

UNDERSTANDING TONE CHANGE: IN SEARCH OF STABILITY-INDUCED TONAL FUSION IN SOUTHWESTERN TAI LANGUAGES

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Abstract

Xishuangbanna Tai Lue (China) features six lexical tones and six emerging grammatical tones. Each grammatical tone arises through the fusion of two lexical tones, a process driven by tonal stability mechanism following segmental deletion. Among Southwestern Tai languages, only Tai Phake and Central Thai have also been reported to exhibit tonal stability behavior. Drawing primarily on fieldwork data, this paper outlines the principal properties of grammatical tones in Xishuangbanna Tai Lue and investigates why, in identical morphosyntactic contexts, stability-induced tonal fusion does not occur in Tai Phake, Central Thai, Northern Thai, and Lampang Tai Lue (Thailand). This absence is attributable to factors including word shape, differentiation of tonal functions, and language contact. Overall, the findings contribute to the documentation of emerging grammatical tone systems and advance our understanding of tone change by addressing the actuation problem—namely, why a given change occurs in one language but not in others, despite comparable structural conditions.

Keywords: Tai Lue; Southwestern Tai; grammatical tone; tone change; tonal stability; tonal fusion

ISO 639-3 codes: khb, twi, hay, tha, phk, zyb, zha, nod, lao, hni, lhu, jiu, blr, xghu, cmn

1 Introduction

Since Haudricourt's (1954) groundbreaking work on the origin of tones in Vietnamese, numerous studies have significantly advanced our understanding of tonogenesis—the birth of tones in atonal languages (cf. Haudricourt 1961; Matisoff 1973; Hombert, Ohala & Ewan 1979; Thurgood 2002). Nevertheless, as several scholars have pointed out (Dockum 2019; Yang & Xu 2019; Campbell 2022), our understanding of subsequent tone changes in already tonal languages still lags behind. Major studies on the later development of tones have focused on how, once lexical tones are well established in a language, these tonal categories undergo further splits, mergers, and/or changes in their phonetic realization. For instance, Dockum's (2019) extensive survey evaluates tone change patterns across hundreds of Tai varieties. Pittayaporn (2007; 2018) and Zhu, Lin and Pachaya (2015) examine the phonetic evolution of Bangkok Thai tones over a century and identify directionality of these changes. Yang and Xu (2019), after reviewing 52 tone change studies on Sinitic, Kra-Dai, Hmong-Mien and Tibeto-Burman languages, suggest the existence of cross-linguistic tendencies in tone change directionality.

This paper also investigates subsequent tone changes in languages where tonal categories are already well established. However, the focus is not on the evolutionary path of existing lexical tones, but rather on the emergence of six grammatical tones¹ resulting from the loss of segmental material. More precisely, recent

¹ In this paper, “grammatical” is used in the broad sense—covering morphology and syntax—and is opposed to “phonological”. Specifically, a grammatical tone designates “a tonological operation which is not general across the phonological grammar, and is restricted to the context of a specific morpheme or construction, or a natural class of morphemes or constructions” (Rolle 2018:19).

studies on Tai Lue [kxb, Kra-Dai] spoken in Xishuangbanna (southwestern China) report six emerging grammatical tones that are distinct from the language’s six lexical tones (Li 2019; 2022). These grammatical tones primarily occur in the following contexts: **a**) when /mak²⁴/ ‘fruit’ combines with another morpheme to form a compound noun (see 1a, [25] is a grammatical tone);² **b**) when the negator /bǎw²⁴/ ‘NEG’ modifies another morpheme (see 1b).³

(1) Tai Lue

a.	/mak ²⁴ xam ⁵⁵ / ‘tamarind’	[mak ²⁴ -xam ⁵⁵]	[m ²⁴ -xam ⁵⁵]	[xam ²⁵]
		‘fruit-tamarind’	‘fruit-tamarind’	‘fruit.tamarind’
b.	/bǎw ²⁴ hǎn ⁵⁵ / ‘not to see’	[bǎw ²⁴ -hǎn ⁵⁵]	[m ²⁴ -hǎn ⁵⁵]	[hǎn ²⁵]
		‘NEG-see’	‘NEG-see’	‘NEG.see’

