

THE SOUND SYSTEM OF LAI

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INTRODUCTION

Lai is a language that belongs to the Naga-Chin-Kuki branch of the Tibeto-Burman family. It is spoken by approximately 100,000 speakers in two regions in the world, Chin State in Burma and Mizoram State in India.

My informant is Kenneth Van-Bik, a native speaker of Lai. Kenneth is 33 years old. He grew up in Haka, Chin State, Burma, where Lai is spoken. He lived there until the age of sixteen, when he moved to Rangoon. In Rangoon he spoke Burmese, a language which he learned as a second language at school.

The following analysis is based on a lexicon, containing approximately 300 words, which I elicited from Kenneth, and on additional data taken from the STEDT database. In the first section I provide an inventory of the phonemes and allophones of Lai, specifying their distribution and plotting the consonants in a chart that displays their place and manner of articulation. In the discussion section I focus on a number of issues that I believe are significant for an account of the sound system of Lai.

AN INVENTORY OF THE PHONEMES OF LAI

The phonemes of Lai are presented in Table 1 (consonants) and Table 2 (vowels). Tables 3 and 4 illustrate each phoneme, usually in both initial and medial position, along with Lai lexical examples, with allophones and environments also specified.

	<i>bilabial</i>		<i>labiodental</i>	<i>dental</i>	<i>alveolar</i>		<i>velar</i>	<i>glottal</i>
<i>plosive</i>	p	b		t	ʈ	d	k	ʔ
<i>plosive (asp.)</i>	p ^h			t ^h	ʈ ^h		k ^h	
<i>nasal</i>	ɱ	m			ɳ	n	ŋ	ɴ
<i>trill</i>					ʀ	r		
<i>fricative</i>			f	v		s	z	
<i>lat. appr.</i>					ɬ	ɮ		

Affricates

\overline{ts}	$\overline{tʃ}$	$\overline{tɬ}$	$\overline{tɭ}$
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Table 1. The consonants in Lai by place and manner of articulation.

<div style="border: 1px solid black; padding: 10px; text-align: center;"> i, ii u, uu e, ee o, oo a, aa </div>		
<div style="border: 1px solid black; padding: 10px;"> — ui ei oi, ooi ai, aai </div>	<div style="border: 1px solid black; padding: 10px;"> iu — eu ou au, auu </div>	<div style="border: 1px solid black; padding: 10px;"> ie ia ua iau uai </div>

Table 2. The vowels of Lai.

Table 3. The consonants in Lai: allophones and distribution.

Phoneme	Allophones	Environment	Examples
/b/	[b]	*_{σ, #}	ban ‘sticky’; sau’bul ‘hammer’
/p/	[pʼ]	_#	kaapʼ ‘shoot’
	[p]	elsewhere	pa’kʰatʼ ‘one’; tam’pii ‘many’
/pʰ/	[pʰ]	*_{σ, #}	pʰaʔl ‘extinguish’; sa’pʰeʔr ‘dry meat’
/t/	[tʼ]	_#	?itʼ ‘sleep’
	[t]	elsewhere	tooi ‘short’; mit’ŋeel ‘eyebrow’
/tʰ/	[tʰ]	*_{σ, #}	tʰoo ‘breath’; pa’tʰum ‘three’
/d/	[d]	*_{σ, #}	daŋ ‘glottis’; kʰun’dim ‘marriage’
/t/	[t]	*_{σ, #}	tiŋ’taŋ ‘guitar’
/tʰ/	[tʰ]	*_{σ, #}	tʰaal ‘summer’; tʰin’tʰaŋ ‘patio’
/k/	[kʼ]	_#	pa’rukʼ ‘six’
	[k]	elsewhere	kutʼ ‘hand’; pa’kua ‘nine’
/kʰ/	[kʰ]	*_{σ, #}	kʰua’sikʼ ‘cold season’; pa’kʰatʼ ‘one’
/?/	[ʔ]	#_V	?ei ‘eat’
	[ʔ]	CV_C	deʔn ‘press’
	[ʔ]	CV_#	pasa’riʔ ‘seven’
/m/	[m]	everywhere	min’mei ‘clouds’; rem ‘be in harmony’
/ŋ/	[ŋ]	*_{σ, #}	ŋitʼ ‘go out’ (lights); ʔei’ŋin ‘fruit’
/n/	[n]	everywhere	nikaa ‘sun’; min’mei ‘clouds’; pan ‘thin (not thick)’
/ŋ/	[ŋ]	*_{σ, #}	pa’ŋiʔ ‘two’; ŋeem ‘comfort’

(continued)

(Table 3, continued)

