

## ILLUSTRATIONS OF THE IPA

## Hmu (Xinzhai variety)

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The Hmu language is spoken by approximately 1,250,000 people who reside in Qiandongnan Miao and Dong Autonomous Prefecture (黔东南苗族侗族自治州), Guizhou Province (贵州省), the People's Republic of China (Wang & Mao 1995: 3–4; Lewis, Simons & Fenning 2016).

Hmu is also known as the eastern dialect of the Hmongic language (Wang 1983: 5–7; Wang 1985: 103–104; *The Language Atlas of China* (Chinese Academy of Social Sciences and Australian Academy of the Humanities 1987); Ratliff 2010: 3),<sup>1</sup> the latter of which,

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<sup>1</sup> In this paper, we adopt the term of 'Hmongic' rather than 'Miao', as the former is used specifically in linguistic classification, while the latter is also used commonly to refer to a specific group (苗族) in China. In order to achieve maximal clarity among various classifications, we follow Ratliff (2010: 3–4) in applying the term 'Hmongic' to refer to the target language. And we would like to thank the Editor, Prof. Amalia Arvaniti, for her helpful suggestion and discussion regarding the application of these terms.



**Figure 1** Map showing the location of Kaili city, reproduced from the geological study of Guo et al. (2005). The triangle indicates the location of Xinzhai.

along with Hmong, A-Hmao, Bunu, Qo Xiong, Jiongnai, Ho Ne, and Pa-Hng, comprises the Hmongic subgroup of the Hmong-Mien language family (for more details, see Wang & Mao 1995: 2–3; Ratliff 2010: 3). The Hmong-Mien family was once proposed to be a member of the Sino-Tibetan family (see especially Li 1937/1973), but Benedict (1942, 1972, 1975) believes that the sound correspondences the hypothesis is based on could have resulted from language contact. Following his own observation of related data, he suggests that Hmong-Mien and Austronesian could be genetically related. For the latest discussions of the relationship between Hmong-Mien and Sino-Tibetan, the reader is referred to Wang (2015), and Wang & Liu (2017).

The speech form investigated in the present study is the Xinzhai variety of Hmu. Xinzhai (新寨) is a small mountain village in Sankeshu (三棵树) Township, which is about 30 kilometers northeast of Kaili City (凯里市) (see Figure 1). Among the 1000 Hmu speakers who reside in Xinzhai, people over the age of eighty are basically monolingual in Hmu. Over the last few decades, with the development of the economy and transportation, the younger generations have largely become bilingual in Southwest Mandarin and Hmu. But Hmu still stands as the primary language of oral communication in family and community events. It does not have its own writing system.

The present illustration is based on the data collected with the third author, Zhenghui Yang (a.k.a.  $t\epsilon^{h}o^{51} \zeta o\eta^{44}$  in Hmu), aged 26 years in 2017. Mr Yang is fluent in both Hmu and Chinese (the Southwestern dialect and Mandarin). He worked with the other three authors intensively in 2014, and before and after that has served as the main consultant in the various projects the first author has undertaken.

In the present study, the phonetic characteristics are analyzed and described on the basis of acoustic and EGG (electroglottography) data. The devices used during the recording sessions include a clip-on condenser microphone (Sony ECM-44B), Eggforsingers 7050A, and a laptop computer (Thinkpad, X1 Carbon, Lenovo, Beijing, China). The software used for recording is *Adobe Audition 2.0*, the sound file format is .wav, with a sampling rate of 44.1 kHz, and 16-bit resolution.

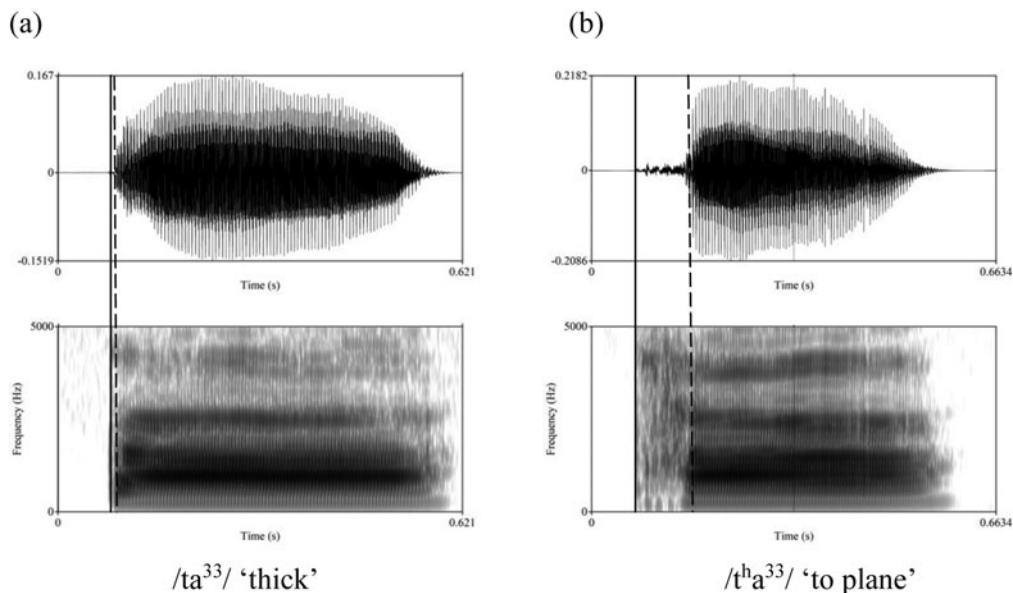
## Consonants

		Bilabial	Labio-dental	Alveolar	Alveol-palatal	Palatal	Velar	Uvular	Glottal
Plosive	Unaspirated	p		t			k	q	
	Aspirated	p <sup>h</sup>		t <sup>h</sup>			k <sup>h</sup>	q <sup>h</sup>	
Affricate	Unaspirated			ts	tʃ				
	Aspirated			ts <sup>h</sup>	tʃ <sup>h</sup>				
Nasal		m̥ m		n̥ n			ŋ		
Fricative	Unaspirated		f v	s z	ʃ		x		h
	Aspirated		f <sup>h</sup>	s <sup>h</sup>	ʃ <sup>h</sup>				
Lateral fricative	Unaspirated			ɬ					
	Aspirated			ɬ <sup>h</sup>					
Lateral approximant				l					
Approximant						j	ɥ		

As demonstrated in the Consonant Table, the consonant inventory of Hmu comprises 32 phonemes. The places of articulation range from the lips (bilabial) to the glottis (glottal). Non-nasal obstruents (plosives and affricates) show a general two-way manner distinction in terms of aspiration: voiceless aspirated vs. voiceless unaspirated. Fricatives (except for lateral, alveolo-palatal, velar, and glottal fricatives), on the other hand, show a three-way distinction in manners: voiced, voiceless unaspirated, and voiceless aspirated. Nasals of two places of articulation (i.e. bilabial and alveolar) contrast in voice. Moreover, this language contrasts velar and uvular consonants.