As shown in (1a-b), these two contexts exhibit the same variation patterns. Lexical tones are used whenever /mak²⁴/ ‘fruit’ or /bǎw²⁴/ ‘NEG’ is segmentally present. This suggests that grammatical tone [25] is created through tonal fusion between lexical tones [24] and [55], following the deletion of the syllable carrying [24], that is, the segmental material of /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’, respectively. This phenomenon, where tones persist despite the deletion of their original tone-bearing unit (TBU), is known as stability. The term, coined by Goldsmith, refers to the phenomenon in which “the toneme, or more generally the tone melody, has a stability which maintains it independently of the other aspects of the signal, and thus the tone melody preserves itself despite modifications to the syllabic structures” (1976:53).

Stability is well-documented in African tonal languages. For example, in Twi [twi, Niger-Congo], a contour tone or a downstep is derived from the segmental loss of a TBU (Schachter & Fromkin 1968). In Haya [hay, Niger-Congo], segments are copied in reduplication, while tones are not (Hyman & Byarushengo 1984). In contrast, although tone is often considered as a prominent feature of Mainland Southeast Asia (cf. Henderson 1965; Matisoff 2001; Enfield 2011; Sidwell & Jenny 2021), tonal stability has been rarely attested—or remains under-described. Within the Kra-Dai family, apart from Tai Lue, I am aware of only two other languages—Thai [tha]⁴ and Tai Phake [phk]—that exhibit stability effect. Specifically, Thai has a type of word game in which rhymes are permuted while tones remain unchanged:

(2) Thai

a.	<i>klúà̃y hḷḷóm</i>	>	<i>klḷḷóm hùáy</i>	‘banana’	
b.	<i>ténrām</i>	>	<i>támreñ</i>	‘dance’	(Yip 2002:67)

In Tai Phake, a contour referred to as “questioning tone” (represented as tone 7) may appear in interrogative phrases, replacing tone 1 or tone 2.⁵ See the tonal change on the word *nī*² ‘good’ in examples (3a-b).

² Tones are transcribed with Chao’s (1930) five-tone numerals: 5 indicates the highest level, 1 the lowest level.

³ In this paper, to facilitate cross-linguistic comparison, the vowel length of previous works is re-transcribed following the convention adopted in Tai Lue studies: the diacritic ˘ is used to annotate a short vowel.

⁴ *Thai* is often used interchangeably with terms like *Siamese*, *Central Thai*, *Bangkok Thai*, and *Standard Thai*. However, the interpretation of these terms can vary depending on the perspective. For instance, *Thai* may be understood geographically (i.e., referring to the dialect/s of the central region of Thailand), normatively (i.e., as the national language established by the authority), or as a shared variety (i.e., as a *lingua franca*). For comprehensive overviews of the issues involved, see Smalley (1994), Diller (2002) and Draper (2019).

For the purposes of this paper, the term *Central Thai* is preferred, as it contrasts with another Tai variety under investigation, namely *Northern Thai*. It refers to the linguistic variety that speakers would typically recognize as the dominant one in Thailand (Diller 2002).

⁵ For phonetic details of these tones, see [Tables 11](#) and [14](#).

(3) Tai Phake

- a. *kin*² *nī*² *nɔ*⁶
 eat good Q
 ‘Is it good to eat?’

Adapted from (Morey 2008:236), emphasis added

- b. *phak*¹ *nai*³ *kin*² *nī*⁷
 vegetable/dish PROX eat good.Q
 ‘Is this dish good to eat?’

