

Consonant acquisition in Lio

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Abstract. Lio is an understudied Austronesian language spoken in Central Flores, Indonesia by 220,000 speakers (Ethnologue, 2019), for which no acquisition research has yet been completed. In this case study, the speech of two female bilingual speakers, ages 7 and 9, were transcribed, to determine which consonants were produced in an adult-like manner by each speaker; all consonants that the children attempted were produced in an adult-like manner, excepting [ʍ] and [r]. [ʍ] is of note, as it was replaced by [j], a phoneme in the speakers' other language, Indonesian, implying a potential influence of bilingualism.

Keywords. Austronesian languages; acquisition; Lio

1. Introduction. McLeod and Crowe (2018) provide a cross-linguistic survey of 64 studies of consonant acquisition (based on production) in 27 languages, but they found very little work on Austronesian languages to include in their survey, including only Phoon et.al. (2014)'s work on elementary Malay students. This study investigates the consonant acquisition of two Lio speakers, with a special focus on the relatively late acquisition of the dorso-velar approximant [ʍ]. Lio is an understudied Austronesian language spoken in Central Flores, Indonesia; this is the first acquisition work completed regarding Lio.

2. Background.

2.1. LIO LANGUAGE. Lio is an Austronesian language spoken in Central Flores, Indonesia and it is spoken by 220,000 speakers according to the 2009 Indonesian census (Eberhard et. al. 2020). The Lio speaking region of Flores can be seen in Figure 1.

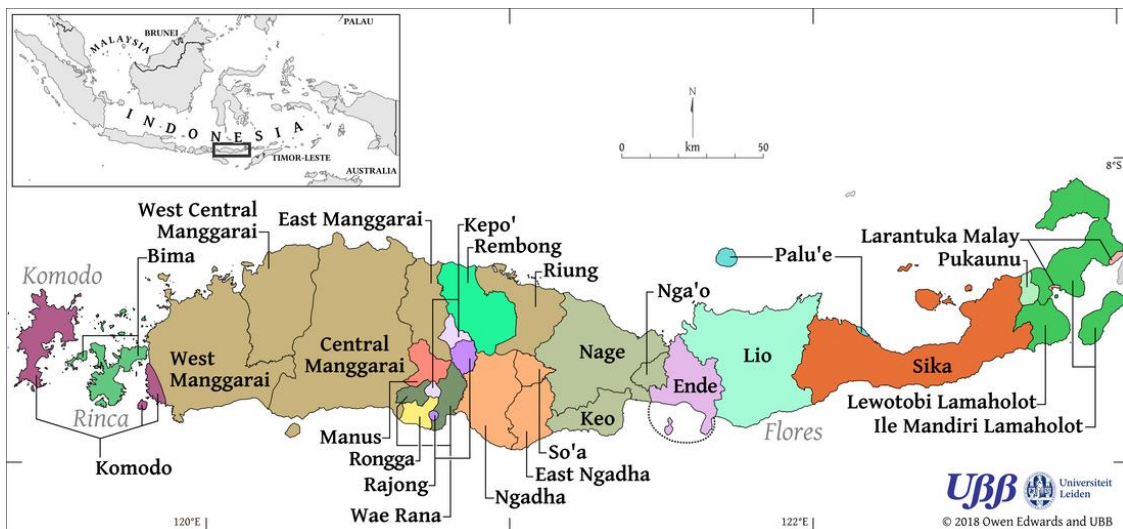


Figure 1. Lio Region of Flores, Indonesia. Map provided by Unit Bahasa dan Budaya (Language and Culture Unit) Kupang, Indonesia

The members of the community from which the data for this project comes identified three dialects of Lio during the author's fieldwork: Lio Ja'o, Lio Nga'o, and Lio Aku. Sawardo et.al. (1987)'s short grammar of the language lists five major dialects, including: Lio

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Tana Kunu, Lio Mbu, Lio Mbengu, Lio Mego, and Lio Aku. Members of the community whose language is considered here have self-identified their dialect as Lio Aku.

Native Lio words are mostly disyllabic, and syllables have a CV or V structure (Elias, 2008). Recent loan words from Indonesian may include nasal codas or onset clusters composed of a stop and an approximant or trill, but there is great interspeaker variation that largely seems to depend on how fluent a speaker is in Indonesian, as almost all speakers of Lio are bilingual. Stress is largely penultimate, though there are some native exceptions to this generalization (Elias, 2008). Like many other Austronesian languages, Lio is predominately an isolating language, and it has SVO word order (Elias 2018).