The following minimal pairs/sets and near-minimal pairs/sets illustrate the contrasts summarized above:

MANNER	CONSONANT	EXAMPLE	GLOSS
Plosives and Affricates (contrasting in aspiration)	p	pu <sup>33</sup>	'to know'
	p <sup>h</sup>	p <sup>h</sup> u <sup>33</sup>	'to make (the bed)'
	t	ta <sup>33</sup>	'earth'
	t <sup>h</sup>	t <sup>h</sup> a <sup>33</sup>	'to plane'
	k	ki <sup>33</sup>	'snail'
	k <sup>h</sup>	k <sup>h</sup> i <sup>33</sup>	'hot'
	q	qa <sup>33</sup>	'chicken'
	q <sup>h</sup>	q <sup>h</sup> a <sup>44</sup>	'guest'
	ts	tʃa <sup>33</sup>	'five'
	ts <sup>h</sup>	ts <sup>h</sup> o <sup>44</sup>	'to stab'
	tʃ	tʃa <sup>33</sup>	'medicine'
	tʃ <sup>h</sup>	tʃ <sup>h</sup> aN <sup>44</sup>	'to shake'
	Fricatives (contrasting in voicing and aspiration)	f	fa <sup>33</sup>
f <sup>h</sup>		f <sup>h</sup> a <sup>33</sup>	'to twist'
v		vi <sup>55</sup>	'sky'
s		so <sup>44</sup>	'thin'
s <sup>h</sup>		s <sup>h</sup> o <sup>44</sup>	'to wash (clothes)'
z		za <sup>51</sup>	'to dye'
ʃ		ʃaN <sup>44</sup>	'nail'
ʃ <sup>h</sup>		ʃ <sup>h</sup> aN <sup>44</sup>	'to wipe'
x		xi <sup>33</sup>	'new'
h	haN <sup>33</sup>	'to walk'	



**Figure 2** Waveforms and spectrograms for the minimal pairs / $ta^{33}$ / 'thick' vs. / $t^h a^{33}$ / 'to plane'. The solid line marks release, while the dashed line signifies the beginning of voicing. With the voiceless unaspirated plosive (left), release and voicing occur almost simultaneously.

Approximants	j	ji <sup>33</sup>	'seedling'
	ɥ	ɥu <sup>44</sup>	'good'
Laterals (contrasting in voicing and aspiration)	l	la <sup>11</sup>	'vegetable garden'
	ɬ	ɬa <sup>11</sup>	'rich'
	ɬ <sup>h</sup>	ɬ <sup>h</sup> a <sup>11</sup>	'to cut'
Nasals (contrasting in voicing)	m	mu <sup>33</sup>	'illness'
	ṁ	ṁu <sup>33</sup>	'Hmong'
	n	noN <sup>44</sup>	'this'
	ṅ	ṅe <sup>33</sup>	'sun'
	ŋ	ŋaN <sup>11</sup>	'goose'

In our database, all consonant contrasts can occur at the onset position of monosyllabic roots in the language, but only a subset (i.e. the nasals) are observed at the coda position.

Throughout the paper, the transcription of the accompanying sound files is phonemic.

### Plosives and affricates

Hmu plosives show four places of articulation (i.e. bilabial, alveolar, velar, and uvular), while affricates are restricted to the alveolar and alveolo-palatal regions. Plosives and affricates are all voiceless in Hmu, and they come with a general two-way contrast in aspiration. That is, they are either voiceless unaspirated or voiceless aspirated. Unaspirated plosives and affricates have shorter VOT duration than the VOT duration of their aspirated counterparts. Consider / $ta^{33}$ / 'thick' vs. / $t^h a^{33}$ / 'to plane' in Figure 2. In the left panel, the VOT of / $t$ / is approximately zero because release and voicing take place almost simultaneously. On the other hand, in the

**Table 1** Duration of fricatives (contrasting in aspiration) in Hmu.

Fricative	f	f <sup>h</sup>	s	s <sup>h</sup>	ç	ç <sup>h</sup>
Duration (ms)	36	109	156	197	167	186

right panel, there is a period of aspiration between release and voicing, the VOT duration of /t<sup>h</sup>/ is about 70 ms.

## Fricatives

The places of articulation where Hmu fricatives are produced are labio-dental, alveolar, alveolo-palatal, velar, and glottal. The fricatives can be bifurcated into voiced and voiceless subgroups; and the voiceless fricatives can be further subdivided in terms of aspiration. Such a three-way distinction in manner is observed in labio-dental and alveolar fricatives.

Aspirated fricatives in Hmu serve to distinguish Eastern Hmongic varieties from the other Hmongic languages. The reader is referred to Shi, Liu & Yang (2017) for details. In Figure 3 and Table 1, it is shown that aspirated fricatives have a longer duration than that of their unaspirated counterparts at the initial position of a syllable.

Perceptually the voiceless unaspirated alveolo-palatal fricative and affricate are often produced with a palatal offglide, but the situation is not as clear for their aspirated counterparts.<sup>2</sup>

## Nasals

Hmu nasals can be pronounced at three places of articulation: bilabial (/m/, /m̥/), alveolar (/n/, /n̥/), and velar (/ŋ/). It should be noted that such contrasts in place only occur in syllable-initial position. Word-finally, only [m], [n], and [ŋ] are observed, and their occurrences are predictable based on the vowel preceding them. That is, [m] only occurs after the vowel /o/, [n] occurs after front vowels, and [ŋ] occurs after back vowels; and since /o/ is a back vowel, [m] and [ŋ] are interchangeable, though native speakers seem to prefer [ŋ] rather than [m] in such cases. In other words, the phonemes /m/, /n/, and /ŋ/ are neutralized in syllable-final position. We therefore represent the syllable-final nasal as an archiphoneme /N/, whose place of articulation is determined by the backness of the vowel preceding it, or by whether the preceding vowel is /o/.