Adapted from (Morey 2008:236),
 emphasis added

Since tone 7 in Tai Phake consistently appears on the final morpheme in a question when the interrogative marker *nɔ*⁶ is absent, it may result from tonal fusion triggered by the segmental deletion of the question particle *nɔ*⁶ ‘Q’.

Another important feature in the emergence of Tai Lue’s grammatical tones is that both /mak²⁴/ ‘fruit’ and /bāw²⁴/ ‘NEG’ can be segmentally reduced to the syllabic nasal [ɱ] (see 1a-b). More specifically, it will be shown that this syllabic reduction is a prerequisite for subsequent tonal stability. As already highlighted by Hartmann in his paper *Syllabic ɱ in Tai-Lue and neighbouring Tai dialects* (1979), the syllabic nasal *ɱ* is attested in several Tai varieties. For instance, the prefix *m̄-*, indicating fruit and roundish objects, is found in Northern Thai (Purnell & Hope 1962) [nod] ; the preclitic negative marker *m-* occurs in Tai Phake (Diller 1992); and the negators *m̄*⁴⁴ in Yongbei Zhuang [zyb] and *m̄*³³ in Tiandong Zhuang (Zhāng et al. 1999:412) [zha] are also documented.⁶ The overlap in both form and function of the syllabic nasal *ɱ* among these Tai varieties suggests that the stability-induced tonal fusion observed in Xishuangbanna Tai Lue could also occur in other Tai languages.

Accordingly, I examine prior studies on Tai Lue spoken in Xishuangbanna (China; hereafter XSBN Tai Lue) and Tai Phake, and present original fieldwork data on Tai Lue spoken in Lampang (Thailand; hereafter LP Tai Lue), Northern Thai spoken in Chiang Mai (Thailand), and Central Thai spoken in Bangkok (Thailand). All the varieties under investigation belong to the Southwestern branch of the Kra-Dai language family, as classified by Li (1977). Further reasons for their selection are as follows:

- LP Tai Lue allows for an examination of whether two varieties of the same language may undergo similar tonal innovations as result of shared structural properties.
- Tai Phake exhibits a possible tonal fusion process triggered by tonal stability.
- Northern Thai and Tai Phake are reported to employ the syllabic nasal *ɱ* in morphosyntactic contexts similar to those in which grammatical tones occur in XSBN Tai Lue.
- Central Thai also displays tonal stability. Although this effect is observed in a type of language game rather than in morphosyntactically constrained environments, Central Thai serves as a control language for testing whether tonal stability, together with genealogical proximity, constitutes a sufficient condition for the emergence of grammatical tones in the two contexts examined here.

The data show that the type of stability-induced tonal fusion observed in XSBN Tai Lue is absent from the other four Southwestern Tai varieties. This study argues that syllable structure, the need to maintain contrasts in tonal function, and language contact are key factors underlying the absence of such fusion. By documenting the processes involved in the emergence of the six grammatical tones in XSBN Tai Lue and by adopting a comparative perspective, the findings not only provide valuable insights into how grammatical tone systems gradually unfold, but also address the actuation problem articulated by Weinreich *et al.* (1968): why does a potential change occur in one language but not in others under seemingly similar conditions?

The remainder of this paper is organized as follows: [Section 2](#) introduces the Gedney tone box, a key tool in comparative and historical Tai linguistics. [Section 3](#) presents the tonal system of XSBN Tai Lue, including its lexical tones, tonal alternations, and emerging grammatical tones. [Section 4](#) outlines the data collection methods and participant information. [Section 5](#) reviews data from Tai Phake and presents original fieldwork

⁶ As this brief literature review shows, the syllabic nasal *ɱ* is transcribed using different conventions. In the following sections, this sound will be always marked with the diacritic *̄*, to highlight its syllabic property.

data from LP Tai Lue, Northern Thai, and Central Thai. [Section 6](#) interprets the findings. [Section 7](#) concludes the paper.

