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Excrecent vowels in Lamkang prefix sequences

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Abstract: Lamkang is a Trans-Himalayan language spoken in the Chandel District of Manipur, India by under 10,000 ethnically Naga people. Due to a complex person indexation system in Lamkang clauses, multiple prefixes with the shape C- are attached to a verb stem creating lexemes with the shape CCCVCV. To make such forms pronounceable, speakers insert super-short vowel-like segments between the C- prefixes. Combining acoustic analysis with speakers' intuitions about syllable structure, we examine the nature of these segments, arguing that an accurate phonetic description of Lamkang vowels must include these super-short vowels, as well as long and short vowels, which are phonemically distinct. We call these super-short vowels *excrecent*, following the terminology discussed in Hall (2011. Vowel epenthesis. In Marc van Oostendorp, Colin J. Ewen, Elizabeth V. Hume & Keren Rice (eds.), *The blackwell companion to phonology*, 1576–1596. Oxford: Blackwell. doi: 10.1002/9781444335262.wbctp0067: 1584). The excrecent vowel is a type of epenthetic vowel, sometimes also called “intrusive”, and is typified by its short duration and centralized quality distinct from lexical vowels. It is unstressed and has the phonetic effect of helping to transition between consonants. We show that the excrecent vowels in Lamkang have formant structures that barely resemble the characteristic formant profiles of the short and long vowels. While excrecent vowels are not contrastive, they are phonologically relevant because they have just enough sonority to form nuclei of C_iVC_{ii} syllables where C_{ii} is often ambisyllabic with the following syllable. The Lamkang data show that while any language-specific phonotactic constraints must reference the syllable, what constitutes a syllable must include the possibility of excrecent vowels as nuclei.

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1 Introduction

Lamkang is a Trans-Himalayan¹ language spoken in the Chandel District of Manipur, India by under 10,000 people, who identify ethnically as Naga.² While the phonetic consonant and tonal inventory of Lamkang is fairly predictable for a language of the region (see Post and Burling 2017), Lamkang also exhibits vowels of three different lengths: long, short, and super-short. Combining acoustic analysis with speakers' intuitions about syllable structure, we examine the nature of these super-short vowels, which we call *excrescent*, following the terminology discussed in Hall (2011: 1584). The excrescent vowel is a type of epenthetic vowel, sometimes called “intrusive”, and is typified by its short duration and centralized quality, distinct from lexical vowels. It is unstressed and has the phonetic effect of helping to transition between consonants. These excrescent vowels have formant structures that barely resemble the characteristic formant profiles of short and long vowels of Lamkang. While excrescent vowels are not contrastive, they are phonologically relevant because they have just enough sonority to form nuclei of C_iVC_{ii} syllables, where C_{ii} is often ambisyllabic with the following syllable. Reviewing morphological processes that create sequences of stop onsets, we show how speakers produce an vowel-like segment that allows for the CCCC sequences to syllabify as $[C^V.C^V.C^V.C^V]$ or $[\zeta.C^V.C^V.C^V]$, where the raised $[^V]$ indicates an excrescent vowel. In addition, where the excrescent vowel acts as the syllable nucleus in C^VC syllables, the final consonant may be ambisyllabic, i. e. $C_i^VC_{ii}C_{iii}^VC_{iiii}$. In other words, while the excrescent vowel is acoustically barely a vowel, it is utilized in creating well-formed syllables in Lamkang.

This paper describes the excrescent vowel's role in Lamkang syllable formation. The paper is organized as follows. Section 2 provides a brief description of Lamkang phonology and morphology to set the stage for how consonant clusters are created through morphological concatenation. The various consonant clusters and sequences are given in Section 3, along with an overview of the person indexation system. Section 4 reviews methodologies used to demarcate and measure vowel lengths and syllable boundaries and presents an analysis of that

¹ Kuki-Chin has traditionally been used to refer to this subgroup (Grierson 1904; Matisoff 2003; Van Bik 2009), but is unacceptable to many speakers of these languages. We follow current practice and use ‘South Central’. ‘Trans-Himalayan’ is used for Tibeto-Burman, also following current practice.

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data; Section 5 provides a discussion and conclusion. The data (e. g. elicited word lists, experimental data, and discussion with speakers) are taken from a US National Science Foundation-funded project to document Lamkang.³

2 Setting the stage: Vowel quality, length, harmony, and tone

The Lamkang phonemic consonantal inventory is typical of other languages of the family.⁴ Long vowels are perceptibly more tense than short vowels. In addition, short vowels are more centralized and lax than long vowels. Thus, phonetically, the opposition is /i: u: e: o: a:/ with /ɪ, ʊ, ɛ, ɔ, ɐ/. Figure 1 illustrates vowel length and quality difference for the words [bɛm⁴⁴] ‘circular’ and [be:m⁴⁴] ‘basket’.

Figure 1: Vowel length and quality as illustrated for [bɛm⁴⁴] ‘circular’ (left) and [be:m⁴⁴] ‘basket’ (right).

We thank Chris Button who created the unpublished spectrographs in Figure 1, when working with the Lamkang team at the University of North Texas. These have not been published elsewhere and are used with his permission.

³ Lamkang data are available at the Lamkang Language Resource hosted at the University of North Texas Digital Library (<https://digital.library.unt.edu/explore/collections/SAALT/>). We acknowledge the help of our entire team in collection and processing of this data, especially Tyler P. Utt, Chris Button, and Sumshot Khular.

⁴ The consonants are /p, p^h, b, t, t^h, d, k k^h, tʰ, t^h, t^r, t^{hr}, ts, tʃ, m, n, ŋ, s, h, w (v), r, l, j/. The glottal stop occurs predictably with vowel initial roots and open syllables with short vowels, but is contrastive word medially in a handful of words. The phonemes /t^r/ and /t^{hr}/ are informally

In Figure 2, the minimal pair [mɔ:t⁴⁴] ‘childhood’ and [mo:t⁴⁴] ‘banana’ illustrates the distinction between Lamkang long and short vowels. The long vowel is 81 ms longer than its short counterpart.