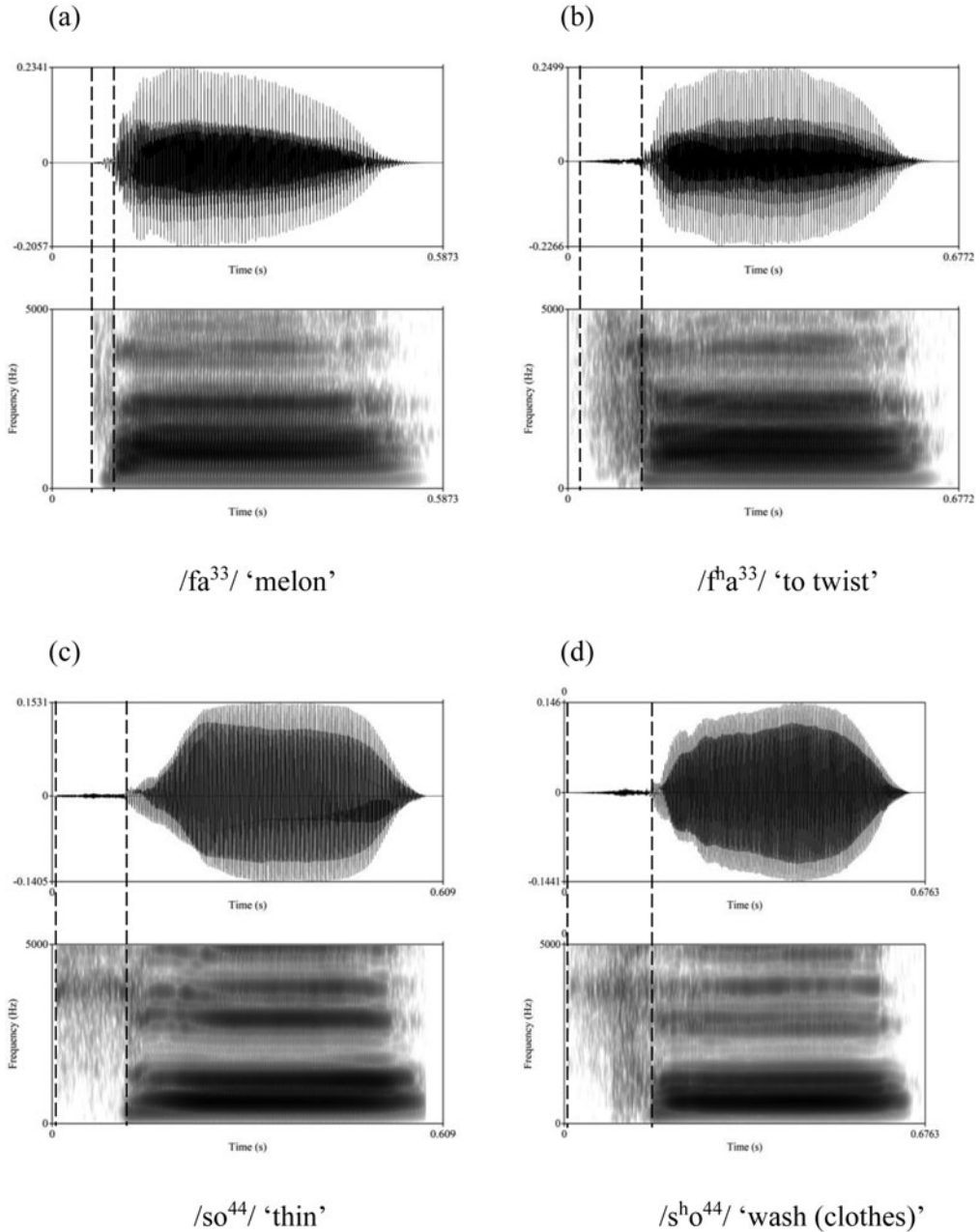
When a vowel is followed by a nasal final, the vowel always becomes nasalized. The nasal final consonant can disappear with its preceding vowel nasalized. The factors that underlie these two variations of the nasal final (that is, as a nasal consonant or as a nasalized vowel) have yet to be fully determined. What we have observed so far is that in the citation form (i.e. when the speaker is reading a vocabulary list), the nasalized vowel seems to be the only option; and the nasal consonant occurs more in casual or connected speech.

Consider the following examples of nasal finals in Hmu:

PHONEMIC	PHONETIC	GLOSS
tiN <sup>11</sup>	t̃i <sup>11</sup> ~ t̃i <sup>11</sup>	‘steadiness’
ʔeN <sup>55</sup>	ʔ̃e <sup>55</sup> ~ ʔ̃e <sup>55</sup>	‘round’
paN <sup>55</sup>	p̃a <sup>55</sup> ~ p̃a <sup>55</sup>	‘flower’
poN <sup>44</sup>	p̃o <sup>44</sup> ~ p̃o <sup>44</sup> ~ p̃o <sup>44</sup>	‘air’

So far in our database, we have found no example in which the schwa (/ə/) is followed by a nasal final.

<sup>2</sup> We would like to thank one of the anonymous reviewers for bringing this phenomenon to our attention.



**Figure 3** Waveforms and spectrograms for the minimal pairs */fa<sup>33</sup>/ 'melon' vs. /f<sup>h</sup>a<sup>33</sup>/ 'to twist'*, */so<sup>44</sup>/ 'thin' vs. /s<sup>h</sup>o<sup>44</sup>/ 'wash (clothes)'*, and */caN<sup>44</sup>/ 'nail' vs. /c<sup>h</sup>aN<sup>44</sup>/ 'to wipe'*. The target sound (fricative) is marked between two dashed lines.

Hmu nasals also contrast in voicing, but this contrast is limited to the bilabial and alveolar nasals. The velar nasal /ŋ/ does not have a voiceless counterpart. The following examples demonstrate nasals that contrast in voicing: */mu<sup>33</sup>/ 'illness' vs. /m̥u<sup>33</sup>/ 'Hmong'*, */ne<sup>33</sup>/ 'grandma (loan word)' vs. /n̥e<sup>33</sup>/ 'sun'*.

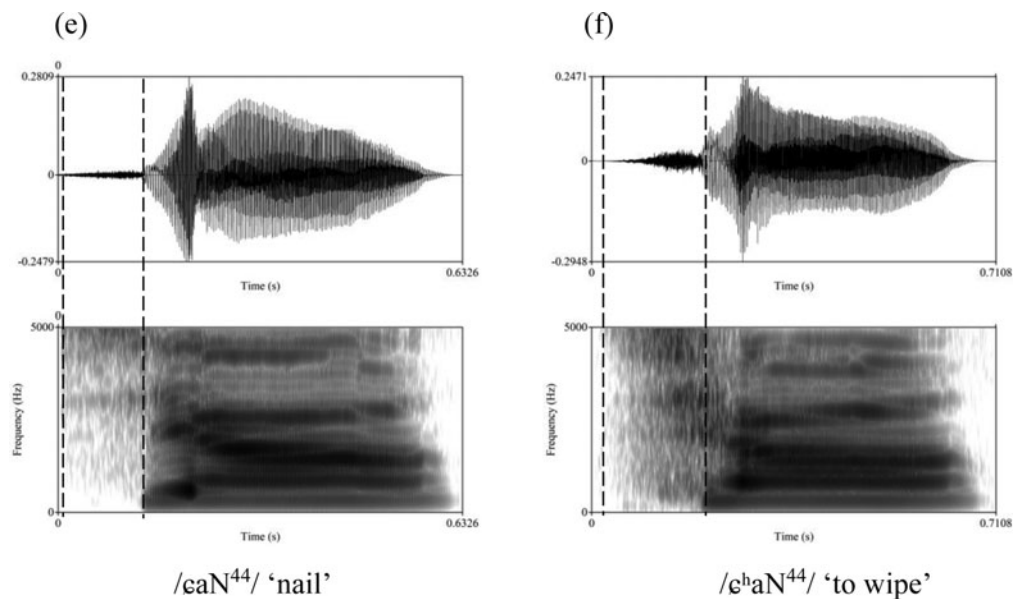


Figure 3 Continued.