2 Proto-Tai tonology and the Gedney tone box

As a widely used method in the comparative and historical tonology of Tai languages, Gedney’s “tone box” (1972) enables the mapping of a Tai language’s synchronic lexical tones back to the four tonal categories of Proto-Tai (i.e., *A, *B, *C and *D)—the hypothetical ancestor of all modern Tai languages (Gedney 1972; 1991; Li 1977; Pittayaporn 2009). More specifically, Proto-Tai is reconstructed with three contrastive tones on “smooth syllables” (i.e., those ending in a non-obstruent sound), conventionally labeled *A, *B and *C. In contrast, “checked syllables” (i.e., those ending in an obstruent) are generally considered toneless and are grouped under the category *D. The tonal systems of modern Tai languages diverge from that of Proto-Tai due to subsequent tonal splits and mergers. These tonal changes are conditioned by the laryngeal features of the syllable-initial consonants at the time of tone splits and mergers. The exact changes vary across languages. The most common pattern is a binary split triggered by the loss of phonemic contrast between voiced and voiceless initials. Checked syllables generally undergo not only this binary split, but also an additional split conditioned by vowel length, conventionally labeled *DS and *DL.

Based on these split patterns, Gedney proposed a diagram with 20 tonal categories that a Tai language could theoretically exhibit. However, no known Tai language displays all 20 categories synchronically, since none has undergone all tonal splits listed in Table 1. As a result, some cells in the diagram necessarily share the same tone.

Table 1. Tone box, adapted from Gedney (1972:202)

		Proto-Tai tones				
		*A	*B	*C	*DS	*DL
Initials at time of tonal splits						
Voiceless	voiceless friction sounds: *s, ^h m, p ^h , etc.	1	5	9	13	17
	voiceless unaspirated stops: *p, etc.	2	6	10	14	18
	gottal: *ʔ, ^ʔ b, etc.	3	7	11	15	19
Voiced	voiced: *b, m, l, z, etc.	4	8	12	16	20

The synchronic tones of a Tai language can be identified through the elicitation of a list of 64 monosyllabic words that accompany the tone box. These words, all of Tai origin, are categorized according to their Proto-Tai features and are distributed across the 20 cells. This approach enables researchers to quickly determine the tonal inventory of most Tai languages⁷ and facilitates cross-linguistic comparison. Accordingly, the tone box method was applied to the varieties examined in this study, all of which belong to the Southwestern branch of the Kra-Dai language family.

3 Tonology of XSBN Tai Lue

3.1 Lexical tones

Table 2 presents the six lexical tones of XSBN Tai Lue, along with their diachronic correspondences as identified through Gedney’s tone box method (1972).

⁷ The application of the original tone box and its accompanying word list is effective for determining the tonal systems of Southwestern Tai varieties, but it has certain limitations when applied to languages outside this branch. For example, these materials do not account for additional splits observed in several Central Tai and Northern Tai languages (cf. Gedney 1972:204; L.-Thongkum 1997). For a more detailed discussion on the subject, see Liao (2023).

Table 2. Lexical tones of XSBN Tai Lue and their diachronic correspondences, modified from Li (2022:122)

Proto-Tai tone Initials at the time of tonal splits	Smooth syllable			Checked syllable	
	*A	*B	*C	*DS	*DL
Voiceless friction sounds	55	24	213	55	24
Voiceless unaspirated stops					
Glottal sounds					
Voiced sounds	42	44	22	44	

The distribution of tones is conditioned by syllable type: while smooth syllables can carry any of the six lexical tones, checked syllables can carry only three. Such syllabic restrictions on tonal distribution are common among Tai languages. Accordingly, two conventions coexist regarding how to count the number of synchronic tones in a Tai language, differing in their treatment of tones originating from *D (associated with checked syllables) versus those from *A, *B and *C (associated with smooth syllables). Some scholars treat tones on smooth and checked syllables as distinct tonal categories. However, if the tones on checked syllables are phonetically similar to certain tones on smooth syllables, the two sets are often considered to be in complementary distribution from a phonological perspective. As shown in Table 2, the second convention is adopted for XSBN Tai Lue. In contrast, it will be demonstrated that the first convention is necessary for LP Tai Lue, where one of the tones in checked syllables lacks a phonetically similar counterpart among the tones on smooth syllables (see [Section 5.2.1](#)). Table 3 summarizes the main characteristics of the six lexical tones of XSBN Tai Lue.