<i>Phoneme</i>	<i>Allophones</i>	<i>Environment</i>	<i>Examples</i>
/ŋ/	[ŋ]	everywhere	ŋaʔ 'receive'; pa'ŋa 'five'; keenj 'back'
/ŋ̥/	[ŋ̥]	*_{σ, #}	ŋaak' 'wait' (Form 1); mit'ŋeel 'eyebrow'
/r/	[r]	everywhere	rat' 'come' (Form 2); pa'ruk' 'six'; fuur 'rainy season'
/ɾ̥/	[ɾ̥]	*_{σ, #}	ɾem 'persecute/torture'; pa'ɾaa 'ten'
/v/	[v]	*_{σ, #}	vaan 'sky'; k^hua'vaj 'sky god'
/f/	[f]	*_{σ, #}	fuur 'rainy season'; si'faak' 'be poor'
/z/	[z]	*_{σ, #}	zaau 'lean/sleep'; zia'zaa 'attitude'
/s/	[s]	*_{σ, #}	sa'p^heʔr 'dry meat'; pasa'riʔ 'seven'
/l/	[l]	everywhere	luu 'head'; p^hiʔl 'forget'; pa'li 'four'
/l̥/	[l̥]	*_{σ, #}	lok' 'jump'; ban'laa 'banana'
/ts̥/	[ts̥]	*_{σ, #}	tsoon 'learn' (Form 1); sa'tsek' 'intestines'
/tʃ̥/	[tʃ̥]	*_{σ, #}	tʃim 'teach' (Form 1); ŋaak'tʃia 'child'
/tʰl̥/	[tʰl̥]	*_{σ, #}	tʰlip' 'bug'; pa'tʰliŋ 'mature man'
/tʰl̥v̥/	[tʰl̥v̥]	*_{σ, #}	tʰl^haa'paa 'moon'; ni'tʰl^haa 'calendar'

<i>Phoneme</i>	<i>Allophones</i>	<i>Environment</i>	<i>Examples</i>	
/a/	[a]	*{σ, #}_	zaŋ	'penis'
/aa/	[aa]	*{σ, #}_	zaaŋ	'strength'
/e/	[e]	*{σ, #}_	bek'	'earlobe'
/ee/	[ee]	*{σ, #}_	beek'	'muddy'
/i/	[i]	*{σ, #}_	p^hit'	'block' (v.)
/ii/	[ii]	*{σ, #}_	p^hiit'	'skin become dry'
/o/	[o]	*{σ, #}_	lok'	'jump' (v.)
/oo/	[oo]	*{σ, #}_	look'	'be worthy'
/u/	[u]	*{σ, #}_	t^hluk'	'be equal'
/uu/	[uu]	*{σ, #}_	t^hluuk'	'fall'
/ui/	[ui]	*{σ, #}_	mui	'be fragrant'
/ei/	[ei]	*{σ, #}_	tei'min	'fruit'
/oi/	[oi]	*{σ, #}_	soi	'criticize'
/ooi/	[ooi]	C_#	tooi	'short'
/ai/	[ai]	*{σ, #}_	ŋai	'have'
/aai/	[aai]	C_#	naai	'near'
/iu/	[iu]	*{σ, #}_	liu	'swim'
/eu/	[eu]	*{σ, #}_	keu	'grow' (Form 1)
/ou/	[ou]	*{σ, #}_	t^hhou	'plow' (Form 1)
/au/	[au]	*{σ, #}_	tiaŋt^ha'rau	'holy spirit'
/aaui/	[aaui]	C_#	saau	'long'
/ie/	[ie]	*{σ, #}_	bier	'loincloth'
/ia/	[ia]	*{σ, #}_	t^hsaa't^hiaŋ	'holy word'
/ua/	[ua]	*{σ, #}_	k^hua'vaŋ	'sky god'
/iau/	[iau]	*{σ, #}_	liau	'PRESENT MARKER'
/uai/	[uai]	*{σ, #}_	buai	'be confused'

Table 4. Vowels, diphthongs, and triphthongs in Lai.

DISCUSSION

The four T's

Lai has four distinct /t/ sounds. The examples in Table 5 constitute a ‘minimal quadruplet’. The four variants occur in the same environment and therefore cannot be considered allophones of one phoneme.

voiceless dental stop	t	ti	‘water’
voiceless aspirated dental stop	th	thi	‘blood’
voiceless alveolar stop	t̪	t̪i	‘afraid’
voiceless aspirated alveolar stop	th̪	th̪i	‘necklace’

Table 5. The /t/ sounds in Lai.

