]   'mat'
     /ʔambo/   [ʔaᵐbo]   'if'
     /gəroso/   [groso]   'soursop'
     /naᵐbo/   [naᵐbo]   'lake'

Vowel contrasts

The oral vowel contrasts are shown by the (near) minimal pairs in (11).

(11) /i/ ≠ /e/ /bəti/   [bət:i] 'ill'
                /bəte/   [bət:e] 'broken off (cord)'

     /ə/ ≠ /i/ /dəŋi/   [dəŋ:i] 'hear'
                /diŋi/   [dĩŋi]   'to ask for'

     /ə/ ≠ /e/ /kəmu/   [kəm:u] 2sg.poss
                /kemu/   [kemu]   'to grasp'

     /u/ ≠ /a/ /pu/   [pu]   'tree'
                /pa/   [pa]   'four'

     /e/ ≠ /a/ /waleʔ/ [walɛʔ] 'return'
                /welaʔ/ [welaʔ] 'flower'

     /o/ ≠ /a/ /ʔambo/ [ʔaᵐbo] 'if'
                /ʔamba/ [ʔaᵐba] 'market'

Nasal vowels

Modo has five nasal vowels (Ṽ) that contrast with the corresponding oral vowels. The distribution of nasal vowels is restricted to the word-final position. The mid-central vowel /ə/ does not have a corresponding nasal form (Fernandez, 1990; Karjo, 2021; Kroon, 2016, pp. 42–43; Nagaya, 2011, pp. 65–68). The contrasts of oral vowels and their nasalized counterparts in Modo are shown in (12).

(12) /i/ ≠ /ĩ/ /diŋi/   [diŋi]   'to beg'
                /dinĩ/   [dinĩ]   'near'

     /e/ ≠ /ẽ/ /mere/   [mere]   'to talk in one's sleep'
                /merẽ/   [merẽ]   'yesterday'

     /a/ ≠ /ã/ /ʔiha/   [ʔiha]   'damage'
                /ʔihã/   [ʔihã]   'fish'

     /o/ ≠ /õ/ /galoh/ [galɔh] 'wave'
                /galõ/   [galõ]   'mountain-plain'

     /u/ ≠ /ũ/ /ⁿtau/   [ⁿtaʷu] 'thing'
                /ⁿtaũ/   [ⁿtaʷũ] 'year'

The phonetic evidence of a nasal vowel [Ṽ] in the word-final position is acoustically shown by the absence of the velar pinch. An example is provided with the word-final nasal vowel [ã] in [ŋarã] 'name' in Figure 5 below. Velar pinch is a typical feature of a velar sound (Ladefoged & Johnson, 2015, p. 209). The absence of a velar pinch on the spectrogram strongly indicates that no velar feature is present when the vowel is released, indicating a nasal vowel with no following velar nasal.
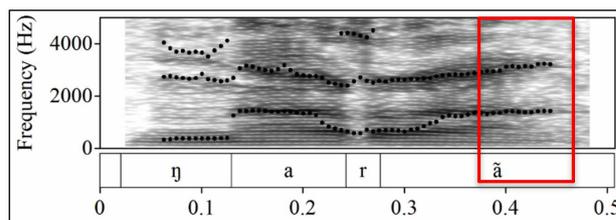

Figure 5. Spectrogram of final nasal vowel [ã]

Vowel distributions

All vowels have a full distribution except for the mid-central vowel /ə/, which occurs only in word-medial positions, and the nasal vowels, which occur exclusively in word-final positions. Of all the vowels, /e/ and /o/ are marginal in word-initial positions, as they appear in only a few lexical items in the database. The vowel distribution is shown in Table 7, with examples in Table 8.

Table 7: Vowel distributions

	Initial	Medial nuclei	Final
/i/	√	√	√
/e/	√	√	√
/ə/	-	√	-
/a/	√	√	√
/o/	√	√	√
/u/	√	√	√
Ṽ	-	-	√

Table 8: Examples of oral vowel distributions

	Initial	Medial	Final
/i/	/ikoʔ/ 'tail'	/hiʲa/ '3sg'	/ari/ 'younger sibling'
/e/	/ede/ 'this'	/hene/ 'that'	/bae/ 'know'
/ə/	-	/dəŋi/ 'hear'	-
/a/	/ari/ 'younger sibling'	/paⁿde/ 'to make'	/ⁿtika/ 'beautiful'
/o/	/ora/ 'Komodo dragon'	/motã/ 'pig'	/ŋao/ 'cat'
/u/	/urã/ 'rain'	/buŋa/ 'wound'	/ahu/ '1sg'

Table 9. Vowel sequences

	/i/	/e/	/ə/	/a/	/o/	/u/
/i/		√	-	√	√	√
/e/	√		-	√	√	(√)
/ə/	-	-		-	-	-
/a/	√	√	-		√	√
/o/	√	-	-	√		√
/u/	√	-	-	√	-	