Table 3. Main characteristics of the six lexical tones of XSBN Tai Lue, modified from Li (2022:140)

Tone numerals	Proto-tones	Phonetic properties	Phonotactic restrictions	Minimal pairs
55	*A1	high-level	CV, CVR	/ka ⁵⁵ / ‘crow’
	*DS1		CVO	/kap ⁵⁵ / ‘box’
42	*A2	falling	CV, CVR	/ka ⁴² / ‘to wedge’
24	*B1	rising	CV, CVR	/ka ²⁴ / ‘to go’
	*DL1		CVO	/kap ²⁴ / ‘bamboo leaf’
44	*B2	half-high level	CV, CVR	/ka ⁴⁴ / ‘price’
	*D2		CVO	/kap ⁴⁴ / ‘to stick (in the mouth)’
213	*C1	falling-rising ⁸	CV, CVR	/ka ²¹³ / ‘young rice plant’
22	*C2	level	CV, CVR	/ka ²² / ‘to do business’

3.2 Tonal alternations

In connected speech, XSBN Tai Lue exhibits two types of tonal alternation commonly referred to as tone sandhi (Fù et al. 1955; Wū & Zhāng 1981). The first type involves allotonic variation of the tone /42/, conditioned by the preceding tone. The second type involves a categorical change of the tone /24/, influenced by the following tone and restricted to specific morphosyntactic contexts.

⁸ Tones /213/ and /22/, both derived from the proto-tone *C, frequently exhibit final glottalization (i.e., [213ʔ] and [22ʔ]). For reasons of space, and because it is not essential to the present analysis, an acoustic description of this glottalization is left for future research.

The allotonic variation of /42/ was first reported by Wū and Zhāng (1981:14), although only partial examples were provided. Table 4 illustrates this alternation using data from my own fieldwork.

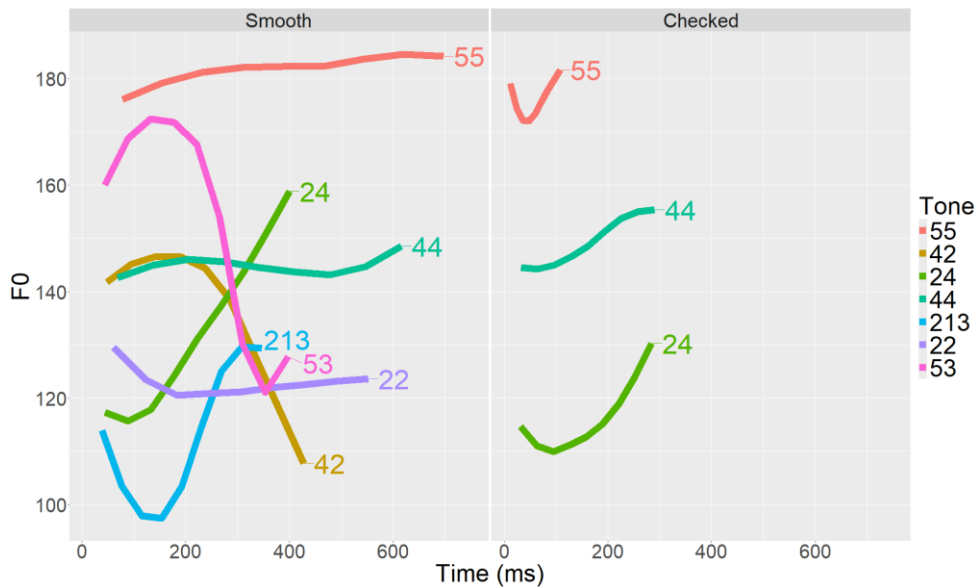
Table 4. Allotonic variation of the tone /42/ in XSBN Tai Lue (rule after Wū & Zhāng 1981:14)