The production of Hmu voiceless nasals begins with a substantial amount of nasal airflow before the nasal release. The spectrograms in Figure 4 demonstrate the contrast between voiced and voiceless nasals ( $/m/$  vs.  $/m̥/$ ; and  $/n/$  vs.  $/n̥/$ ). The voiceless nasals start with a noise portion, and show little or even no voicing before the release of the nasal. Auditorily the voiceless nasals in Hmu could be perceived as ending with a homorganic stop; in fact Fang-Kuei Li also reports that in Black Miao (another variety of Hmu), the voiceless nasal  $/n̥/$  sounds like  $[n̥t^h]$  (Li 1980: 19).<sup>3</sup> However, it should be noted that in the acoustic analysis as demonstrated in the spectrograms in Figure 4, no burst occurs between the voiceless nasal initial and the following vowel. What induces the auditory perception of the plosive ending is a topic worth pursuing in future research for Hmongic languages.

On the other hand, if a voiceless nasal occurs after the vowel of the preceding syllable, it is realized with a voiced nasal onset before the voicelessness starts; consider Figure 5.

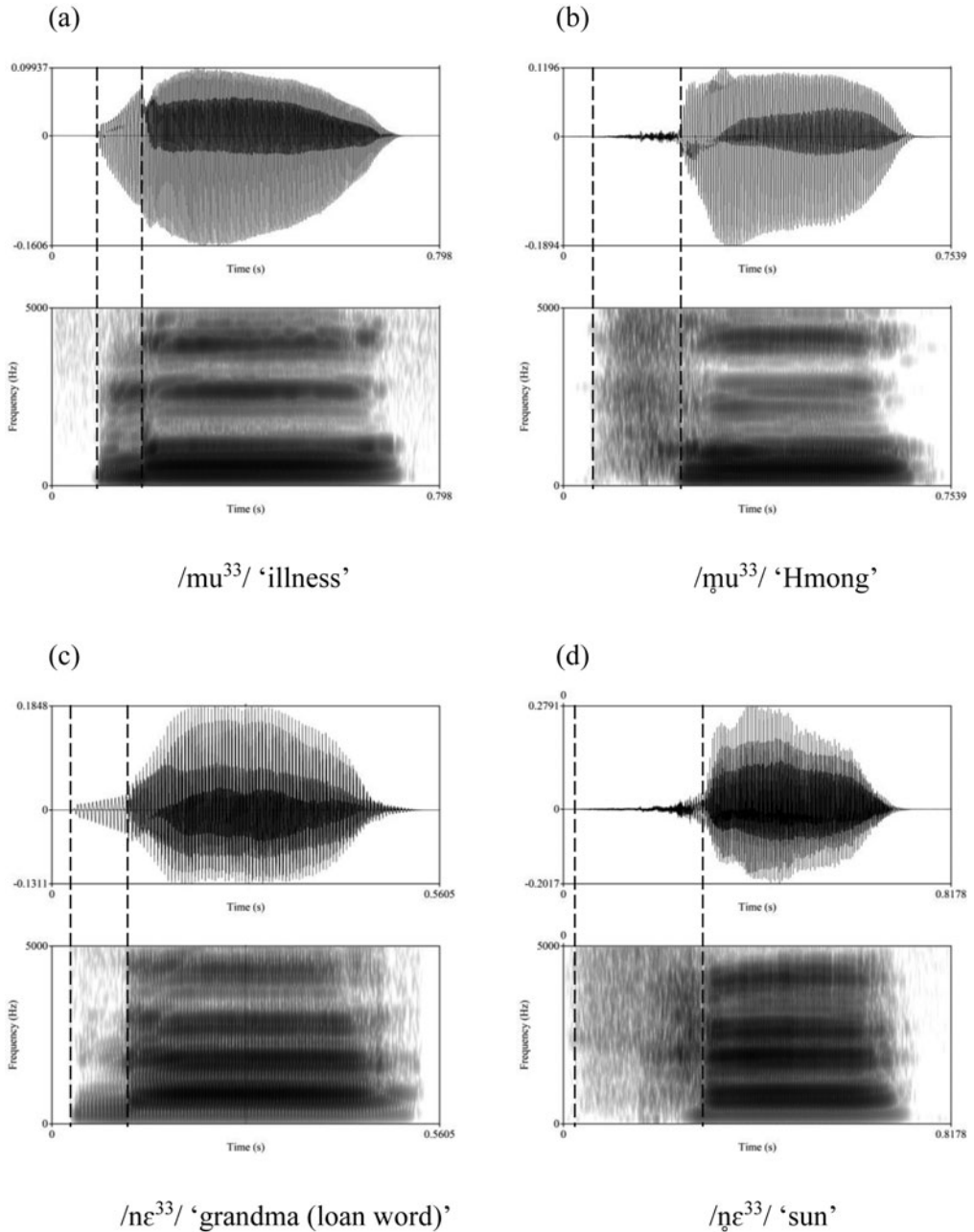
It is also worth noting that voiceless nasal onsets always make the following vowel nasalized. We have not found any syllable composed of a voiceless nasal initial and a modal (i.e. not nasalized) vowel. The same situation is not observed with voiced nasal onsets.

## Laterals

The lateral consonants also show a tripartite distinction among unaspirated voiceless lateral fricative  $/l/$ , aspirated voiceless lateral fricative  $/l^h/$ , and lateral approximant  $/l̥/$ . This minimal set demonstrates the contrastive status between  $/l/$ ,  $/l^h/$  and  $/l̥/$ :  $/la^{11}/$  'vegetable garden' vs.  $/la^{11}/$  'rich' vs.  $/l^ha^{11}/$  'to cut' (see Figure 6).

<sup>3</sup> The phenomenon in which voiceless nasal onsets are perceived to end in a stop is also discussed by Chan (1987) and Chan & Ren (1987), who have shown that it is an areal feature among some languages of southern China and northern southeast Asia. We would like to thank one of the anonymous reviewers for pointing this out. For the most recent research of Black Miao, the reader is referred to Kuang (2013b).