Table 10. Examples of vowel sequences

	/i/	/e/	/ə/	/a/	/o/	/u/
/i/		/pi.e/ 'tick'	-	/si.a/ 'salt'	/ⁿgi.o/ 'to wait'	/mi.u/ '2pl'
/e/	/ʋe.i/ 'wife'		-	/ke.le.a/ 'to shout'	/ge.oʔ/ 'to pick maize'	-
/ə/	-	-		-	-	-
/a/	/pla.i/ 'run'	/ba.e/ 'to know'	-		/ɟa.o/ 'green'	/ⁿta.ũ/ 'year'
/o/	/co.i/ 'bride-price'	-	-	/lo.ã/ 'hut'		/ho.u/ '2sg'
/u/	[tu.i] 'to tell'	/tu.e/ 'sea snail'	-	/nu.a/ 'hole'	-	

Vowel sequences

Table 9 shows the possible sequences of vowels in Modo. All vowels may occur in a sequence, except for the mid-central vowel /ə/. These sequences are not diphthongs since each vowel belongs to a different syllable unit. This is evident when speakers are asked to pronounce words containing such a sequence in a careful speech. Of all the possible sequences, no instances of /oe/ and /uo/ have been identified so far (see also Verheijen, 1987). The reason for the absence of these two vowel sequences is still unknown. Examples of vowel sequences are presented in Table 10. As shown, the sequence of /iu/ alternates with /eu/, as in /mi.u/~/me.u/ '2pl' and /di.u/~/de.u/ 'far'.

Syllable structures

The maximum syllable structure in Modo is (C)V(C). The onset is not always present, but when it is, it can be filled by any single consonant, prenasalized consonants, or consonant clusters. Vowel-initial words always occur with an initial glottal, resulting in the #ʔV_ sequence at the beginning of a word. However, as stated earlier, this glottalization is considered a phonetic phenomenon rather than a phonemic one because there are no contrasts between a glottalized vowel and an oral vowel in the word-initial position. The possible CV patterns are presented in (13) through (15). Most words in Modo are disyllabic, with some being trisyllabic. Monosyllabic words are rare in Modo, which are mostly particles and very few content

words. A few quadri-syllabic words have been identified, which may be derived from compounds, as shown in (16). For example, the word *mucikali* 'all' is derived from two different words: *muci* 'all' and *kali* 'times', so *mucikali* means 'all of…'. However, this interpretation needs more data and further detailed analysis.

Mono-syllabic words

(13) V   /i/   [i]   '3sg.cl'
      CV   /pa/   [pa]   'four'
      CVC   /ⁿdoʔ/   [ⁿdɔʔ]   'pieces'

Di-syllabic words

(14) CV.V   /ʋe.i/   [ʋe.i]   'wife'
      V.CV   /a.hu/   [ʔa.hu]   '1sg'
      V.CVC   /a.naʔ/   [ʔa.naʔ]   'child'
      CV.CV   /wa.tu/   [wa.tu]   'stone'
      CV.CVC /me.deh/ [me.dɛh]   'heavy'

Tri-syllabic words

(15) CV.CV.V   /ku.ⁿca.o/   [ku.ⁿca.ɔ]
                             'to fight'
      CV.V.CV   /ᵐbu.i.pu/   [ᵐbu.i.pu]
                             'still'
      CV.CV.CV /se.sa.ʔe/   [se.sa.ʔe]
                             'the older one'

Quadri-syllablic words

(16) CV.CV.CV.CV /mu.ci.ka.li/   [mu.ci.ka.li]
                                  'all'
      CV.CV.CV.CV /ko.ro.ko.ⁿto/ [kɔ.rɔ.kɔ.ⁿtɔ]
                                  'to squad'
      CV.CV.CV.CV /ke.le.mo.ne/   [ke.le.mo.ne]
                                  'mangrove'

In terms of syllabification, two phonotactic issues need to be accounted for, i.e., (1) lengthened consonants due to the short duration of schwa [ə] and (2) consonant clusters resulting from vowel deletion. Regarding the first issue, Modo has a mid-central vowel /ə/ (schwa), which is extremely short and never occurs in word-initial or word-final positions. As it lacks length in the nucleus position, when stressed, the following consonants get lengthened to fulfill the syllable weight, as shown by the examples in (17). This lengthening affects the syllabification, suggesting that the analysis should be based on mora rather than a simple CV structure. To account for this case, we adopt the Weight-Stress Principle (WSP) theory, which posits that (a) stressed syllables should be heavy and (b) unstressed syllables should be light (Duanmu, 2008, p. 59). In light of this, we assume that vowels in stressed syllables have two morae, whereas vowels in unstressed syllables have one mora.

The mid-central vowel [ə] is a lax vowel, which is light in this case and therefore, has only one mora. For the vowel to be heavy (i.e., have two morae) in a stressed syllable, the following consonant should be lengthened. The lengthened consonants should be considered ambisyllabic and bimoraic; they belong to two syllables simultaneously. This syllabification analysis is also identical to Dhao, an Austronesian language spoken on Ndao Island (Balukh, 2020, pp. 61–62). The syllable template with lengthened consonants is shown in (18) below. It should be noted that in trisyllabic words, the [ə] in the antepenultimate syllable, which is an unstressed syllable, is subject to reduction, resulting in the formation of a consonant cluster onset.