Rule	Example
[42] → [53] / [55], [24], [213] __	[ma ⁵⁵ mǎn ⁵³] ‘his/her dog/s (lit. dog + 3SG)’
	[mu ²⁴ mǎn ⁵³] ‘his/her table/s (lit. table + 3SG)’
	[tsəŋ ²¹³ mǎn ⁵³] ‘his/her umbrella/s (lit. umbrella + 3SG)’
[42] / [42], [44], [22] __	[ju ⁴² mǎn ⁴²] ‘his/her broom/s (lit. broom + 3SG)’
	[ten ⁴⁴ mǎn ⁴²] ‘his/her bed/s (lit. bed + 3SG)’
	[p ^h a ²² mǎn ⁴²] ‘his/her knife/s (lit. knife + 3SG)’

As shown in Table 4, tone /42/ automatically changes its realization depending on the preceding lexical tone. It is realized as [53] after /55/, /24/, or /213/, and remains unchanged after /42/, /44/, or /22/.

Figure 1 illustrates the pitch contours of XSBN Tai Lue’s six lexical tones, together with [53], the allotonic variant of tone /42/.

Figure 1: Pitch contours (after Loess smoothing) of the six lexical tones and the allotone of /42/ produced by a male speaker (M1). One token is illustrated for each of the seven tones found in smooth syllables (left), along with one token for each of the three tones that can occur in checked syllables (right). The ten selected tokens are near-minimal pairs (Li-Naaier & Wang 2026).⁹



Regarding the categorical change of tone /24/, this process is closely linked to the emergence of the six grammatical tones. It is morpho-syntactically constrained, occurring primarily in the following contexts: **a)** in compound nouns denoting food, where the first component is /mak²⁴/ ‘fruit’, and **b)** in negative phrases, where the negator /bǎw²⁴/ ‘NEG’ precedes and modifies another morpheme.

This rule was originally reported by Fù et al. (1955), though without concrete examples. Table 5 illustrates the rule using data from my own fieldwork.

⁹ The acoustic analyses presented in this paper (i.e., Figures 1 and 2) are drawn from another study. Readers may consult the associated [OSF repository](https://osf.io/4sghc/overview) (https://osf.io/4sghc/overview) of that study for access to the relevant data and code.

Table 5. Tonal and segmental alternations related to /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’ in XSBN Tai Lue (rule after Fù et al. 1955:44)

Context	Underlying pattern		Surface forms	Gloss
	1st syllable	lexical tone of the 2nd syllable		
1. /mak ²⁴ / ‘fruit’ + morpheme	/mak ²⁴ /	55	[mak ²⁴ xam ⁵⁵] / [m̩ ²⁴ xam ⁵⁵]	‘tamarind’
		42	[mak ²⁴ fɿŋ ⁴²] / [m̩ ²⁴ fɿŋ ⁴²]	‘starfruit’
		24	[mak ⁵⁵ lot ²⁴] / [m̩ ⁵⁵ lot ²⁴]	‘Elaeagnus conferta’
		44	[mak ⁵⁵ moŋ ⁴⁴] / [m̩ ⁵⁵ moŋ ⁴⁴]	‘mango’
		213	[mak ⁵⁵ kɔ ²¹³] / [m̩ ⁵⁵ kɔ ²¹³]	‘pear’
		22	[mak ⁵⁵ paw ²²] / [m̩ ⁵⁵ paw ²²]	‘coconut’
2. /bǎw ²⁴ / ‘NEG’ + morpheme	/bǎw ²⁴ /	55	[bǎw ²⁴ ha ⁵⁵] / [m̩ ²⁴ ha ⁵⁵]	‘not look for’
		42	[bǎw ²⁴ mi ⁴²] / [m̩ ²⁴ mi ⁴²]	‘not have’
		24	[bǎw ⁵⁵ mi ²⁴] / [m̩ ⁵⁵ mi ²⁴]	‘not stir’
		44	[bǎw ⁵⁵ wa ⁴⁴] / [m̩ ⁵⁵ wa ⁴⁴]	‘not say’
		213	[bǎw ⁵⁵ xa ²¹³] / [m̩ ⁵⁵ xa ²¹³]	‘not kill’
		22	[bǎw ⁵⁵ hu ²²] / [m̩ ⁵⁵ hu ²²]	‘not know’