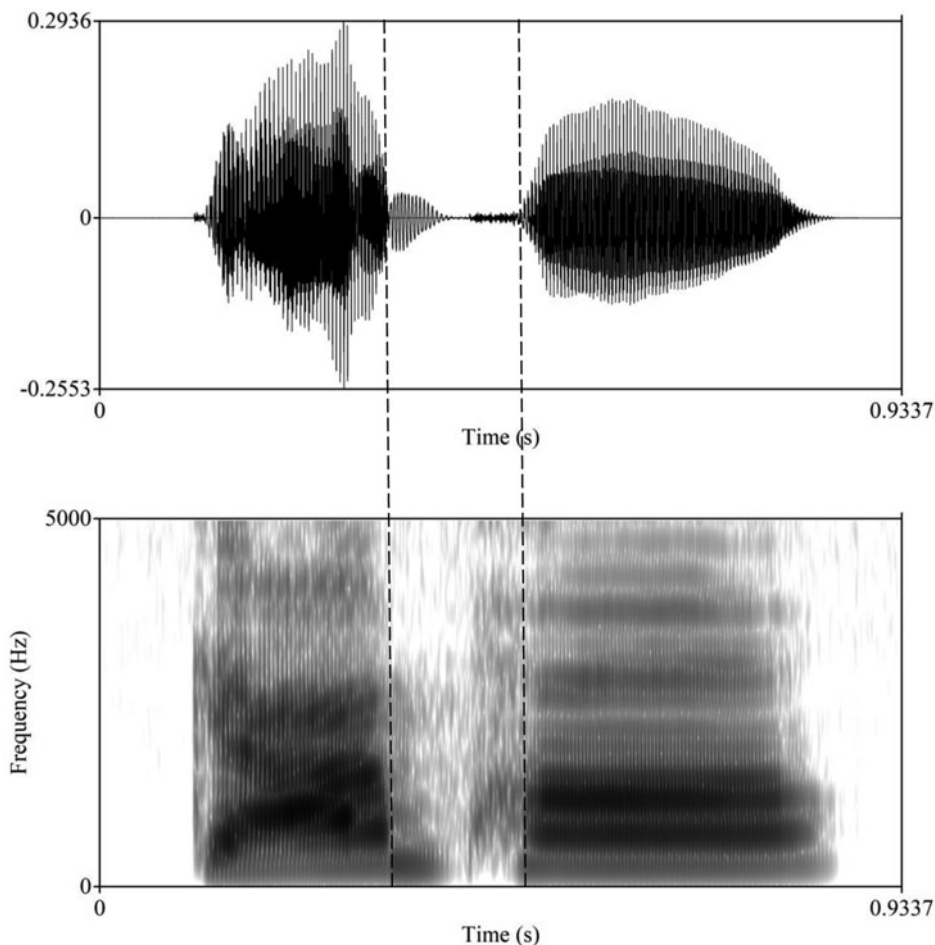


**Figure 4** Waveforms and spectrograms for the minimal pairs  $/\mu^{33}/$  'illness' vs.  $/\ṃu^{33}/$  'Hmong', and  $/\ne^{33}/$  'grandma (loan word)' vs.  $/\ṇe^{33}/$  'sun'. Two dashed lines mark off the nasals.

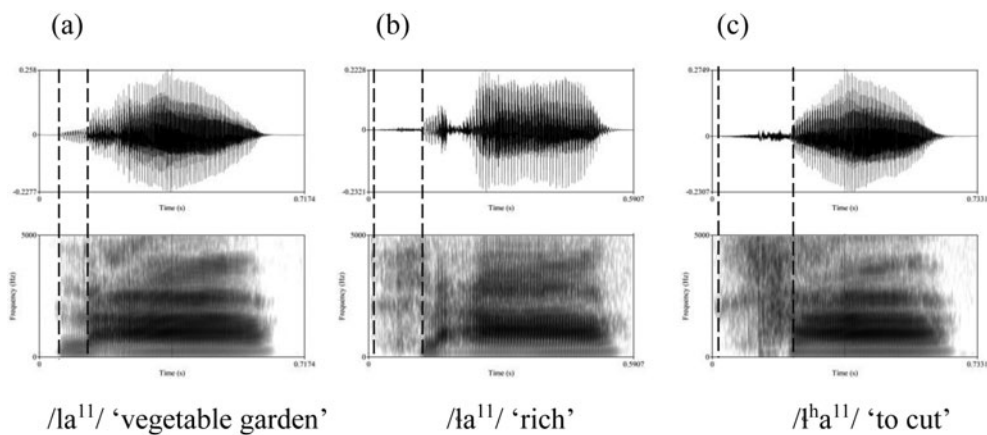
### Approximants

Hmu approximants contrast two places: palatal ( $/j/$ ) and velar ( $/w/$ ). When produced at an utterance-initial position in a prosodically strengthened way, the two approximants tend to be realized respectively as voiced alveolo-palatal fricative ( $/j/ \rightarrow [ʝ]$ ) and voiced velar fricative





**Figure 5** Waveforms and spectrograms for /ka<sup>24</sup> maN<sup>44</sup>/ ‘dinner’. The two dashed lines mark off the voiceless nasal onset of the second syllable, which starts with a voiced nasal, then followed by voicelessness before the vowel starts.

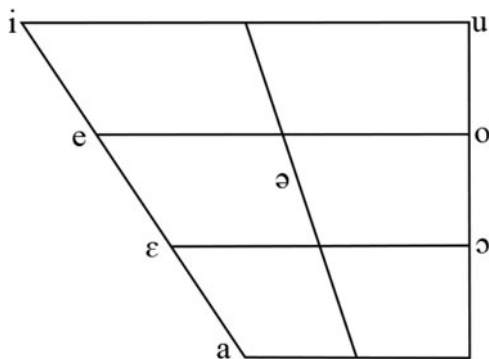


**Figure 6** Waveforms and spectrograms for the minimal pairs /la<sup>11</sup>/ ‘vegetable garden’ vs. /la<sup>11</sup>/ ‘rich’ vs. /h<sup>11</sup>a<sup>11</sup>/ ‘to cut’. Two dashed lines mark off the laterals.

(/ɥ/ → [ɥ]). In such situations, however, the approximants and their fricative counterparts are interchangeable, resulting in no difference in meaning.<sup>4</sup>

The approximant /j/ is the only consonant that can serve as the second component of a two-member consonant cluster (CC). See the section of the syllable structure for more details.

## Vowels



VOWEL (MONOPHTHONG)	EXAMPLE	GLOSS
i	pi <sup>33</sup>	'to give'
e	te <sup>44</sup>	'to kick'
ə	pə <sup>44</sup>	'loud'
ε	tε <sup>33</sup>	'son'
a	pa <sup>33</sup>	'thigh'
ɔ	tɔ <sup>44</sup>	'tree'
o	to <sup>44</sup>	'axe'
u	pu <sup>33</sup>	'to know'

As demonstrated in the diagram and the above examples, Hmu has eight oral monophthongs (/i e ε ə ɔ o u/) and the vowel-to-consonant ratio is about 0.24. The mean vowel-to-consonant ratio in languages of the world amounts to 0.39 (Maddieson 1984: 9). From this perspective, the Hmu vowel system is simpler than average. Moreover, Hmu vowels do not contrast in length, nasality, or tenseness.

See also the vowel chart plotted on the relative F1/F2 formant values in Figure 7. F1 and F2 were measured at three spots: one quarter of the vowel duration (25%), the mid point (50%), and three quarters of the vowel duration (75%). The mean formant value of a vowel was calculated by averaging over the three measurements. The consonants in the words examined are varied and not controlled for places and manners of articulation.

It should be noted that /a/ is realized as [ɑ] when it is followed by the velar nasal; and /u/ is realized as [əu] after alveolar consonants, such as [təu<sup>55</sup>] 'pipeful (measure unit)'.

<sup>4</sup> We would like to thank one of the anonymous reviewers for the comments that prompted us to reexamine the phonological behaviors of the approximants, which results in a revision of our analysis, so that it can hold up against all the related facts observed.