(17) Words with schwa /ə/
      /dəŋi/   [ˈdəŋ:i]   'to listen'
      /kəteʔ/   [ˈkət:eʔ] 'to cut'
      /ləku/   [ˈlək:u]   'to sleep'
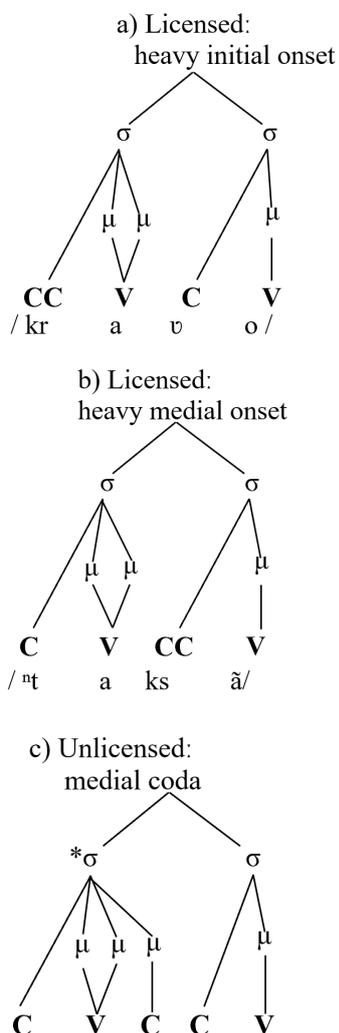   /kəpaẽ/   [ˈkəp:aẽ] 'over'

(18) Syllable template with lengthened consonants
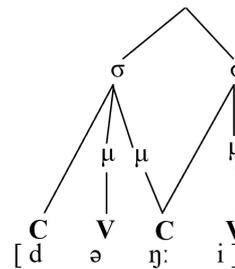
As for the second case, it has been explicated earlier that the deletion of the vowels [ə] and [a] results in consonant clusters. In the word-initial position, both consonants in the sequence are placed at the onset, as this is the only available slot, as shown in (19a). For the word-medial position, we adopt the Law of Finals theory, which posits that "word-final rhymes and word-medial rhymes should resemble each other" (Duanmu, 2008, p. 55). In Modo, the consonant sequence, such as [ks] in [ⁿtaksã] 'chin', cannot be syllabified as *[ⁿtak.sã] or *[ⁿtaks.ã] because neither the [k] nor the sequence [ks] can appear in the word-final (coda) position. To account for this, the sequence [ks] must be treated as a cluster in the onset position, as shown in (19b). This syllabification strategy is possible because the sequence of consonants [k] and [s] is allowed in Modo. Note that although Modo allows the consonants [h] and [ʔ] word-finally, these two consonants never occur in any consonant clusters or medial coda positions. This indicates that Modo does not phonotactically

allow medial coda. Therefore, any consonant that appears in the medial coda position is considered unlicensed, as illustrated in (19c) below.

(19) Syllable template with consonant clusters

a) Licensed:
heavy initial onset

/ kr   a   ʋ   o /

b) Licensed:
heavy medial onset

/ ⁿt   a   ks   ã/

c) Unlicensed:
medial coda

Stress assignment

Stress in Modo is signaled by intensity and pitch (see Marlett, 2019, pp. 229–233), although in some cases, the pitch may not always be consistent. Stress assignment is independent of the number of syllables in the base. The primary stress typically falls on the penultimate syllable, as shown in (20) and (21) below.

(20)   /ʋe.i/   [ˈʋe.i]   'wife'
       /a.hu/   [ˈʔa.hu]   '1sg'

(21)   /ᵐbu.i.pu/ [ᵐbu.ˈi.pu]   'still'
       /se.sa.ʔe/ [se.ˈsa.ʔɛ] 'the older one'

Clitics are stressless, so they do not affect stress assignment. In (22) below, the clitics =mu '2sg' and =ne '3sg.poss' create trisyllabic words, but the stress remains on the first syllable, which is

the penultimate of the disyllabic root, leaving the clitic stressless. In (23), compounding results in four-syllable strings, but the primary stress remains on the penultimate, while the first syllable carries the secondary stress. However, the examples in (24) and (25) show that the stress may shift at the phrasal or sentence levels. This shift could be related to the characteristics of the phonological words or the phrasal accents. Notice that instead of word stress, phrasal accent is a widespread feature found in languages of the Malayo-Polynesian area (Goedemans & Zanten, 2014). However, further study on the suprasegmental features in Modo is needed to fully understand this phenomenon. For example, stress falls on the final syllable [wã] of the word [lo.ˈwã] 'hut' in (24) and on the final syllable [ᵐba] of the word [suᵐba] 'Sumba' in (26), while still maintaining penultimate stress on other words.