Figure 2: Vowel length and quality as illustrated by [mo:t⁴⁴] ‘banana’ (left) and [mɔ:t⁴⁴] ‘childhood’ (right).

Vowel harmony is seen in polysyllabic words. For example, with the *k*-possessive or *k*-nominalizer prefixes, when the root has a high vowel, the prefix vowel is realized as either front or back, rather than central, e. g. the possessive prefix *k*- (*kr-mɪk*⁴³ ‘my eye’), and nominalizer *k*- (*kɔ-dɔk*⁴³ ‘(to be) soft’).

We observe two contrastive tones: falling [mɔl⁴³] ‘mountain’, and high-level [mɔl⁴⁴] ‘fur’. Prefixes, suffixes, auxiliaries, and clitics may be unspecified for tone. See Ozerov (2018) for discussion of a similar system in closely related Anal. After verb stems, we observe regressive tone dissimilation, e. g. if the tone on the suffix is high-level, the tone of the stem will be falling. For example, compare *m-t-dee*⁴⁴ [m^ət^əde:⁴⁴] ‘S/he sees me’ (where *m*- is 1st patient and *t*- is a type of hierarchical index marker called ‘inverse’ in descriptions South Central Tibeto-Burman languages, and *dee*⁴⁴ is the stem-II variant of the verb ‘see’) and *a-t-dee*⁴³-*in*⁴⁴ [at^əde:⁴³m⁴⁴] ‘S/he sees you all’ (where *a*- ‘second patient’, *-in*⁴⁴ ‘second plural’). Next, we review the complex onsets seen in monomorphemic words and those formed by morphological concatenation.

referred to as retroflex; they are more accurately described as alveo-palatal stops with rhotic release. Possible codas include /p, t, k, m, n, ŋ, l, r/ with /d/ occurring in a few borrowed forms. There are no coda clusters in Lamkang.

3 Consonant clusters and sequences

Sequences of consonants are possible either in monomorphemic words (which we call consonant *clusters*), or through a concatenation of prefixes (which we call consonant *sequences*). We discuss clusters and sequences with examples and chart all attested clusters. Words illustrating clusters in Tables 1–5 are given in Appendix A; they are drawn from a 4,500 word lexical database created by both elicitation and extraction from a corpus of texts.

3.1 Consonant clusters (CC in monomorphemic words)

Possible CC onset clusters in monomorphemic words are listed in Table 1 with C1 given in the column and C2 in the second row. Some clusters may be the result of prefix-root combinations that have lexicalized, which we treat as monomorphemic words in the synchronic grammar.

Table 1: Attested CC clusters in monomorphemic words.

C1 ↓	C2 →	Stops, affricates												Fricatives		Glides		
		b	p	p ^h	d	t	t ^h	t ^r	trh	tʰ	tʰʰ	ts	k	k ^h	s	h	j	w
stops, affricates	p				✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
	t	✓	✓	✓	✓							✓	✓	✓		✓	✓	
	k	✓	✓		✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓
	ts	✓	✓															
fricatives	s											✓	✓					✓

The least sonorous sounds are farthest away from the nucleus: stop- affricate- fricative- nasal- liquid- glide, in keeping with the Sonority Sequencing Principle (Selkirk 1984). Predictably, there are no clusters with initial nasals followed by stops; instead, a sequence of nasal and stop (e. g. np^h, mt) is realized as [n^əp^h], [m^ət], or [m̥t], with variation in syllabicity of the initial [m] based on rate of speech and speaker style. As listed in Table 2, there are also less unusual clusters with nasal and liquid C2s.

In C1–C2–C3 sequences, we find that the liquids and glides in C2 position are syllabic. Possible obstruent–sonorant–C clusters in monomorphemic words are listed in Table 3.

Table 2: Attested CC clusters with nasal/liquid C2 in monomorphemic words.

C1 ↓	C2 →	Nasals			liquids	
		m	n	ŋ	l	r
stops, affricates	p	✓	✓	✓		
	t	✓	✓	✓	✓	✓
	k	✓	✓	✓	✓	✓
	ts				✓	
fricatives	s	✓	✓	✓		
nasals	m	✓	✓			✓
	n				✓	

C1[sonorant]-C2[sonorant]-C clusters with a bilabial nasal in C1 position are also attested, i. e. *mrl* and *mrs*. Here, [m] is typically syllabic: [m̩rl] and [m̩rs]. Attested clusters of two obstruents plus a third C are listed in Table 4.

Even longer clusters of four consonants are found, as seen in the words given in Table 5.

Here, it is likely that the initial *k-* is from a nominalizer, but in the synchronic grammar, the root is not recognized without that prefix. As well, the *t-* and *p-* following the initial *k-* may originate from earlier productive prefixation (Matisoff 2003). These too are no longer separable from the root in Lamkang. For the words in Table 5, there is an excrescent segment between the first two consonants, the syllabification is: [kʰt.t̪r.bɪk⁴³] ‘(to be) narrow’ with C2, the [t], being ambisyllabic.

3.2 Consonant sequences (CC through prefixation)

Lamkang displays a participant marking system which interacts with tense such that, in future and past tenses, prefixes are used to indicate the patient participants, and suffixes are used for agent agreement, while in non-future tense, both patient and agent are indicated by prefixes. In addition, the inverse in descriptions is used when 2nd person acts on 1st or when 3rd acts on 2nd or 1st. Table 6 describes the participant marking in affirmative and negative clauses (see Chelliah et al. 2019 for full description of Lamkang verb conjugation).

Table 3: Attested obstruent-sonorant-C clusters in monomorphemic words.