Lio has 25 consonant phonemes, as can be seen in Table 1. Lio Aku includes labial, coronal, and dorsal voiced and voiceless stops—including nasals and prenasalized voiced stops, voiceless fricatives, and approximants. It also includes a labial and coronal implosive, a coronal trill, and two coronal affricates.

		LABIO-		APICO-	LAMINO-		DORSO-	GLOTTAL
		LABIAL	DENTAL	ALVEOLAR	DENTAL	PALATAL	VELAR	
STOP	VOICELESS	p ⟨p⟩			t ⟨t⟩		k ⟨k⟩	ʔ ⟨'⟩
	VOICED	b ⟨b⟩		d ⟨d⟩			g ⟨g⟩	
	PRENASAL	^m b ⟨mb⟩		ⁿ d ⟨nd⟩			^ŋ g ⟨ngg⟩	
	IMPLOSIVE	ɓ ⟨bh⟩		ɗ ⟨dh⟩				
AFFRICATE						dʒ ⟨j⟩		
NASAL		m ⟨m⟩		n ⟨n⟩			ŋ ⟨ng⟩	
FRICATIVE			f ⟨f⟩	s ⟨s⟩				[h] ⟨h⟩
APPROXIMANT			v ⟨w⟩	l ⟨l⟩			ʋ ⟨gh⟩	
TRILL				r ⟨r⟩				

Figure 2. Consonant Inventory of Lio (from Elias 2019).

2.3. CONSONANT ACQUISITION. Though much of the work on consonant acquisition has focused on English and other Indo-European languages, McLeod and Crowe (2018) provide a cross-linguistic survey of 64 studies of consonant acquisition in 27 languages, based on production of consonants. Their findings are summarized in Figure 2.

Criteria	No. of studies		1;10–2;11 (21–35 months)	3;0–3;11 (36–47 months)	4;0–4;11 (48–59 months)	5;0–5;11 (60–71 months)	6;0–6;11 (72–83 months)	7;0–7;6 (84–90 months)
75%–85%	29	Pulmonic	/ʔ, ^m b, k ^w , s, ts, ts ^h , p ^a , t ^a , k ^a , u, m, ⁿ d, ^ŋ g, n, ɕ, p, b, d, t, q, f, pf, j, w, k, p ^h , c, f, ^h ʃ, t ^h , g, h, t ^h , ɣ, h, h, t ^h , ɕ, ts ^h , k ^h /	/t ^h , n ^w , ŋ ^w , R, ɔ ^h , s ^w , m, ʒ, l ^w , ts ^{hw} , t ^h , k ^{hw} , j, t, ts, s, l, ʃ, x, ɣ, j, ʃ ^h , ɔ, s ^h , ɛ, r, r, ʌ, v, j, z, ɕ, t ^{wh} , k ^{wh} , x ^w , u, t ^{wh} , dʒ ^w , dʒ, ɕ, j, ʒ/	/r, j, ɔ, c ^h /	/t, θ/	/ʒ, s/	
75%–85%	3	Nonpulmonic	/p ^a , t ^a , c ^a , k ^a , b, l, l/	/t ^{wh} , k ^{wh} , ts ^{wh} , l ^h , ll ^h , ts ^a , kx ^a , ll/	/l ^h , ʃ ^h /			
90%–100%	37	Pulmonic	/t ^h , t ^h , j, tʃ, t, c, u, p, m, t/	/pf, n, ʔ, ɕ, ts ^h , k, ɣ, b, j, ŋ, h, p ^h , u, d, t ^h , ʒ, f, c ^h , x, g, w, ɕ, ɕ, s, j, k ^h , l, h, k ^h , q, ɕ, b, t ^h , q, ɔ ^h , ɣ, v, j, ʃ/	/y, ʃ, ɕ, dʒ, ʌ, k ^{wh} , ts, s, ts ^h , ɔ, h, r, z, j, t ^h /	/ʒ, cɕ, j, ɣ, r, θ/	/β/	/w/

Note. Some consonants were only examined in studies using the 75%–85% or 90%–100% criteria, so consonants may appear in one row, but not the other. The consonants within a cell are ordered from earliest to latest acquisition (see Supplemental Material S1 for additional information).