(22)   [ˈla.ho =mu]
       go=2sg
       'you go'

(23)   [ˌʔa.na ˈmɔ.nɛ]
       child man
       'boy'

(24)   [ˌlo.ˈwã ko   ˌʔa.ta ˈwi.ne]
       hut   poss person woman
       'The hut of women'

(25)   [ˌa.ta   su.ˈᵐba ˈto.ʷã ˌta.o   pu.si ˈwe.i =ne]
       person Sumba can make alive wife =3sg.poss
       'The Sumbanese made his wife alive.'

Morphophonology

Modo lacks morphological affixation, with the exception of subject pronominal clitics, such as =i '3sg' and possessors like =ne '3sg.poss', and the prefix ke-, which is attached to cardinal number to form ordinal numbers. The pronominal clitic paradigm is presented in Table 11 below (Margono et al., 1987; Verheijen, 1987). The subject clitics are attached to verbs to agree with the nominal or pronominal subject. Verheijen (1987, pp. 48–49) and Margono et al. (1987, p. 34) report that the third-person singular clitic =i has the variant =e, which occurs when the preceding vowel of the verb is /i/ or /u/. However, this clitic is currently no longer productive. It almost never appears in our recorded naturalistic data. Furthermore, only very few elicited phrases show this clitic. The possessive clitic for the first-person singular pronoun has two variants: =ŋu and =ku. The distinction between

the two forms is currently unclear, particularly regarding whether =*ku* is a loan from Indonesian or an internal innovation.

Table 11. Modo pronominal clitics

Pron.	Modo	SUBJ	POSS
1sg	ahu	=hu	=ŋu/=ku
2sg	hou	=o	=mu
3sg	hia	=i	=ne
1pl.incl	hete	=te	=te
1pl.excl	hami	=mi	=mi
2pl	miu	=mu	=mu
3pl	sere	=si	=si

As previously mentioned, clitics do not affect stress assignments. When the possessive marker ko is followed by pronominal pronouns or clitics, the vowel [o] changes to [ə], [e] or [u]. As shown in (26) below, the vowel [o] changes to [ə] when followed by the possessive clitic =*mu* '2sg.poss'. The vowel [o] becomes [e] when followed by [h], and undergoes a vowel harmony when followed by the pronoun *ahu* '1sg'.

(26) Vowel change

/ko/ + /=mu/ → [kəm:u] 'your'
poss 2sg.poss

/ko/ + /hami/ → [kehami] 'our'
poss 1pl.excl

/ko/ + /ahu/ → [kuhu] 'my'
poss 1sg

Other morphophonological processes in Modo include deletion and assimilation in compounding. Deletion is shown by the examples in (27).

(27) /ama kia/ → [am.kia] 'younger brother
father small/young   of father/mother'
/ina   kia/ → [iŋ.kia] 'younger sister
mother small/young   of father/mother'

The vowel [a] in the final syllable of the word /ama/ 'father' and /ina/ 'mother' is deleted when the following word in the phrase begins with the voiceless velar stop [k] in *kia* 'small/young'. The resulting compound word forms a disyllabic word, and the first syllable ends with a nasal consonant, which is generally unacceptable in Modo. This could have been an influence from Indonesian. In the second example in (27), *ina* + *kia*, the alveolar nasal [n] gets a velar feature from the following velar stop, changing it into the velar nasal [ŋ]. Additional studies are needed to investigate this phenomenon further.

Notes on orthography

To date, Modo still lacks an established orthography. Previous works on Modo (Margono et al., 1987; Troeboes et al., 1987; Verheijen, 1987) did not develop a practical writing system. Native speakers typically write the language using the Indonesian orthographic system, which does not adequately represent the unique sounds of Modo. Developing an orthography specific to the Modo phonological system would be beneficial for creating literacy materials and revitalization efforts.

Given the phonological analysis presented above, some phonemes need to be highlighted. To differentiate the marginal voiced dental stop /d̪/ from the other two alveolar stop sounds (the plain /d/ and the implosive /ɗ/), we propose using <dh> for the dental sound [d̪] and the grapheme <d'> with an apostrophe for the implosive [ɗ]. To maintain consistency with using apostrophes for the implosives, we represent the bilabial implosive /ɓ/ with <b'>. As for the prenasalized stops /ᵐp/, /ᵐb/, /ⁿt/, /ⁿd/, /ⁿc/, /ⁿɟ/, /ᵑk/, /ᵑg/, we propose to use <mp>, <mb>, <nt>, <nd>, <nc>, <nj>, <ngk>, and <ngg>, respectively.

Another issue is the glottal stop /ʔ/. It is not represented in word-initial positions since its occurrence is phonetically predictable. In medial and final positions, two options exist: the apostrophe <'> or the grapheme <q>, as used by Verheijen (1987) in his ethnographic report. For this case, we suggest using the apostrophe in both word-medial and final positions. Although the use of apostrophe word-medially is common in the languages of this region, it is not typically used word-finally, since the final glottal stop [ʔ] in most languages in the area is a phonetic variation of the velar stop /k/, not phonemic. It is important to note that this apostrophe will not conflict with the one used for implosive sounds because implosives never occur in the word-final position.