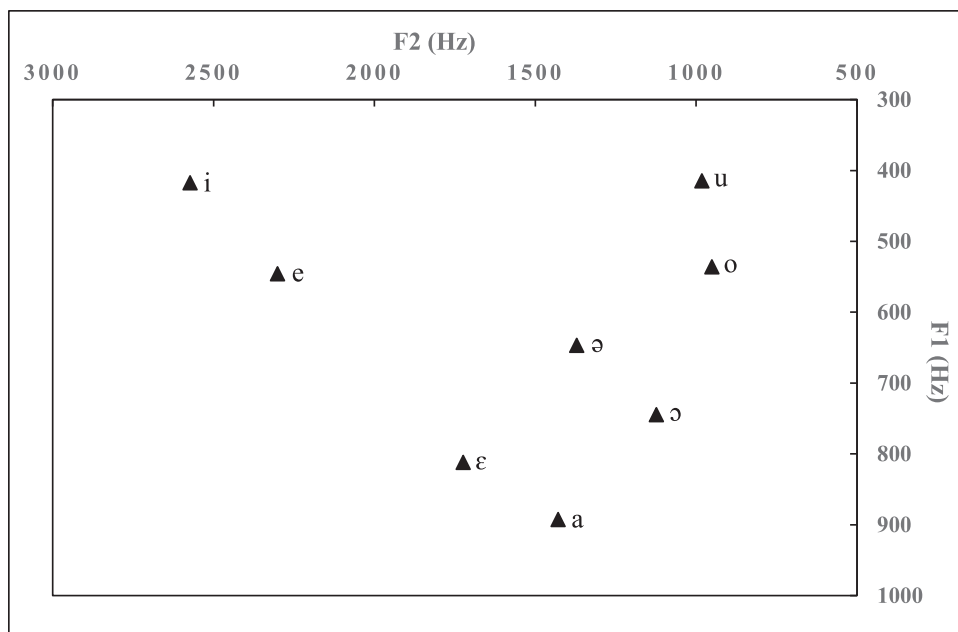


Figure 7 Hmu vowels in F1 vs. F2 vowel space

Table 2 Tones of Hmu.

Tone category	Tone value	Example
T1	33	[ki <sup>33</sup> ] 'snail' [to <sup>33</sup> ] 'deep'
T2	55	[ki <sup>55</sup> ] 'to cry' [to <sup>55</sup> ] 'to rush'
T3	24	[ki <sup>24</sup> ] 'localizer' [to <sup>24</sup> ] 'to pound'
T4	22	[ki <sup>22</sup> ] 'dry' [to <sup>22</sup> ] 'farther'
T5	44	[ki <sup>44</sup> ] 'to freeze' [to <sup>44</sup> ] 'no'
T6	11	[ki <sup>11</sup> ] 'to expose' [to <sup>11</sup> ] 'where'
T7	23	[ki <sup>23</sup> ] 'to shear' [to <sup>23</sup> ] 'shuttle'
T8	51	[ki <sup>51</sup> ] 'to dig' [to <sup>51</sup> ] 'stool'

*Note:* the Proto-Hmong language has been proposed to have four tone categories (level 平, rising 上, falling 去 and entering 入), each of which can further split in two based on the voicing of the onset, resulting in a total of eight tone categories: Yingping 阴平 (T1), Yangping 阳平 (T2), Yinshang 阴上 (T3), Yangshang 阳上 (T4), Yinqu 阴去 (T5), Yangqu 阳去 (T6), Yinru 阴入 (T7), Yangru 阳入 (T8) (Chang 1947, 1953, 1972; Wang 1994: 1; Wang & Mao 1995: 23). The tone categories 1–8 are the labels used in the previous studies on Proto-Hmong reconstruction.

## Tones

Hmu is a tone language. According to our database, monosyllabic words can take eight phonemic tones: five-level tones (High Level: 55, Mid–High Level: 44, Mid Level: 33, Mid–Low Level: 22, Low Level: 11), two rising tones (High Rising: 24, Low Rising: 23) and a high falling tone (51).<sup>5</sup> See Table 2 for some contrastive sets.

The pitch trajectory of each tone in terms of semitones is illustrated in Figure 8. These plots are based on the pitch contours of a set of monosyllabic words. Two things are especially worth noting. First, the only falling tone (51) is of remarkably shorter duration than the other

<sup>5</sup> Tone value is marked using the five-scale pitch system developed by Chao (1930), where 5 = the highest level and 1 = the lowest level.

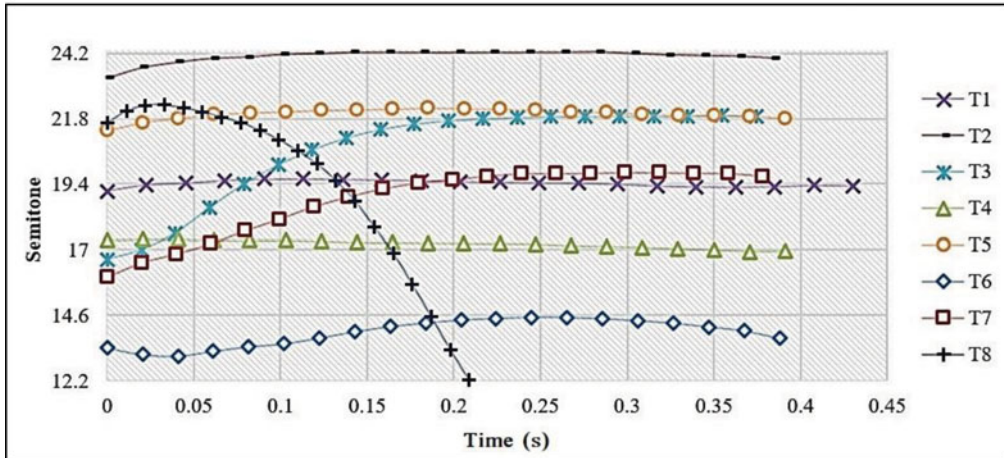


Figure 8 (Colour online)  $f_0$  trajectories of Hmu tones (Liu et al. 2017: 16)

tones. Second, the  $f_0$  trajectories of rising tones T3 (24) and T7 (23) are special in that each trajectory can be divided primarily into two parts based on its movement. In the first part the pitch moves up from low to high through half of the duration, then in the second part it remains level towards the end. This is somewhat different from the rising tone we commonly observe in languages like Mandarin Chinese, for which the pitch trajectory only moves upward. The rising trajectories as observed in Xinzhai Hmu are also found in Yuliang, another Hmu variety (Liu & Zhang 2016: 202).