C1C2 ↓	C3 →	b	p	p ^h	d	t	t ^h	ts	tʰ	tʰɿ	tʰr	k	k ^h	s	m	n	l	r	j
stops, affricates	pr				✓	✓	✓		✓			✓	✓				✓		
	pn		✓		✓		✓		✓									✓	
	tr														✓	✓			
	kr	✓		✓		✓	✓	✓	✓				✓				✓		✓
	kl								✓	✓								✓	
	kn									✓	✓			✓					

Table 4: Attested obstruent-obstruent-C clusters in monomorphemic words.

C1C2 ↓	C3 →	t ^r	t ^{hr}	r	j
	tt			✓	
	kp	✓	✓	✓	

Table 5: CCCC clusters with k- prefixes.

Sequence	Example
(k-)trb	[k-trbɪk ⁴³] ‘(to be) narrow’
(k-)trk ^h	[k-trkɪp ⁴³] ‘(to be) freezing’
(k-)trs	[k-trsɪi ⁴⁴] ‘(to be) pointed’
(k-)prs	[k-prsɔk ⁴⁴] ‘to understand’
(k-)prm	[k-prmaa ⁴⁴] ‘(to be) early’
(k-)prj	[k-prjaa ⁴³] ‘(to be) broad’

Table 6: Affirmative and negative non-future tense participant marking.

	Patient				Agent				
	1&1pl. excl.	1pl. incl.	2	3		1&1pl. excl.	1pl. incl.	2	3
Affirm. & Neg.	m-	mi-	a-	Ø-	Affirm.	k-/t-/n-	n-/t-	a-	m-
					Neg.	-ng	-ng	-tí	-é

Examples are given in (1a)–(1d). Note that in these clauses, the conjugation is built on Stem II.⁵

- (1)⁶ a. *nang ngi maan adeelam*
nɛŋjɪ⁴⁴ = ŋjɪ ma:n⁴⁴ Ø-e-de:⁴³-lɛm⁴⁴
you.SG = A them 3P-2-see.II-3.PL
‘You see them.’
b. *ma ngi nang atdee*
ma:⁴⁴ = ŋjɪ nɛŋjɪ⁴³ ɛ-t-dee⁴⁴
s/he = A you.SG 2P-INV-see.II
‘He sees you (SG).’

⁵ Only in the future and non-future tenses for affirmative clauses is Stem I used. In negative clauses, for all three tenses, Stem I is used. The conjugation system is described in Chelliah et al. (2019).

⁶ In the interlinear glossed text examples (1a)–(2c), the first line is the orthography and the second is the phonetic representation.

- c. *ma ngi nei mtdee*
 ma:⁴⁴ = ŋi nei⁴⁴ m^ə-t^ə-dee⁴⁴
 s/he = A me 1P-INV-see.II
 ‘He sees me.’
- d. *mtknoolam*
 m^ə-t^ə-k^ə-noo⁴³ -lem⁴⁴
 3A-INV-1P-shake.II 3.PL
 ‘They are shaking me off.’

Notice how the prefixes stack in (1b)–(2c): in (1b) we see the 2nd person patient followed by the inverse marker *t-*, then the verb stem; in (2a) we see the 3rd agent, followed by the inverse marker, the valence changing causative *p-* and the stem. (2b)–(2c) are examples of consonant sequences with the 1st patient in the future tense. Note that there is a slight, yet perceptible, difference between the vowels that occur with inflectional morphemes (those farther away from the root) and derivational morphemes (those closer to the root), in that the derivational morphemes tend to have longer vowels. We have not quantified the differences between vowels for inflectional and derivational morphemes in this study.

- (2) a. *mtppiik*
 m^ə-t^ə-p^ə-piik⁴⁴
 3A- INV -CAUS-give.II
 ‘He is making me give (something).’
- b. *mkjur ra*
 m^ə-k^ə-yur⁴³ re⁴⁴
 3A-1P-sell.II 3A.FUT
 ‘They will sell us.’
- c. *mktpenglam ra*
 m^ə-k^ə-t^ə-peen⁴³-lem⁴⁴ re⁴⁴
 3A-1P-INV-hit.II 3.PL 3A.FUT
 ‘They will hit me.’

Another source of consonant sequences formed through concatenation is when a possessive prefix is affixed to a noun, e. g. with the 1st possessive *k-* as in [k^əplep⁴³] ‘my friend’ or 3rd possessive *m-* as in [m^əplep⁴³] ‘his/her friend’. Here as well, we see insertion of a vocalic segment to break up the sequence.

To summarize, through concatenation of verbal and nominal prefixes, consonant sequences from one to four consonants (C₄ + stem) are possible,

but only with an excrescent vowel preserving the CV(C) structure. In the next section, we provide further analysis of this excrescent vowel which allows for the preservation of the CV(C) syllable, and report on speaker intuitions on syllable shape.

4 Acoustics, experiment, observation

We investigate the nature of the excrescent vowel by considering its acoustic properties in Section 4.1. We also attempt to access speaker intuition of syllable breaks through a pilot experimental study in Section 4.2, and through observations of orthographic variation in Section 4.3.

4.1 Acoustic production analysis

The acoustic properties of Lamkang excrescent vowels are the focus of this section. We conducted a production study to answer the following research questions:

1. What is the average length for phonemically long and short vowels?
2. What is the average length of excrescent vowels?
3. Do excrescent vowels share the acoustic properties (specifically, formants and periodicity of the waveform) of phonemically long and short vowels?