Moreover, we need to distinguish between the voiced labio-dental approximant /ʋ/ and the bilabial approximant /w/. To differentiate between the two, we recommend using the grapheme <v> for labio-dental approximant /ʋ/. For nasal vowels, we suggest that a diacritic is used, such as < ē> and <ō>, to distinguish them from non-nasal vowels, like <e> and <o>. Finally, the mid-central vowel /ə/ is represented by the plain mid vowel plus the low tone diacritic, thus <è>. The practical orthography

of all the phonemes in Modo is presented in Table 12.

Table 12. Practical orthography

Phoneme	Orthography	Phoneme	Orthography
/p/	\<p\>	/i/	\<i\>
/b/	\<b\>	/e/	\<e\>
/ɓ/	\<b'\>	/ə/	\<è\>
/d/	\<d\>	/a/	\<a\>
/d̪/	\<dh\>	/o/	\<o\>
/ɗ/	\<d'\>	/u/	\<u\>
/t/	\<t\>	/ĩ/	\<ī\>
/c/	\<c\>	/ẽ/	\<ē\>
/ɟ/	\<j'\>	/ã/	\<ā\>
/k/	\<k'\>	/õ/	\<ō\>
/g/	\<g\>	/ũ/	\<ū\>
/ʔ/	\<'\>		
/m/	\<m\>		
/n/	\<n\>		
/ŋ/	\<ng\>		
/r/	\<r\>		
/f/	\<f\>		
/s/	\<s\>		
/h/	\<h\>		
/l/	\<l\>		
/w/	\<w\>		
/j/	\<j\>		
/ʋ/	\<v\>		
/ᵐp/	\<mp\>		
/ᵐb/	\<mb\>		
/ⁿt/	\<nt\>		
/ⁿd/	\<nd\>		
/ⁿc/	\<nc\>		
/ⁿɟ/	\<nj\>		
/ŋk/	\<ngk\>		
/ŋg/	\<ngg\>		

IV. DISCUSSION

Verheijen (1987) lists 29 consonants in Modo, whereas Margono et al. (1987) find 18 consonants, including a loan consonant /f/. The analysis presented before shows that Modo exhibits 31 consonant phonemes, comprising 29 native phonemes and two loan phonemes, /f/ and /j/. The three sounds that are not listed in Verheijen's (1987) consonant inventory are /d̪/, /ɟ/, and /ʋ/. Meanwhile, Margono et al. (1987) treat prenasalized consonants as consonant clusters, and thus, all eight prenasalized stops are not listed in the consonant inventory. In addition, /d̪/, /ɟ/, /ʋ/,

/ɓ/, and /ɗ/ are also not treated as phonemes by Margono et al. (1987).

Typologically, Modo, with 29 native consonants, constitutes a language with the most extensive consonant system in the Nusa Tenggara Timur (NTT) region. The consonants are relatively symmetrical, except for the dental plosive, where there is no voiceless dental plosive /t̪/. Modo has a four-way consonant contrast in which it has the voiceless /p, t, c, k/, voiced plosive /b, d, ɟ, g/, and prenasalized voiced stops /ᵐb, ⁿd, ⁿc, ŋg/. Although the contrast is symmetrical, Modo only exhibits two implosive phonemes, /ɓ/ and /ɗ/, typical of Austronesian languages in the NTT region (Balukh, 2024; Hajek, 2010). Previous studies consider the implosives to be allophonic variations of their plain stop counterparts; however, this study proposes that they are two distinct phonemic sets as they can occur word-initially and word-medially and co-occur with various vowels. In addition, this study also reveals that Modo exhibits the labio-dental approximant /ʋ/, a typical sound in the Western Flores area but rarely described in the literature. The unique phoneme to Modo is the denti-alveolar plosive /d̪/. No language in the NTT region is reported to have such a sound thus far. This sound is analyzed as phonemic because it is contrastive /d/, as shown in example (2).

The analysis of vowels in the presented previous section indicates that Modo has 11 vowels: six oral and five nasal vowels. The nasal vowels are considered unique because very few languages throughout the NTT region exhibit nasal vowels. Beside Modo, Lamaholot and Adonara, languages in the easter part of Flores Island are reported to constitute nasal in their vowels phonemically (see Balukh, 2024; Kroon, 2016, pp. 42–43; Nagaya, 2011, pp. 65–68). Nasal vowels are not found in languages in the western part of Flores, such as Manggarai (Karjo, 2021) and Rembong (Fernandez, 1990). All vowels have complete distributions, except for the mid-central vowel /ə/, which only occurs word-medially, and nasal vowels, which are only found word-finally. The nasal vowels in Modo were analyzed as a sequence of a vowel and the velar nasal /ŋ/ in previous works. However, this study shows they are nasal vowels, as supported by the acoustic feature. By positing nasal vowels as phonemes, this study suggests that only two consonants are allowed in word-final position, namely /h/ and /ʔ/, in contrast to the previous studies

proposing that Modo has three final consonants /ŋ/, /ʔ/, and /h/ (Margono et al., 1987, p. 21; Verheijen, 1987, p. 42).