Distinctive Aspiration

All voiceless stops in Lai, with the exception of the glottal stop, have an aspirated counterpart. Likewise, the affricate /tʃ/ has an aspirated homologue /tʃʰ/. In the previous section we saw a minimal pair for the aspirated and unaspirated voiceless dental and alveolar stops. Following are minimal pairs for the bilabial stop, velar stop, and alveolar-lateral affricate:

<i>Unaspirated</i>		<i>Aspirated</i>	
peʔ	‘connect’	pʰeʔ	‘deny’
kam	‘mouth area’	kʰam	‘block’ (v.)
flaa	‘drop’ (v.)	flʰaa	‘shadow’

The following spectrograms are based on Kenneth’s pronunciation of the minimal pair for [k] ([kam], Figure 1) and [kʰ] ([kʰam], Figure 2). Please note that the scale of the spectrograms is different in each case. As expected, the duration of the aspiration at the stop release is relatively low for the unaspirated stop (30 msec) and extremely high for the aspirated stop (170 msec). Measurements taken of the release burst for the aspirated and unaspirated affricates reveal the same pattern: [tʃa] — 50 msec and [tʃʰa] — 200 msec. Such a clear contrast is essential in a language in which aspiration is distinctive. Without such a distinction the phonetics would introduce ambiguity into the language.

Voiced–Voiceless Distinction

There are two voiced stops in Lai: [d] and [b]. Contrary to expectation there are no voiced dental or velar stops. These gaps are even more surprising considering the fact that the nasals, trills, fricatives and lateral approximant each have a voiced-voiceless pair. The voiced-voiceless variants are distinct phonemes in Lai. Following is a list of minimal pairs demonstrating this:

<i>Voiced</i>		<i>Voiceless</i>	
ban	‘sticky’	pan	‘thin (not thick)’
dam	‘be healthy’	tam	‘plenty’
zaau	‘lean/sleep’	saau	‘long’
man	‘price’	man	‘use’
vaakʰ	‘wonder’	faakʰ	‘be in pain’
rem	‘be in harmony’	ɽem	‘persecute/torture’
ŋaʔ	‘receive’	ŋaʔ	‘wait’
na	‘you’	na	‘ear’
lei	‘tongue’	lei	‘bridge’

Consonant distribution

It is apparent from the phoneme table that most of the consonants cannot appear everywhere. A careful examination reveals that Lai exhibits an interesting pattern of consonant distribution:

- Voiced nasals, trills and lateral approximants (/m/, /n/, /ŋ/, /r/, /l/) can appear in word final or syllable final position. Their voiceless counterparts (/ɱ/, /ɳ/, /ɲ/, /ɽ/, /ɭ/) cannot.
- Fricatives and affricates cannot appear in word final or syllable final positions.
- All voiceless unaspirated stops (/ʈ/, /p/, /t/, /k/) except /t/, appear word/syllable final, while voiced stops (/b/, /d/) or voiceless aspirated stops (/pʰ/, /tʰ/, /kʰ/) do not. The voiceless unaspirated /t/ is never word/syllable final.

Stops in word final position are never released in Lai. Without a release there cannot be aspiration. The lack of a release may also account for the lack of word final /t/. The alveolar /t/ and dental /t/ may not be distinguishable when they are not released. It is not surprising that the affricates /t͡s/ and /t͡ʃ/ pattern together with the fricatives, since they are a combination of a stop and a fricative. However, one might expect the affricates /t͡l/ and /t͡lʰ/ which end with

a lateral approximant to appear word finally (like a voiced lateral approximant), yet they do not.

It appears that Lai treats the syllable final position on a par with the word final position. This may be a consequence of the morphology of Lai. A majority of the polysyllabic words in my lexicon are compound words, where each syllable is a word.

Stress

Stress in Lai falls invariably on the last syllable.

The 'glottal stop'

The glottal stop in Lai is a phenomenon that requires further explication. I have detected three environments in which the alleged glottal stop occurs:

*Word initially before a short vowel or a diphthong:

ʔor	'throat'
ʔum	'cooking pan'
ʔei	'eat'

*Word medially in a syllable of the form CVʔC in which the vowel is short:

k ^h aʔm	'save'
p ^h aʔl	'extinguish'
bɛʔŋ	'slap'
diʔn	'drink'
buʔr	'dip'

*Word finally in a syllable of the form CVʔ in which the vowel is short:

sifaʔ	'poor'
p ^h eʔ	'deny'
tiʔ	'afraid'

Words in Lai never start with a vowel but rather with a glottal stop. The glottal stop can be followed by any short vowel and by some of the diphthongs. Judging from the spectrograms of a number of words beginning with a glottal stop it seems that in word initial position it is in fact a pure stop. This is determined by the lack of signs proving otherwise (e.g., some kind of noise, aspiration, voicing, creaky voice vertical lines, etc.).