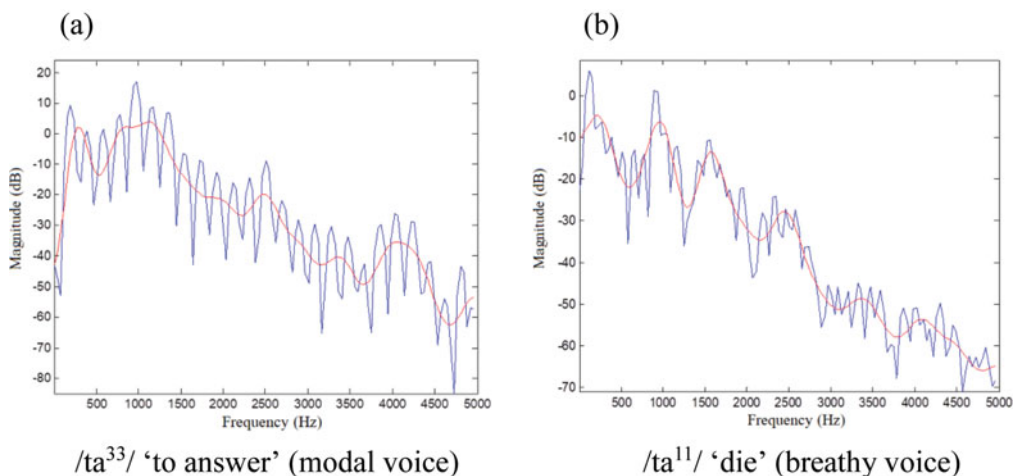
An important feature of the Hmu tone system is that it has five-level tones. The Xinzhai variety of Hmu is one of the several Hmongic languages that have up to five-level tones (see Kwan 1971, Wang 1994, Wang & Mao 1995, and Kuang 2013a, b for five-level tones in other varieties of Hmu; and see Kong 1992 for five-level tones in Western Hmongic). As far as we know, no other languages in the world has been reported to have as many as five contrastive level tones (Chao 1948; Maddieson 1978: 338; Kuang 2013a: 76; 2013b: 1).

In addition, tone sandhi is not observed in Hmu (Liu et al. 2017: 18–22). That is to say, the realization of a tone is not affected by the surrounding tonal environment.

## Voice quality

Apart from the pitch and duration differences, voice quality is also a component of Hmu tones. Two phonation types are observed in the production of the vowels in Hmu: modal and breathy voice.<sup>6</sup> The breathy phonation is only observed with low-level tone /11/. According to our preliminary analysis, the production of the low-level tone (/11/) comes with the largest open quotient value in comparison with that of the other tones. We examined tokens with the low-level tone (/11/) for the ratio of open phase and the whole cycle in the EGG signal, and obtained the open quotient value of 60–65%. With the modal voice having the open quotient of approximately 55% (Kong 2001: 172), the EGG signal of the low-level tone suggests that it is produced with breathy voice. This accords with our preliminary judgement during our first field investigation.

<sup>6</sup> Breathly voice is commonly found on tones in Hmongic languages, including Green Mong (Huffman 1987, Andruski & Ratliff 2000), White Hmong (Esposito 2012; Garellek et al. 2013), Black Miao (Kuang 2013b), and Hmu (Liu & Kong 2017).



**Figure 9** (Colour online) Spectral representations calculated at one cursor of vowel /a/ in  $/ta^{33}/$  'to answer' (modal voice) vs.  $/ta^{11}/$  'die' (breathily voice). The blue line represents FFT spectrum, the red line represents log spectrum.

The breathily voice of vowels on the low-level tone (/11/) is readily perceived by non-native speakers. Vocal pulses in breathily voice have far less intensity at the higher harmonics and more energy at the fundamental frequency. One can therefore measure the energy of the fundamental frequency (the first harmonic) and higher harmonics, and determine the presence of breathiness by the amplitude accretion of the fundamental frequency and the amplitude decrease of the higher harmonics (Ladefoged & Antoñanzas-Barroso 1985: 79, 81). Another acoustic measure that is commonly used to detect breathiness is the amplitude difference between the first and second harmonics (Fischer-Jørgensen 1967, Bickley 1982, Kirk, Ladefoged & Ladefoged 1984, Maddieson & Ladefoged 1985, Huffman 1987 among many others), with expected higher H1–H2 differences for breathily sounds (Andruski & Ratliff 2000: 43, 46; Ladefoged 2003: Section 7.2). Acoustic measurements of Hmu data show that the non-modal voice is characterized by less intensity at higher frequencies and higher difference between the first and second harmonics, which is strongly indicative of breathily voice. These acoustic features are illustrated in the spectra in Figure 9, in which the H1–H2 value of modal voice is about 9.7 dB, while it is about 13.5 dB in breathily voice.

The non-modal phonation type that co-occurs with the low-level tone /11/ can vary from person to person. So far breathily, harsh, and nearly modal voices have been observed with tone /11/. The harsh voice is likely a by-product of breathily with very low tone, in which a speaker can tend to lower their larynx. Physiologically, lowering the larynx can not only decrease the longitudinal tension of vocal folds controlled by cricothyroid muscles, but also brings about the engagement of other supralaryngeal muscles, leading to supraglottal constriction (Edmondson et al. 2001: 90; Edmondson & Esling 2006: 169–171). The voice quality can therefore be perceived as harsh voice when the vocal folds and ventricular folds are compressed in a narrowing supraglottal space. The production of very low pitch can also induce the aryepiglottic folds to vibrate (Esling 2013: 3). Through their laryngoscopic experiments of harsh voice, Esling & Harris (2005: 373) figured that when glottal adduction was quickly followed by ventricular incursion, aryepiglottic constriction occurred.

## Syllable structure

The canonical Hmu syllable minimally consists of an obligatory nucleus (V) on a specific tone. The syllable may also comprise up to three optional elements in the following linear

structure: (C) (C) V (C). The archiphonemic nasal (N) is the only syllable-final consonant, and is often merged with the vowel, resulting in a nasalized vowel. A complex (CC) initial always has /j/ as the second element.

- (1) V /ɔ<sup>33</sup>/ ‘water’
- (2) CV /ta<sup>55</sup>/ ‘to come’
- (3) CCV /tju<sup>55</sup>/ ‘door’
- (4) CVC /taN<sup>22</sup>/ ‘half’
- (5) CCVC /tjaN<sup>55</sup>/ ‘oil’

Similar to its linguistic neighbors, Hmu is phonologically monosyllabic with a strong tendency towards disyllabicity in its lexicon. Multi-syllabic words are mostly compounds.

## Transcription of the recorded passage

The passage is a Hmu version of ‘The North Wind and the Sun’ story, transcribed phonemically using the symbols presented and discussed in the main text of this illustration. The tones are marked for the eight tones described above, with Chao’s five-scale notation. In the transcription, the symbol ‘|’ marks a pause, while ‘||’ marks the end of a complete sentence. Interlinear glossing and a free translation are also provided.

tɕo<sup>55</sup> tɕi<sup>44</sup> pɛ<sup>51</sup> hɛ<sup>33</sup> lɛ<sup>33</sup> ɲɛ<sup>33</sup>  
 CLF wind north and CLF sun  
 ‘The North Wind and The Sun’

### Sentence 1

mɛ<sup>55</sup> ɛ<sup>33</sup> tja<sup>11</sup>| tɕo<sup>55</sup> tɕi<sup>44</sup> pɛ<sup>51</sup> su<sup>22</sup> lɛ<sup>33</sup> ɲɛ<sup>33</sup> njaN<sup>33</sup> haN<sup>24</sup> i<sup>44</sup>||  
 have one time CLF wind north and CLF sun at place that

ɕ i<sup>44</sup> u<sup>51</sup> tɛ<sup>22</sup> qe<sup>24</sup> uo<sup>51</sup> no<sup>44</sup>|| u<sup>51</sup> mǎ<sup>22</sup> u<sup>51</sup> ta<sup>55</sup> sɛ<sup>55</sup> feN<sup>33</sup>  
 argue who strong more argue go argue come yet distinguish

to<sup>44</sup> lo<sup>22</sup> tɛ<sup>22</sup> xi<sup>33</sup> kja<sup>22</sup>||  
 NEG come.out CLF high low

‘The north wind and the sun were arguing about which of the two was stronger.’