Figure 3. Mean age of acquisition of pulmonic and nonpulmonic consonant phonemes across 27 languages using the 75%–85% and 90%–100% criteria organized according to age in years. (McLeod and Crowe 2018)

Several patterns appear to emerge from McLeod and Crowe’s summary:

Overall, consonants produced with the lips (bilabial and labiodental), pharynx (pharyngeal, epiglottal, and glottal), and posterior tongue (palatal, velar, and uvular) were acquired earlier than consonants articulated with the anterior tongue (dental, alveolar, postalveolar, and retroflex). ...

Anterior plosives and nasals (e.g., /t, d, n/) were typically acquired earlier than anterior fricatives (e.g., /s, z, ʃ, ʒ/), liquids (e.g., /l/), trills (e.g., /r/), and affricates (e.g., /tʃ, dʒ/). (McLeod and Crowe, 2018, p. 1554)

Many of the consonants in Lio Aku are represented in McLeod and Crowe's work, including [b, d, g, ^mb, ⁿd, ^ŋg, p, t, k, ʔ, m, n, ŋ, β, s, f, h, v, l, r, dʒ]. For consonants in Lio not covered by this extensive survey, other work was considered.

In their case study of a Fulfulde speaker, Cissé, Demolin and Vallée (2011) found that the alveolar implosive [d] that this consonant was produced in an adult-like manner by 10 months of age (11). The velar approximant [u] has been shown to have not yet been acquired by Ibibio speakers by 4 years and 6 months of age, while other approximants in the language were already acquired (Akpan 2011). In their study of Icelandic consonant acquisition, Másdóttir and Stokes (2015) classified [u] as an emerging sound as of 3 years and 4 months, the later age they considered in their study, while all other approximants had been fully mastered at this age.

3. Methodology.

3.1. DATA. The recorded Lio speech data considered in this case study were downloaded from the PARADISEC (Pacific And Regional Archive for Digital Sources in Endangered Cultures) database; the Lio collection was recorded in Wolondopo, Flores as a part of a language documentation training program, Linguistic Fieldwork and Documentation Training in Indonesia Program (Yanti, 2019)¹. The author was a participant in this training program.

The recordings include a transcribed recording from a nine-year-old female (MON015)², a non-transcribed recording of seven-year-old female (INS002), and a non-transcribed recording of both speakers (CON004). Both are bilingual speakers of Lio and Indonesian.

As this is the only readily available child language data for Lio, the author strove to use as much of the data as possible. She transcribed the recording of the seven-year-old so that it could be used in the present analysis. As the recording with both children involved singing, it was excluded from the present analysis both due to difficulties in transcription and that it did not include natural speech.

3.2 ANALYSIS. The author considered the pronunciation of each speaker and noted whether the sounds were produced in an adult-like manner. As the impetus for this study occurred during fieldwork, the author was able to confirm with native speakers that any sounds that did not sound adult-like were in fact pronounced differently, to avoid any mistakes due to unfamiliarity with the language.

Careful notes were taken as to whether the speakers deleted consonants or replace them with another sound. In order to determine if a consonant had been acquired by participants, the same diagnostics as Másdóttir and Stokes (2015) were used. Thus, a consonant was considered *mastered* if the child's accuracy is at or above 90%, *acquired* if accuracy is between 75 and 89%, and *emerging* if between 50 and 74%.

4. Results and Discussion.

4.1. RESULTS. Given the age of each of the speakers, it was predicted that each of them would have mastered all of the consonant sounds in Lio. Notably, this was not the case. The speech sample from the seven-year-old speaker shows evidence of her having mastered almost all the consonants in Lio, excepting [β], [d], and [f]. Of the phonemes that

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² Codes correspond to the recording codes in PARADISEC.

she attempted, there were only two that she did not produce in an adult-like manner: [ɯ], the velar approximant, was instead produced as [j], the palatal approximant, in a single instance of the word [ɯʔaru] <gharu> ‘there,’ which she produced as [jaru], and [r] was instead produced as [ɽ] in a single instance of [rio] <rio> ‘bathe.’ Notably, she was able to correctly produce [r] in all intervocalic contexts.