I used the minimal pair [kam] and [kaʔm] in order to analyze the alleged glottal stop in word medial position. The difference between the two words is very easy to detect auditorily. However, it is difficult to provide an exact

account simply by listening to the pair. The spectrograms reveal that there is no real glottal stop between the vowel and the consonant in [kaʔm]. Nevertheless, there are two differences between [kam] and [kaʔm] that seem to hold true for other similar cases.

	<i>kam</i> 'mouth area'	<i>kaʔm</i> 'promise'
stop burst duration	30 msec	20 msec
vowel duration	100 msec	80 msec
nasal duration	120 msec	60 msec

A vowel that is followed by a 'glottal stop' is slightly shorter in duration than a vowel that is immediately followed by a consonant. However, the difference seems to be negligible. The parameter that significantly distinguishes the two words is the length of the last segment /m/. When a consonant is preceded by a 'glottal stop' its duration is half of that of a consonant that is immediately preceded by a vowel. Additionally, the effect of the phantom glottal stop is a creaky voice during the pronunciation of the vowel, which spreads to the first part of the nasal that follows it.

The creaky voice effect of the so-called glottal stop is evident in word final glottal stops. As we can see in the following spectrogram (Figure 3) of the word [buʔ] ('cooked rice'), the vowel is short (110 msec). The quality of the vowel changes in the last 25 msec, when it becomes creaky. This is evident by the widely spaced vertical lines, which reflect the vibrations of the vocal cords.

The same proportion (~80 msec 'regular' vowel and ~20 msec creaky voice) is found in other examples of the word final vowel-glottal stop sequence such as [kan maʔ] ('we') (Figure 4) and [kaʔ] ('shoot', Form 2).

Vowel length

There are 5 short-long vowel pairs in Lai. The examples of minimal pairs in the phoneme chart demonstrate that the short and long vowels are lexically distinguished. The durations of the vowels in the minimal pair [ɬok] and [ɬook] are extremely contrastive. The short vowel is maintained for 80 msec and the long vowel for 210 msec.

The vowel lengths are distinct not only in closed syllables but in open ones too. This can be demonstrated with the Lai pronouns, which have three different forms: regular (1), subordinate (2) and reflexive (3). The second and third forms of the first and third person singular constitute minimal pairs in that

the second form ends with a short vowel [a] and the third form with a long vowel [aa]:

<i>short vowel</i>		<i>long vowel</i>	
ka	'I' (2)	kaa	'I' (3)
?a	'she / he' (2)	?aa	'she / he' (3)

Measurements taken of the first minimal pair reveal that the vowel duration is unquestionably distinct: 110 msec for the short vowel and 370 msec for the long vowel.

As we can see, Lai distinguishes between long and short vowels. However, it seems that the distinction is not as clear-cut as we might wish it to be. Short vowels in CVC environments, in word final positions and before a glottal stop are maintained for approximately 110 msec. Long vowels, on the other hand, seem to be affected by their environments. Long vowels in CVC environments have a duration of approximately 200 msec, while word final long vowels may last as long as 370 msec. An additional consideration, which may affect the duration of the vowel, is the necessity for distinction. Whenever there are minimal pairs the speakers must pronounce the vowel in a way that will not cause confusion. For instance, a first person subordinate pronoun, [ka], may be confused with a first person reflexive, [kaa], if the pronunciation is careless. Naturally, this hypothesis requires further investigation in order to judge its validity.

It is interesting to note that the duration of the vowel in [ka] is similar to that of [kaʔ]. This indicates that the final glottal stop does not affect the vowel length but rather the creaky voice quality of the vowel, as discussed in the section on the glottal stop.

Diphthongs

I have found sixteen distinct diphthongs in Lai and one triphthong. Examples of each of those are found in the phoneme table. The long diphthongs, [ooi], [aai], and [aaʊ], are shortened to [oi], [ai] and [au] before a glottal stop. The long diphthongs only appear word finally.

I used two tests in order to determine whether those sounds are in fact diphthongs/triphthongs. According to Kenneth the sounds cannot be split by syllable boundaries. Additionally, when I asked him to say words with these sounds slowly he pronounced the vowel transitions continuously.

The spectrogram in Figure 5 is taken of the word [liau] ('PRESENT MARKER') which contains a triphthong.

CONCLUSION

In this paper I have attempted to describe the sound system of Lai by providing an inventory of the phonemes and allophones of the language, including their distribution. Additionally, I discussed a number of its interesting phonetic characteristics:

- the aspirated-unaspirated pairs of voiceless stops
- the voiced-voiceless pairs of fricatives, nasals, and 'liquids'
- the glottal stop phenomenon
- an undeviating stress pattern
- short-long vowel pairs