4.1.1 Data collection

Two datasets are discussed in this section: minimal pairs contrasting short and long vowels to establish a baseline for vowel length, and clauses with multiple prefixes attached to a verb stem, such as those in (1a)–(1d) and (2a)–(2c). With the baseline length established, we then compare the quality and length of phonemically short vowels to the excrescent vowel. The data cited here comes from one female speaker, Sumshot Khular, aged approximately 50, from Thamlakuren village in Chandel, Manipur. To record minimal pairs, we used a frame sentence for the first utterance (e. g. *lamkang pao*⁴³ *vi* [*target word*] *tdit*⁴⁴ meaning ‘In Lamkang we say [*target word*]’). The target word was then repeated in isolation two more times, for a total of three utterances per word. In total, the

minimal pair recording has 33 words, 14 words with short vowels and 19 words with long vowels. These are given in Table 7. Including repeated utterances, there is a total of 99 utterances with 42 examples of short vowels and 57 examples of long vowels.

Table 7: Vowel length distinction in minimal pairs.

Short vowel		Long vowel	
average length (ms)		average length (ms)	
[bøk ⁴³] ‘hut’	96.44	[bu:k ⁴³] ‘to unload firewood from a basket’	130.73
[ɾik ⁴³] ‘lice’	89.01	[ri:k ⁴⁴] ‘heavy’	148.07
[mɔt ⁴³] ‘childhood’	107.99	[mo:t ⁴³] ‘banana’	173.46
[ɛn ⁴⁴] ‘curry’	98.61	[ɛ:n ⁴³] ‘to give light’	263.52
[ket ⁴⁴] ‘exactly shoot’	165.85	[ke:t ⁴³] ‘thorny fern’	205.69
[dɔl ⁴³] ‘mud’	103.74	[du:l ⁴³] ‘to push’	241.54
[pløk ⁴³] ‘to give birth’	66.91	[plu:k ⁴³] ‘baby’s spit up’	184.56
[søk ⁴³] ‘to pound or grind’	74.76	[su:k ⁴³] ‘slave’	179.78
[tʃɔm ⁴⁴] ‘to pick’	110.59	[tʃð:m ⁴³] ‘to mix as in rice or lentils’	276.10
[lɔn ⁴³] ‘hill’	197.02	[lɔ:n ⁴³] ‘to climb’	237.38
[tɔŋ ⁴³] ‘later’	49.95	[tu:ŋ ⁴⁴] ‘to ride as in a car or on a horse’	194.43
[klɔt ⁴³] ‘to spend’	83.03	[klu:t ⁴⁴] ‘to be nauseated’	169.04
[lɪm ⁴³] ‘injury’	66.97	[li:m ⁴⁴] ‘overflow’	229.96

In addition to minimal pairs for baseline measurements of vowel length, clauses with verbal and nominal prefixes were elicited to analyze the length of excrescent vowels. The first utterance was recorded in a frame sentence including pronominal forms of the agent and patient, i. e. [*maan*⁴³-*ni*⁴⁴] ‘they (AGENT)’ and [*nei*⁴⁴-*e*⁴⁴] ‘me’. This framed utterance was followed by two isolated utterances for a total of three utterances. There are a total of 31 prefixed verbs with 89 tokens. Nouns with possessive prefixes attached were recorded in a frame sentence including the pronominal form [*nei*⁴⁴] ‘1st person’ and the target word. Each noun was recorded in isolation, and then again in the frame sentence with the possessive prefix attached. For example, after the word [plɛp⁴³] is uttered in isolation, [*nei*⁴⁴ *k-plɛp*⁴³] ‘my friend’ is uttered three times

in a row. We collected approximately 10 words of the shape *k*- ‘1st person’ + noun stem or *m*- ‘3rd person’ + stem where the noun had an initial voiced or voiceless obstruent or sonorant.

4.1.2 Data analysis

The recordings were annotated using PRAAT to obtain vowel length measurements. To create the annotation grid, we used the formants as a guide to assign the edges of the vowels and we placed the boundaries at the nearest zero crossing before the first periodic waveform of the vowel and the last periodic waveform of the vowel.⁷ We restricted our investigation to closed syllables, as it is easier to consistently mark the end of the vowel, and therefore, more accurately compare vowel length across syllables.

4.1.3 Results

First, we report the results of the minimal pair baseline analysis. Based on measurements with averages of all tokens, we arrive at the figures in Table 7, which show the difference in length between phonemically short and long vowels in thirteen minimal pairs.

Phonemically short vowels range from 66.91ms to 197.02ms; long vowels from 130.73ms to 276.10ms. Thus, on average, the short vowels are 118ms shorter than long vowels in Lamkang. As seen in Figures 3 and 4 with [rik⁴³] ‘louse’ and [rik⁴⁴] ‘heavy’, both short and long vowels within lexical items have periodic waveforms and identifiable formants.

This observation provides a baseline against which to compare the length and formant characteristics of excrescent vowels found in CC prefixes, which are super-short, voiced, and almost formantless. First, consider length. Excrescent vowels inserted between C- prefixes are on average 33ms long. This is 52ms shorter than the average phonemically short vowel. Table 8 shows the average lengths of the excrescent vowels, short vowels, and long

⁷ We extend our thanks to both Nancy Caplow and Kristine Hildebrandt who, over the course of our project, provided guidance on best practices in determining vowel boundaries.

Figure 3: Short vowel length and formant structure as illustrated by [rik⁴³] ‘lice’.

vowels, and compares the lengths of these segments before obstruents and sonorants.

The sonority of the following consonant does not seem to affect the lengths of phonemic vowels. The excrescent vowels, however, do lengthen slightly before sonorants. Figures 5–9 provide examples of excrescent vowels following the final C- prefixes before verb stems starting with a voiceless stop, voiced stop, nasal, and liquid. Figure 5 provides an example of a prefixed verb root, [m^a-k^a-t^a-peɭ⁴³] with multiple excrescent vowels between the prefixes. The full verb phrase [m^a-k^a-t^a-peɭ⁴³ re⁴⁴] ‘He/She will collide with me’ includes re⁴⁴ ‘3rd AGENT FUTURE’. Note that with an initial [m], we observe in the data two patterns: the [m] will be syllabic, or will be followed by an excrescent vowel, as in Figure 5.