The findings of this research can contribute to the development of an orthography of Modo that, in turn, will be useful for the community to write their language or produce written materials that can help language learning and transmission in the community. This phonological sketch describes the main phonological aspects of Modo, such as consonant and vowel inventories, syllable structure, and phonotactic aspects. These descriptions constitute a basis for a more comprehensive description of Modo grammar.

This paper presents findings that are unidentified in prior studies, such as nasalized vowels (/ã/, /ĩ/, /ũ/, /ẽ/, /õ/) and consonants /ɓ/, /ɗ/, /ʄ/, and /ʋ/. Nonetheless, the fieldwork conducted for this study only obtained a limited amount of data for an in-depth analysis. Furthermore, the native speakers were not always available to be language consultants during the fieldwork due to their daily activities or fluency in speaking Modo. The phonological features of Modo have been disclosed in this paper; however, there remain unanswered issues nonetheless. Questions arising involve the formation of quadri-syllabic words, the stress shift in phrase and sentence domain, and the phonological constraints that influence the final vowels of verbs when they take pronominal or possessive clitics. More phonological evidence and further investigation are necessary to resolve these problems.

V. CONCLUSION

Despite its status as an endangered language, Modo, a language of the Bima-Lembata subgroup of the Central Eastern Malayo-Polynesian of the Austronesian family, spoken on the islands of Komodo and Rinca, is understudied. This paper describes Modo's synchronic phonology and provides a more detailed analysis of the sound system, including the phonotactic aspects of the language.

Modo has a moderately large consonant inventory, consisting of 29 native phonemes and two loans: /j/ and /f/. The consonant segments are symmetrical, except for the dental plosive, which has only one member, /ḓ/. Modo has two implosive consonants and eight prenasalized consonantal phonemes. Additionally, the labio-dental approximant /ʋ/ should be mentioned, as it was not distinguished in the previous literature. Only two consonants are allowed in the final coda position: /h/ and /ʔ/. Concerning vowels, Modo has six oral and five nasal vowels. Among the oral vowels, there is a mid-central vowel /ə/. This vowel is short, so the following consonants are lengthened in order to fulfill the syllable weight, resulting in an ambisyllabic consonant. Additionally, this vowel is easily deleted, which results in consonant clusters. However, these clusters are optional and should be placed in the onset of the syllable structure, either as an initial or medial onset since Modo does not allow codas in word medial positions. Primary stress falls on the penultimate syllable, although it may shift to the final syllable when occurs in phrases or sentences. Modo has limited morphophonological processes; only deletion and assimilation are observed in compounds.

This current study provides a snapshot of the linguistic situation on the Komodo and Rinca islands and the synchronic phonological properties of Modo, including the phonemic inventories and the syllable structures. It also clarifies some phonological issues in previous research, such as plain plosive-implosive pairs and nasal vowels. While previous studies consider the implosives to be allophonic variations of their plain stop counterparts, this study demonstrates that they are two distinct phonemic sets. In addition, none of the previous works lists nasal vowels as phonemes; however, our data show significant occurrences of nasal vowels, which are contrastive. This study also develops an orthography for Modo, which could be useful for literacy, language preservation, and revitalization.

List of abbreviations

1	= first person
2	= second person
3	= third person
C	= consonant
class	= classifier
excl	= exclusive
incl	= inclusive
k.o.	= kind of
neg	= negation
poss	= possessive
prog	= progressive
pl	= plural

sg   = singular
V   = vowel

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DECLARATION OF COMPETING INTERESTS

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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APPENDIX 1: SWADESH WORDLIST