The nine-year-old speaker attempted words with every Lio consonant phonemes excepting [f], and also produced almost all of the phonemes in an adult-like manner. The exception to this was [ɯ], which was consistently replaced with [j]. This occurs in every instance in which she ought to have produced [ɯ] including 15 instances of [ɯea] <ghea> ‘there,’ and one instance of [ɯava] <ghawa> ‘down,’ which she produced as [jea] and [java], respectively.

Matrices for each child can be found in the appendices; they are not reproduced here due to their size.

4.2. DISCUSSION. McLeod and Crowe (2018) found that [r] is usually produced with 90% accuracy in the 5.0-5.11 range. However, even adult Lio speakers produce [r] in free variation with [ɽ] (Elias 2018), and this may have influenced the production of this phoneme. Furthermore, the interlocutor for this recording is a native speaker of English, who was not fluent in Lio and spoke Indonesian as a second language; it is also possible that this may have influenced the speaker. It is important, also, to note that there is only one instance of [ɽ] in place of [r]; as she still produces [r] 75% of the time, this is nonetheless an acquired sound. Thus, the author refrains from making too bold a claim as to the acquisition of this particular phoneme.

Regarding [ɯ], according to the elders of Wolondopo, where this data was collected, substitution of [ɯ] with [j] is common by children who have not yet acquired the velar approximant. This substitution is not observed in adult speech. It is the only dorsal approximant, which may influence this, though other velar sounds had been acquired by this point. Acquisition research on other languages shows that this may be an approximant that is later in other languages as well: [ɯ] has been shown to have not yet been acquired by Ibibio speakers by 4 years and 6 months of age, while other approximants in the language ([j] and [w]) were already acquired (Akpan 2011). In their study of Icelandic consonant acquisition, Másdóttir and Stokes (2015) classified [ɯ] as an emerging sound as of 3 years and 4 months, the later age they considered in their study, while all other voiced approximants ([v] and [l]) had been fully mastered at this age. However, even though [ɯ] is acquired later in other languages relative to other approximants, it is still acquired well before the age of the two Lio speakers considered in this case study.

That both child speakers examined in this study are bilingual speakers of both Lio and Indonesian must be considered. Both speakers replaced [ɯ] with [j]; while [j] is not a native Lio phoneme, it is a phoneme in Indonesian, which may explain why [j] was selected to replace [ɯ], and why both speakers utilize this phoneme well past when we might otherwise expect [ɯ] to be acquired.

5. Conclusion. This case study adds to our understanding of consonant acquisition, especially as it relates to bilingual speakers and understudied sounds. As the two Lio speakers examined in this study had not acquired the approximant [ɯ], it leads to questions as to when monolingual speakers of Lio might acquire this particular sound; the author hopes this can be a focus in future work. This work, while narrow in its scope, also extends our understanding of Lio, an understudied language.

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Appendix 1. Consonant Matrices for 7-Year-Old Female Speaker

r																1							
j																					1		8
h																						2	
ʔ																					0		
^h g																				2			
ŋ																			2				
g																		4					
k																	16						
ḍʒ																6							
r															3								
l														4									
s													12										
n												4											
ɖ											0												
^h d											2												
t											6												
d											9												
v											8												
f											0												
m											5												
β											0												
^m b											1												
b											2												
p											3												
	p	b	^m b	β	m	f	v	d	t	^h d	ɖ	n	s	l	r	ḍʒ	k	g	^h g	ŋ	ɥ	h	ʔ
	3	2	1	0	5	0	8	9	6	2	0	4	12	4	4	6	16	4	2	2	1	2	2
	100	100	100	0	100	0	100	100	100	100	0	100	100	100	75	100	100	100	100	100	0	100	100

Appendix 2. Consonant Matrices for 9-Year-Old Female Speaker

j																					16		37
h																						2	
ʔ																					0		
^ŋ g																				4			
ŋ																			1				
g																	15						
k																67							
\widehat{d}_3																35							
r															58								
l														55									
s													47										
n												30											
ɸ											2												
ⁿ d										2													
t									35														
d								31															
v							42																
f						0																	
m					37																		
β				2																			
^m b			2																				
b		17																					
p	16																						
	p	b	^m b	β	m	f	v	d	t	ⁿ d	ɸ	n	s	l	r	\widehat{d}_3	k	g	^ŋ g	ŋ	ʔ	h	ʔ
	16	17	2	2	37	0	42	31	35	2	2	30	47	55	58	35	67	15	1	4	16	2	2
%	100	100	100	100	100	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	0	100	100