Figure 4: Long vowel length and formant structure illustrated by [ri:k⁴⁴] ‘heavy’.

Table 8: Average vowel length and length of excrescent, short, and long vowels in similar environments.

	Excrescent vowel	Short vowel	Long vowel
Average length in all environments (142 tokens)	33	85	203
Before obstruents (120 tokens)	25	97	177
Before sonorants (22 tokens)	42	83	231

The excrescent vowel is slightly longer before a nasal, voiced stop, and a liquid: 16 ms in one token as seen in Figure 6 before a nasal, and around 22 ms for both the liquid and voiced stop as seen in Figure 7. (The illustrative figures are cropped to focus in on the excrescent vowel and its immediate environment.) There is some variation; for example, as seen in Figure 5, a nasal prefix followed by an excrescent

Figure 5: Excrescent vowels before a voiceless stop as illustrated by [mʰkʰtʰpɐ lʰ³ rɐ⁴⁴] ‘He will collide with me’.

Figure 6: Excrescent vowel before a nasal as illustrated by [mʰkʰtʰnɔk⁴⁴ lɐm⁴³ rɐ⁴⁴] ‘They will shake me off’.

vowel of 53 ms, which is considerably longer than average for an excrescent vowel in any environment. The cluster of voiceless obstruents that follow is broken up by shorter excrescent vowels, 11 ms and 12 ms in length respectively.

Not only are excrescent vowels shorter than phonemic short vowels, they also show an irregular, aperiodic waveform with barely visible formants as seen in the contrast between Figures 8 and 9. (Figure 9 is focusing on C2.)

Let us also consider consonant sequences in noun stems prefixed with *k*- ‘1st possessive’. The average length of excrescent vowels in nouns with the first

Figure 7: Exrescent vowel before a liquid as illustrated by [mʰəpʰrthle:⁴⁴] 'You are loosening me'.

Figure 8: Exrescent vowel before a voiced stop as illustrated by [mʰkpʰde:n⁴⁴ ləm⁴³ rɐ³³] 'They will hit me'.

Figure 9: Excrescent vowel with perceptible formants as illustrated by [m³k³ptʃ³r⁴⁴ rɐ⁴⁴] ‘He will soak me’.

person prefix is given in Table 9. The nouns are analyzed in different phonetic environments and in a frame with a redundant independent first person pronoun for consistent phonetic framing.

Table 9: Average length of excrescent vowels in prefixed nouns for [k-p] sequences.

Forms	Length of excrescent vowel (ms)
[nei ⁴⁴ k³plep ⁴³] ‘my friend’	36.259
[nei ⁴⁴ k³ptʰlaː ⁴³] ‘my spirit’	43.066
[nei ⁴⁴ k³prul ⁴³] ‘my snake’	49.162
[nei ⁴⁴ k³pjon ⁴³] ‘my urine’	39.250

Figure 10 provides an illustration of *k-plep*⁴³ from the noun phrase *nei*⁴⁴ *k-plep*⁴³ ‘my friend’.

Figure 10: Excescent vowel before a voiceless stop in prefixed nouns as illustrated by [nei⁴⁴ k-plep⁴⁴] ‘my friend’.

One exception to insertion of an excescent vowel is when the stem has a voiced bilabial stop /b/, as in *k-boo:r*⁴³ ‘my basket’, *k-bu:*⁴³ ‘my nest’, and *k-ba:k*⁴³ ‘my bat’, where we see no excescent vowel. Either these sequences of morphemes form true clusters, or the vocoid is so short that we would need a more fine-grained method of analysis to capture it. Another example of CC sequences without excescent vowels is the *kk* sequence which occurs in forms like the possessive of [k^əden]⁴³ ‘palate’ which would be *kkdang* [k^əden]⁴³. The initial *kk* sequence has no excescent vowel. Rather, as shown in Figure 11, the closure is and release longer than for a single [k].

Contrasting Figure 11 with the excescent vowel seen in Figure 12, we observe the variation in length between productive morphology and lexicalized prefixes no longer separable from the root.

The excescent vowels between the second *k* prefix and the root, shown in Table 10, are longer on average than those seen after productive prefixes. This may indicate that the nonproductive sequences were lexicalized as CV sequences and that the vowel subsequently weakened and reduced.

Figure 11: K- prefix with *kd* initial root cluster as illustrated by [kʰdɐŋ⁴³] ‘my palate’.

Figure 12: Excrescent vowel with frozen prefix as illustrated by [dɔl ktʰɐ⁴⁴] ‘good land’.

Table 10: Average length of excrescent vowels in prefixed nouns after [k-k] sequences.

Forms	Length of excrescent vowel (ms)
[nei ⁴⁴ k-kʰdɐŋ ⁴³] ‘my palate’	66.724
[nei ⁴⁴ k-kʰnaː ⁴³] ‘my ear’	46.515
[nei ⁴⁴ k-kʰbeː ⁴³] ‘my kidney’	73.723
[nei ⁴⁴ k-kʰtʃɛi ⁴⁴] ‘my spear’	64.315

4.2 Tapping experiment

To understand how speakers syllabify consonant sequences, we used a tapping experiment to gather speaker intuitions about the syllable boundaries in forms with multiple prefixes.⁸ This data demonstrate the way speakers perceive the prefixes to be onsets of individual syllables with excrescent vowels as the nuclei. The experiment reported here is a pilot of the method we may replicate in a future larger study including more participants and tokens. Despite the small sample size, the results show variability in syllabification patterns (both inter-speaker and intra-speaker) and regularity of the excrescent vowel between stacked prefixes.