No	Phonemic	Phonetic	English gloss	No	Phonemic	Phonetic	English gloss
1	/ahã/	[ʔahã]	'to eat'	46	/ihã/	[ʔihã]	'fish'
2	/ahu/	[ʔahu]	'1SG'	47	/ikɔʔ/	[ʔikɔʔ]	'tail'
3	/aiba/	[ʔaiba]	'when'	48	/ilu/	[ʔilu]	'to spit'
4	/amaʔ/	[ʔamaʔ]	'father'	49	/ina/	[ʔina]	'mother'
5	/anaʔ/	[ʔanaʔ]	'child'	50	/inũ/	[ʔinũ]	'to drink'
6	/aⁿte/	[ʔaⁿte]	'seed'	51	/isi/	[ʔisi]	'meat (flesh)'
7	/aŋĩ/	[ʔaŋĩ]	'wind'	52	/ɹao/	[ɹao]	'green'
8	/apa/	[ʔapa]	'what'	53	/kaka/	[kaka]	'bird'
9	/api/	[ʔapi]	'fire'	54	/kako/	[kako]	'to play'
10	/ata/	[ʔata]	'person'	55	/kaləbe/	[kalbe]	'wing'
11	/ate/	[ʔate]	'liver'	56	/kɔdã/	[kɔdã]	'big'
12	/awa/	[ʔawa]	'if'	57	/kəlaĩ/	[klaĩ]	'sand'
13	/awã/	[ʔawã]	'cloud'	58	/kəliŋa/	[kəliŋa]	'ear'
14	/awã/	[ʔawã]	'sky'	59	/kəmoɹo/	[kəm:oɹo]	'to suck'
15	/ba/	[ba]	'to swell'	60	/kənai/	[knai]	'to breathe'
16	/bae/	[bae]	'know (fact)'	61	/kənanu/	[knanu]	'to think'
17	/balae/	[balaɛ]	'snake'	62	/kəraʋo/	[kraʋo]	'ashes'
18	/bale/	[bale]	'to throw'	63	/kere/	[kere]	'to dig'
19	/ɓanũ/	[ɓanũ]	'water'	64	/kəteʔ/	[kət:ɛʔ]	'to cut'
20	/baraʔ/	[baraʔ]	'belly'	65	/ki/	[ki]	'foot'
21	/basaʔ/	[basaʔ]	'wet'	66	/kideʔ/	[kidɛʔ]	'small'
22	/bɔlã/	[bɔlã]	'star'	67	/kini/	[kini]	'other'
23	/binatã/	[binatã]	'animal'	68	/kolo/	[kolo]	'head'
24	/ɓokaʔ/	[ɓokaʔ]	'neck'	69	/komõ/	[komõ]	'mouth'
25	/buⁿga/	[buⁿga]	'dog'	70	/kuni/	[kuni]	'back (body part)'
26	/dae/	[dae]	'to sew'	71	/laho/	[laho]	'to walk'
27	/ɗàʔ/	[ɗàʔ]	'bad'	72	/lahi/	[lahi]	'husband'
28	/dəŋi/	[dəŋ:i]	'to hear'	73	/laho/	[laho]	'to walk'
29	/dinĩ/	[dinĩ]	'near'	74	/lale ede/	[lale ʔede]	'here'
30	/diu/	[diu]	'far'	75	/lale ŋəde/	[lalɛ ŋəd:e]	'in'
31	/ɗùaʔ/	[ɗùʷaʔ]	'to hunt'	76	/leba/	[leba]	'where'
32	/ɖuɖu/	[ɖuɖu]	'dull (knife)'	77	/ləku/	[lək:u]	'to sleep'
33	/duᵐpeʔ/	[duᵐpɛʔ]	'short'	78	/lela/	[lela]	'to fly'
34	/duⁿdu/	[duⁿdu]	'to push'	79	/ləmaʔ/	[ləm:aʔ]	'tongue'
35	/ede/	[ʔede]	'this'	80	/leⁿtẽ/	[leⁿtẽ]	'to float'
36	/guᵐpu/	[guᵐpu]	'thick'	81	/leʋa/	[leʋa]	'long'
37	/haɔ/	[haɔ]	'scratch'	82	/lima/	[lima]	'five'
38	/hami/; /hete/	[hami]; [hete]	'1PL.ex'; '1PL.in'	83	/lima/	[lima]	'hand'
39	/hənã/	[hən:ã]	'right (correct)'	84	/liu/	[liw]	'left (hand)'
40	/hene/	[hene]	'that'	85	/lo səne/	[lo sən:e]	'there'
41	/həre/	[hər:e]	'to stand'	86	/lo/	[lo]	'at'
42	/hia/	[hiʲa]	'3SG'	87	/luki/	[luki]	'skin (of person)'
43	/miu/	[miu]	'2PL'	88	/maba/	[maba]	'to hit'
44	/hou/	[hou]	'2SG'	89	/mai/	[mai]	'to come'
45	/hutu/	[hutu]	'louse'	90	/maleʔ/	[malɛʔ]	'to laugh'