### Sentence 2

kaN<sup>55</sup> i<sup>44</sup> mɛ<sup>55</sup> tɛ<sup>22</sup> haN<sup>33</sup> kje<sup>24</sup> ta<sup>55</sup>|  
 when that have CLF walk road come

nɛ<sup>55</sup> naN<sup>22</sup> p<sup>h</sup>aN<sup>33</sup> u<sup>24</sup> poN<sup>23</sup> ɬ<sup>h</sup>jə<sup>33</sup>||  
 3SG wear CLF clothes cotton big

‘Then there came a traveler wearing a thick coat for the cold.’

### Sentence 3

nɛ<sup>55</sup> o<sup>33</sup> lɛ<sup>55</sup> qe<sup>55</sup> ma<sup>44</sup> u<sup>44</sup>| tɛ<sup>22</sup> qe<sup>24</sup> xo<sup>44</sup> tɛ<sup>22</sup> haN<sup>33</sup>  
 3SG two CLF CONJ.so speak well who make CLF.person walk

kje<sup>24</sup> ɛ<sup>33</sup>| t<sup>h</sup>a<sup>24</sup> nɛ<sup>55</sup> paN<sup>51</sup> p<sup>h</sup>aN<sup>33</sup> u<sup>24</sup> poN<sup>23</sup> ta<sup>33</sup> mǎ<sup>22</sup>||  
 road that take 3SG GEN CLF clothes cotton thick off

neN<sup>24</sup> ne<sup>55</sup> qe<sup>55</sup> uo<sup>51</sup> no<sup>44</sup>||  
 then 3SG CONJ.so strong more

‘They agreed that whoever of the two would be able to make the traveler take off his coat would be considered the stronger of the two.’

*Sentence 4*

tɕo<sup>55</sup> tɕi<sup>44</sup> pe<sup>51</sup> qe<sup>55</sup> tɕ<sup>h</sup>i<sup>24</sup> u<sup>ə</sup> ɤ<sup>11</sup> mu<sup>51</sup> tɕi<sup>44</sup> ta<sup>55</sup>||  
 CLF wind north CONJ.so try blow wind come.out

tɕ<sup>h</sup>a<sup>33</sup> ne<sup>55</sup> mu<sup>51</sup> tɕi<sup>44</sup> u<sup>ə</sup> ɤ<sup>22</sup> poN<sup>44</sup>||  
 but 3SG blow wind increasingly very

‘So then the wind blew with all its might.’

*Sentence 5*

te<sup>22</sup> haN<sup>33</sup> kje<sup>24</sup> i<sup>44</sup> qe<sup>55</sup> q<sup>h</sup>a<sup>24</sup> ne<sup>55</sup> paN<sup>51</sup> p<sup>h</sup>aN<sup>33</sup> u<sup>24</sup>  
 CLF.person walk road that CONJ.so wrap 3SG GEN CLF clothes

poN<sup>23</sup> ɬ<sup>h</sup>ɔ<sup>33</sup> i<sup>44</sup> u<sup>ə</sup> ɤ<sup>22</sup> tɕoN<sup>44</sup>|| taN<sup>22</sup> qaN<sup>22</sup> tɕo<sup>55</sup> tɕi<sup>44</sup> pe<sup>51</sup>  
 cotton big that increasingly tight later CLF wind north

qe<sup>55</sup> to<sup>44</sup> pu<sup>33</sup> ɛ<sup>44</sup> tɛ<sup>11</sup> ɛ<sup>44</sup> jə<sup>22</sup> qe<sup>55</sup> ɕoN<sup>33</sup> jaN<sup>55</sup>||  
 CONJ.so NEG know how.to.do modal CONJ.so stop PFV

taN<sup>22</sup> ɛ<sup>33</sup> kaN<sup>55</sup> te<sup>33</sup> le<sup>33</sup> n̄e<sup>33</sup> qe<sup>55</sup> ta<sup>55</sup> jaN<sup>55</sup>||  
 wait one moment CLF CLF sun CONJ.so come.out PFV

‘The stronger the wind blew, the more tightly the traveler held his coat, until the wind grew tired and stopped blowing.’

*Sentence 6*

ne<sup>55</sup> kh<sup>i</sup>33 ɕo<sup>23</sup> ki<sup>11</sup> ɬi<sup>51</sup> tɕə<sup>44</sup> ɛ<sup>33</sup> tso<sup>23</sup> te<sup>22</sup> haN<sup>33</sup> kje<sup>24</sup> i<sup>44</sup>||  
 3SG hot red =very to one shine CLF.person walk road that

qe<sup>55</sup> t<sup>h</sup>a<sup>24</sup> po<sup>22</sup> ɬjo<sup>22</sup> ne<sup>55</sup> paN<sup>51</sup> p<sup>h</sup>aN<sup>33</sup> u<sup>24</sup> poN<sup>23</sup> ɬ<sup>h</sup>ɔ<sup>33</sup> i<sup>44</sup> mə<sup>22</sup>||  
 CONJ.so take quickly 3SG GEN CLF clothes cotton big that off

‘Then the sun shone strongly, making it become very hot, suddenly the traveler took of his coat from the heat.’

*Sentence 7*

kaN<sup>55</sup> i<sup>44</sup> neN<sup>44</sup> tɕo<sup>55</sup> tɕi<sup>44</sup> pe<sup>51</sup> i<sup>44</sup> qe<sup>55</sup> ta<sup>51</sup> j i N<sup>23</sup> keN<sup>23</sup>||  
 moment that then CLF wind north that CONJ.so admit have.to

ne<sup>55</sup> o<sup>33</sup> le<sup>55</sup> neN<sup>44</sup> te<sup>22</sup> tjo<sup>11</sup> le<sup>33</sup> n̄e<sup>33</sup> uo<sup>51</sup> no<sup>44</sup>||  
 3SG two CLF then still be CLF sun strong more

‘And so the north wind agreed that the sun was truly the stronger of the two.’

ABBREVIATIONS

3SG third person singular  
 CLF classifier



CONJ	conjunction
GEN	genitive
NEG	negative
PFV	perfective aspect

## Acknowledgements

This work was funded by Ministry of Education of the People's Republic of China (No. 17JJD740001). We would like to thank the three anonymous reviewers for their detailed and insightful comments. We also would like to thank the Editor of *JIPA*, Prof. Amalia Arvaniti, for her very helpful suggestions.

## Supplementary material

To view supplementary material for this article, please visit <https://doi.org/10.1017/S0025100318000336>

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