4.2.1 Experimental procedure

Six Lamkang speakers ranging in age from 20 to 30 participated in the tapping experiment. All six participants were born in Manipur, and had since moved to Hyderabad. At the time of the experiment, participants had been living in Hyderabad for an average of five years. I (author Robinson) explained to the participants the procedure of tapping or lightly clapping at syllable boundaries with an example word. I then went over the inflected forms of the four target verbs ‘catch, slap, sit, trap’ with participants. These are complex forms to read, so review was necessary. Participants did 3–5 rounds of practice, then repeated each word three times while tapping or clapping.⁹

4.2.2 Results

The onset of the following syllable is syllabified as the coda of the previous syllable, resulting in an ambisyllabic pattern of $C_1VC_{ii}.C_{ii}V$ -STEM, (ambisyllabic because participants repeated the C with release at the end of the first syllable and the beginning of the second). The patterns $CV.CVC$ -stem and $C_1VC_{ii}.C_1VC_{ii}$ -stem are also seen. In Table 11, we provide the results of the tapping experiment with 6 speakers for inflected forms of the verbs for ‘catch, slap, sit, and trap.’

⁸ The script and recording can be found at CoRSAL in the UNT Digital Library (Chelliah 2017). <https://digital.library.unt.edu/ark:/67531/metadc1213567/m1/>

⁹ We thank Matthew Gordon for the suggestion to explore this method of investigating syllabification.

Table 11: Tapping experiment results showing speaker syllabification of inflected verbs.

	m-k-tpe:ŋ ⁴³ -rā ⁴⁴ 1P-3A-slap-IPFV 'She is slapping me'	m-k-kyo:ŋ ⁴³ -lam ⁴⁴ -ra ⁴⁴ 1P-3A-catch-3PL-IPFV 'They will catch me'	m-t-p-koŋ ⁴³ -lam ⁴⁴ -ra ⁴⁴ 1P-INV-CAUS-sit-3PL-IPFV 'They will make me sit'	m-t-pmen ⁴⁴ 1P-INV-trap 'She is trapping me'
Speaker 1	[m ^ə k.t ^ə .pe:ŋ.ra]	[m ^ə k.k ^ə .kio:ŋ.lam.ra]	[m ^ə t.t ^ə p.koŋ.lam.ra]	[m ^ə t.pmen]
Speaker 2	[m ^ə .k ^ə t.pe:ŋ.ra]	[m ^ə .k ^ə .kio:ŋ.lam.ra]	[m ^ə t.t ^ə p.koŋ.lam.ra]	[m ^ə t.t ^ə p.men]
Speaker 3	[m ^ə k.pe:ŋ.ra]	[m ^ə .kio:ŋ.lam.ra]	[m ^ə .t ^ə p.koŋ.lam.ra]	[m ^ə t.t ^ə p.p ^ə .men]
Speaker 4	[m ^ə t.t ^ə p.pe:ŋ.ra]	[m ^ə k.k ^ə .kio:ŋ.lam.ra]	[m ^ə k.koŋ.lam.ra]	[m ^ə t.p ^ə .men]
Speaker 5	[m ^ə .k ^ə p.pe:ŋ.ra]	[m ^ə k.kio:ŋ.lam.ra]	[m ^ə .k ^ə p.koŋ.lam.ra]	[m ^ə t.p ^ə .men]
Speaker 6	[m ^ə .k ^ə t.pe:ŋ.ra]	[m ^ə .kio:ŋ.lam.ra]	[m ^ə .t ^ə p.koŋ.lam.ra]	[m ^ə .t ^ə p.p ^ə .men]

Note that the syllabification is not uniform across speakers. For instance, with the form [m-k-kyo:ŋ⁴³-lam⁴⁴-ra⁴⁴] ‘they will catch me’, as pronounced by speakers 3 and 6, no excrescent vowel is inserted between the *k-* prefix and root. For the other speakers, however, we see each prefix consonant is gathered up as the onset of a syllable with an excrescent vowel. Speaker 5 has the following syllabification: C_i^VC_{ii}.C_{iii}VC_{iiii} where *k-* is the coda of the syllable preceding the verb stem. Particularly in careful speech, speakers tend to separate verb stems with complex onsets, e. g. [t^əpe:ŋ⁴³] ‘to slap’ and [p^əmen⁴⁴] ‘to trap’. Speaker 1 produces the more common fast speech [pm] – although they sound similar, the articulatory movements for [pm] and [m] are perceptibly different, with pursed lips before the release for [pm] distinguishing it from [m]. The tapping experiment thus confirmed observations based on acoustic analysis that speakers do insert a vocalic segment between prefixes. The inter- and intra-speaker variation shows that this segment is not required, but is one possibility available to speakers for syllabification.

4.3 Orthographic practices

Hall (2011) states orthographic choices can provide a window into speaker intuitions on excrescent vowels. She reports that in Kera, an East Chadic language with no tradition of writing, speakers selected a version with no vowels when given a choice between spellings with and without the excrescent vowels. On the other hand, she notes that Lebanese Arabic speakers, who also do not write their language (because it is the colloquial form), do write the vowels. She concludes that this suggests that, “speakers’ consciousness of epenthetic vowels may differ from language to language” (p. 1584).

In the case of the Lamkang, speakers naturally tend to omit the excrescent vowel in writing except in cases where the sonorant or liquid is syllabic – here, they include a vowel in the spelling. Writers seem, therefore, to be unconsciously aware that the syllabic consonant has more weight than a single consonant. Interestingly, as early as 1987 at the Deodars Spiritual Life Centre writing workshop in Mussoorie, Uttar Pradesh, speakers discussed the three types of vowels that needed to be represented: very short or ‘half’ vowels, regular vowels, and long vowels (Chelliah 2017). The discussion arose because, in translations of hymns and the Bible, full vowels were used wherever missionary translators perceived a vowel. Today, for writers, especially those involved in language revitalization or those using Lamkang on social media, the super-short vowels are not written. There is some variation with syllabic nasals and liquids. Words like ‘She or he will wake me up’ which consist of the prefixes *m-* ‘1P.IPFV, *k-* ‘3A’, and the auxiliary *ra* ‘3rd agent future’, can be written as *mkprdel rah* or *mak perdel rah*. The *a* of *mak* is for the perceived excrescent vowel, and the *e* of *per* for [ɾ].¹⁰ Similarly, with prefixed words like *k-paa* ‘my father’ (*k-* ‘1st’ + root), variant spellings include: *k’paa*, *kpaa*, and *kapaa*, with the apostrophe demonstrating morpheme awareness. The full vowel is rare these days, seemingly a remnant of early spelling conventions. We offer these observations as one view into native speaker intuitions on the excrescent vowel. Speakers’ writing shows an awareness or acknowledgement that this vocalic segment is super short and unlike phonemically short ‘real’ vowels.