No	Phonemic	Phonetic	English gloss	No	Phonemic	Phonetic	English gloss
91	/mara/	[mara]	'dry'	138	/pui/	[pui]	'to tie'
92	/masu/	[masu]	'to smell'	139	/puse/	[puse]	'navel'
93	/mata ro/	[mata ro]	'sun'	140	/pusi/	[pusi]	'to live'
94	/mata/	[mata]	'eye'	141	/pusu/	[pusu]	'heart'
95	/mateʔ/	[mateʔ]	'to die'	142	/ranu/	[ranu]	'to squeeze'
96	/ᵐbã/	[ᵐbã]	'to flow'	143	/rara/	[rara]	'red'
97	/mədeh/	[məd:ɛh]	'heavy'	144	/raʔ/	[raʔ]	'blood'
98	/mina/	[mina]	'fat (substance)'	145	/rehẽ/	[rɛhẽ]	'good'
99	/mĩ/	[mĩ]	'how'	146	/rekẽ/	[rɛkẽ]	'to count'
100	/moⁿca/	[moⁿca]	'yellow'	147	/rəwũ/	[rəw:ũ]	'fog'
101	/mone/	[mone]	'man (male)'	148	/riⁿdo/	[riⁿdo]	'to sing'
102	/mucikali/	[mucikali]	'all'	149	/ro/	[ro]	'day (not night)'
103	/munu/	[munu]	'to fall (drop)'	150	/roᵐbo/	[roᵐbo]	'straight'
104	/murẽ/	[murẽ]	'black'	151	/rua/	[ruʷa]	'two'
105	/muta/	[muta]	'to vomit'	152	/sa/	[sa]	'one'
106	/nahã/	[nahã]	'sharp (knife)'	153	/saᵐpu/	[saᵐpu]	'dirty'
107	/naᵐbo/	[naᵐbo]	'lake'	154	/satah/	[satah]	'grass'
108	/nani/	[nani]	'and'	155	/sei/	[sei]	'who'
109	/nani/	[nani]	'with (accompanying)'	156	/sekio/	[sekio]	'few'
110	/naŋĩ/	[naŋĩ]	'to swim'	157	/sia/	[siʲa]	'salt'
111	/napu/	[napu]	'brushwood'	158	/sire/	[sire]	'they'
112	/ⁿcao/	[ⁿcao]	'to fight'	159	/susɔ/	[susɔ]	'rub'
113	/ⁿdaho/	[ⁿdaho]	'to fear/be afraid'	160	/susu/	[susu]	'breast'
114	/ⁿdore/	[ⁿdore]	'to lie down'	161	/tali/	[tali]	'rope's'
115	/nipis/	[nipis]	'thin'	162	/tana/	[tana]	'earth (soil)'
116	/ⁿtaũ/	[ⁿtaʷũ]	'year'	163	/tase/	[tase]	'sea (ocean)'
117	/ⁿtodoh/	[ⁿtɔdɔh]	'mountain'	164	/tau beke/	[tau beke]	'to split'
118	/nu/	[nu]	'smoke'	165	/təlɔ/	[təlɔ]	'egg'
119	/nuⁿdoʔ/	[nuⁿdɔʔ]	'to say'	166	/təlu/	[təl:u]	'three'
120	/ŋarã/	[ŋarã]	'name'	167	/teⁿtẽ/	[teⁿt:ẽ]	'hold (in hand)'
121	/ŋɔ/	[ŋɔ]	'to see'	168	/təʋu/	[təʋ:u]	'dust'
122	/ŋodoʔ/	[ŋɔdɔʔ]	'to sit'	169	/toko/	[toko]	'bone'
123	/ŋənte/	[ŋəⁿt:e]	'cold (weather)'	170	/tu/	[tu]	'knee'
124	/ŋəntu/	[ŋəⁿt:u]	'tooth'	171	/tuka/	[tuka]	'narrow'
125	/ᵑgəleʔ/	[ᵑgəl:ɛʔ]	'smooth'	172	/tuki/	[tuki]	'stick (of wood)'
126	/ŋirũ/	[ŋirũ]	'nose'	173	/tunu/	[tunu]	'to burn'
127	/ŋolo/	[ŋolo]	'leaf'	174	/tuʷa/	[tuʷa]	'old'
128	/pa/	[pa]	'four'	175	/uleh/	[ulɛh]	'worm'
129	/paɟaʔ/	[paɟaʔ]	'wide'	176	/urã/	[ʔurã]	'to rain'
130	/pana/	[pana]	'warm'	177	/usu/	[ʔusu]	'guts'
131	/pərate/	[prate]	'to kill'	178	/ʋei/	[ʋei]	'wife'
132	/pila-pila/	[pila-pila]	'some'	179	/ʋiã/	[ʋiʲã]	'to give'
133	/popo/	[popo]	'to wash'	180	/ʋod̪o/	[ʋod̪o]	'many'
134	/popo/	[popo]	'white'	181	/ʋou/	[ʋou]	'new'
135	/posa/	[posa]	'wipe'	182	/ʋoʔ/	[ʋoʔ]	'hair'
136	/pu/	[pu]	'tree'	183	/ʋuah/	[ʋuʷah]	'fruit'
137	/puh/	[puh]	'to blow (wind)'	184	/ʋunu/	[ʋunu]	'feather (large)'

No	Phonemic	Phonetic	English gloss
185	/wadi/	[wadi]	'because'
186	/wake/	[wake]	'root'
187	/wakeʔ/	[wakɛʔ]	'to bite'
188	/waleʔ/	[walɛʔ]	'to turn (veer)'
189	/walu/	[walu]	'river'
190	/wana/	[wana]	'right (hand)'
191	/watu/	[watu]	'stone'
192	/weh/	[wɛh]	'rotten (log)'
193	/welaʔ/	[welaʔ]	'flower'
194	/wəwiã/	[wəwːiʲã]	'night'
195	/wiⁿco/	[wiⁿco]	'to stab (or stick)'
196	/wine/	[wine]	'woman'
197	/wiⁿtã/	[wiⁿtã]	'to pull'
198	/wita/	[wita]	'not'
199	/wuku/	[wuku]	'nail'
200	/wulã/	[wulã]	'moon'