5 Discussion and conclusion

The data presented for Lamkang show super-short excrescent vowels inserted between underlyingly C-(C)-(C)-stem forms. What makes this remarkable is the opposition between the reduced phonetic profile of the vocoid (lack of strong periodic patterning in the waveform, short duration) with its centrality in syllable formation. The maximum number of consonants in a cluster, that is a monomorphemic form, is 4 (see Tables 4 and 5), and the maximum number of consonants in a sequence formed through concatenation is also 4 (see Table 6). The excrescent vowels occurring between prefixes seem to be shortest when

¹⁰ The data for this analysis come from transcriptions done by four native speakers for the Lamkang Lexical Database project.

farthest from the root. Closer to the root, as with the *p*-causative, the excrescent vowels are longer (see Table 9).

We should not confuse the phenomena we are describing here in Lamkang with sesquisyllabicity as found in Southeast Asian languages such as Burmese (Green 1995) and Kammu (Svantesson 2004). Sesquisyllables are unstressed and reduced (Matisoff 1973; Matisoff 2009). Lamkang does have some verb stems with complex onsets (e. g. [*pmen*⁴⁴] ‘to trap’, [*tpe:ŋ*⁴³] ‘to slap’) which are most likely derived through historical processes and fit the definition of sesquisyllable. The excrescent vowel of Lamkang, however, is seen in productive morphology, and is different in origin.

We also note that other Trans-Himalayan languages with similar person indexation systems to Lamkang’s do not seem to reflect this pattern. For example, in Anal, the prefixes stacked before verb stems include vowels in their underlying form (e. g. *ká*- ‘1’, *ná*- ‘1PL’, *á*- ‘2’, *vá*- ‘3’) (Ozerov 2019). Because vowels are present in the prefixes’ underlying forms, the syllable structure is maintained without addition of excrescent vowels. Additionally, we see that in Haokip’s (2018) account of five Trans-Himalayan languages of the Barak Valley (Saihiem, Hrangkhoh, Chorei, Sakachep, and Ronglong), like Anal, the underlying forms of the agreement clitics and prefixes are CV. In the genetically close and geographically proximate language Monsang, monomorphemic words with clusters [br], [bl], [kr], and [kl] are in free variation with these clusters broken up by epenthetic vowels, for example [ti:ŋklen ~ ti:ŋkelen] ‘armpit’; [abɔ̃ɔ̃ ~ abɔ̃ɔ̃ɔ̃] ‘maternal uncle’ (Monsang and Veikho 2018: 101).

Perhaps the best known languages with similar reduced vowels are Tashlhiyt Berber and Nuxalk. Here the reduced vowels are in monomorphemic words. The syllable structure of these languages has been extensively debated (Bagemihl 1991; Coleman 2001; Dell and Elmedlaoui 2017; Ridouane 2008). By some accounts, the release of voiceless obstruents act as syllable nuclei. In other accounts, clusters are broken up by vowel-like segments described variably as excrescent (Bagemihl 1991), epenthetic (Coleman 2001), intrusive (Ridouane 2008), or transitional vowels or vocoids (Dell and Elmedlaoui 2017). Quality and length vary between speakers, and, in the case of Tashlhiyt Berber, sociolinguistic factors determine when such vowels occur. In no instance is formant structure or waveform characterized as anything but an unstressed vowel.¹¹ Lamkang is

¹¹ An anonymous reviewer points out that excrescent vowels such as what we have described for Lamkang can be seen in Lai (2017) thesis on Wobzi Khroskyabs, a rGyalrongic language of China. In Wobzi Khroskyabs, there are up to 6 C slots in the onset position. While the author does not describe vowel epenthesis, our reviewer notes that some of the spectrograms show short epenthetic vocoids.

similar to these languages in that clusters are dis-preferred and vowels are used to break them up; Lamkang is unique in the nature of that vowel.

We have shown that Lamkang has three vowel types: long, short, and excrescent. The excrescent vowels occur between 1) consonant clusters of monomorphemic words, or 2) sequences of up to 4 prefixal morphemes of the shape C. Examining them through acoustic analysis and native speaker intuition, we observe that, despite their short durations, hardly visible formants, and non-phonemic status, excrescent vowels are essential for syllable formation. The role excrescent vowels play in Lamkang phonotactics indicates that typologies of vowels must include this unusual, highly variable, super-short segment as a viable syllable nucleus.

Appendix A: Sample words for Lamkang CC clusters¹²

Cluster	Lamkang	Gloss
pd	pdukni ³⁴	the next day
pt	ptaa ³⁴	(to be) lacking
pt ^h	pthii ³³	to lift and throw
ptɬ	ptlung ⁴³	to welcome (someone)
pt ^h ɬ	pthla ⁴⁴	feather
pt ^r	ptxao ⁴⁴	April
pk	pkaang ⁴³	shell
pk ^h	pkhao ⁴³	reptile
ps	pser ⁴³	citrus
pts	pchaan ⁴⁴	(to be) able
ph	pham ⁴⁴	to grab (all of something)
pm	pmen ⁴³	to trap
pn	pnaang ⁴³	bamboo rope
pŋ	pŋgal ⁴³	wild boar
pj	pyiil ⁴³	cucumber
tb	tbor ⁴³	(to be) dirty
tp	tpee ⁴³	to bend down
tp ^h	tphuur ⁴³	to chop down (tree, bamboo)

(continued)

¹² Column 1 is provided in IPA, column 2 is in the orthography where [x] represents the alveopalatal with rhotic release.

(continued)

Cluster	Lamkang	Gloss
td	tden ⁴⁴	when
tts	ttsang ⁴⁴	storm
tk	tkar ⁴⁴	shawl
tk ^h	tkhiu ⁴³	seven
th	thuu ⁴⁴	winnowing fan
tm	tmin ⁴⁴ (khur)	landslide
tn	tnek ⁴³	clay
tŋ	tngoong ⁴³	nape (of neck)
tl	tlaa ⁴³	pancreas, spleen
tr	trkhu ⁴⁴	hole
tj	tyuk ⁴⁴	reindeer
tsb	tsbuu ⁴³	pile (of dried weeds to be burned)
kb	kbal ⁴³	dirt
kp	kpaan ⁴³	scabies
kd	kder ⁴³	elder
kt	ktuk ⁴⁴	cockscorn
kt ^h	kthaa ⁴⁴	sticky rice
kt̪	ktlok ⁴³	other
kt̪̥	kthlum ⁴³	sweet
kts	ktse ⁴⁴	spear
kt̪ʰ	ktxiik ⁴³	remnants, small fragments (of cloth, firewood)
ks	kseep ⁴³	gills
kh	khiing ⁴³	ginger
km	kmuur ⁴⁴	to growl
kn	knaa ⁴³	ear
kŋ	kngao ⁴³	(to be) naughty
kl	kling ⁴⁴	spindle
kr	kreng ⁴⁴	river
kj	kyou ⁴³	February
kw	kwuu ^{43;44}	bunch
tsp	tspaan ⁴⁴	mold
tsl	tslaa ⁴³	gift
sk	skool ⁴³	horse
sk ^h	skhi ⁴⁴	deer
sm	smuk ⁴³	bovine
sn	snuu ⁴³	lady, girl, woman
sŋ	sngaar ⁴³	wild cat
sw	swang ⁴³	python
mb	mboom ⁴³	bunch
mp	mpuuk ⁴⁴	destiny
mp ^h	mpha ⁴⁴	time
md	mdei ⁴³	stalk (banana, sugar cane, bamboo)

(continued)

(continued)

Cluster	Lamkang	Gloss
mt	mtun ⁴⁴	surface
mt ^h	mthung ⁴³	liver
mtt	mtlaak ⁴⁴	entrance hole, escape hole
mts	mtsii ⁴⁴	tree ring
mh	mhaa ⁴³	tooth, sharp side of knife
mm	mmuu ⁴³	seed
mn	mnuu ⁴³	bug, worm
mr	mrot ⁴⁴	to agree
np ^h	nphe ⁴⁴	small silver river fish
nl	nlaa ⁴³	girl, lady

Appendix B: Sample words for Lamkang CCC-CCCC clusters

cluster	Lamkang	gloss
prd	prdi ⁴⁴	egg
prt	prteel ⁴⁴	to face trouble
prt ^h	prthit ⁴⁴	to kick
prtt	prtlai ⁴³	to squander, waste
prk	prkul ⁴³	to roll
prk ^h	prkhaa ⁴³	walnut
(k-)prm	kprmaa ⁴⁴	to make a mistake, to sin
(k-)prs	kprsaa ⁴³	to be difficult
(k-)prj	kpryaa ⁴³	(to be) wide
prl	prlei ⁴⁴	(to be) poor
pnd	pndang ⁴⁴	to make clear
pnt ^h	pnthot ⁴³	to sift
pnt ^h t	pnthlaa ⁴³	bangle
pnr	[kdei] pnri ⁴⁴	knowledge
(k-)trb	ktrbiik ⁴⁴	(to be) narrow
(k-)trk ^h	ktrkhip ⁴⁴	(to be) freezing
(k-)trs	ktrsij ⁴⁴	to point, to be pointed
(k-)t ^{rh}	ktxhaa ⁴³	(to be) good
trm	trmuu ⁴³	wild berry
trn	trnaal ⁴⁴	to make slippery

(continued)

(continued)

cluster	Lamkang	gloss
tłr	tlrii ⁴⁴	border (of field)
tkr	tkril ⁴⁴	to gnash (teeth)
tpť	tptrao ⁴³	to plant
tpl	tplin ⁴⁴	to develop, grow
tpř	tpřsim ⁴⁴	to pack
tpřl	tpřluu ⁴⁴	to roll (a mat, drum of grain)
tpj	tpyol ⁴⁴	to swallow
krb	krbun ⁴⁴	fighting
krp ^h	krphuung ⁴⁴	floating
krt ^h	krthleng ⁴⁴	change
krt ^h	krthuk ⁴³	to become
křts	křtso ⁴³	to exchange (vegetables, paddy)
krk ^h	krkhil ⁴⁴	all around
křl	křloo ⁴⁴	to match
křj	křyaa ⁴³	to think, hear
kłť ^{rh}	kłťxhik ⁴⁴	to shake
kłť	kłťxu ⁴³	to bathe
kłř	kłřuu ⁴³	chimpanzee
knt ^ř	kntxim ⁴⁴	equal
knt ^{rh}	kntxhel ⁴⁴	to separate
kns	knsok ⁴⁴	to vomit
(t-)kn	tknlor ⁴³	glory
kpt ^{rh}	kptxhun ⁴⁴	to begin
kpt ^ř	kptxooi ⁴³	following
kpr	kproł ⁴³	(to be) big
kprś	kprśaa ⁴³	(to be) difficult
mřś	mřson ⁴⁴	other
mřl	mřlak ⁴⁴	sometimes

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