Both /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’ can be reduced to the syllabic nasal [m̩]. Moreover, whether segmentally reduced or not, these two morphemes change their tonal realization between [24] and [55], depending on the following tone: their tonal realization is [24] before /55/ and /42/, and [55] before the remaining four lexical tones, namely /24/, /44/, /213/, /22/.¹⁰

Note that Li (2022:145–178) identified six previously undescribed contours whose contexts of use perfectly overlaps with those of the categorical change of tone /24/. Li-Naaijer & Wang (2026) further developed Li’s analysis and incorporated detailed acoustic evidence to demonstrate the contrast between the six lexical tones and the six grammatical tones. In the next section, I summarize the major findings of Li (2022:145–178) and Li-Naaijer & Wang (2026) to provide a succinct overview of the phenomenon under investigation.

3.3 Grammatical tones

The six recently uncovered contours in XSBN Tai Lue—[25], [242], [535], [54], [523], and [52]—are grammatical in the sense that their usage is primarily confined to specific morphosyntactic contexts, namely food compound nouns whose first component is /mak²⁴/ ‘fruit’, and negative constructions in which /bǎw²⁴/ ‘NEG’ modifies another morpheme. Crucially, within these two contexts, three patterns of tonal and segmental variation are consistently observed. Taken together, these interrelated patterns shed light on the origin and development of the six grammatical tones.

For the purposes of the present study, the variation patterns shown in Table 6 have been simplified: details not essential to demonstrating the core mechanism underlying the formation of grammatical tones in XSBN Tai Lue have been omitted. For a comprehensive account of these variation patterns and their implications, see Li (2022:145–178) and Li-Naaijer & Wang (2026). Audio files corresponding to each form in the first context can be found in [the OSF repository associated with the present paper](#). Note that monosyllabic forms were

¹⁰ For a detailed discussion of the possible motivations for this tonal alternation from both a diachronic and a synchronic perspective, see Hartmann (1979:99–100).

pronounced by speaker F2 (aged 23 in 2018, the year of recording), whereas disyllabic¹¹ and reduced disyllabic forms were pronounced by speaker M5 (aged 84 in 2018).

Table 6. Tonal and segmental alternations related to /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’ in XSBN Tai Lue, modified from Li (2022:145–178) and Li-Naaijer & Wang (2026)

Context	Lexical tone of the 2nd syllable	Formal speech	Colloquial speech		Meaning
		Disyllabic pattern (canonical)	Reduced disyllabic pattern (traditional)	Monosyllabic pattern (innovative)	
1. /mak ²⁴ / ‘fruit’ + morpheme	55	/mak ²⁴ .xam ⁵⁵ /	[m ²⁴ .xam ⁵⁵]	[xam ²⁵]	‘tamarind’
	42	/mak ²⁴ .fɿŋ ⁴² / [mak ²⁴ .fɿŋ ⁵³]	[m ²⁴ .fɿŋ ⁵³]	[fɿŋ ²⁴²]	‘starfruit’
	24	/mak ²⁴ .lot ²⁴ /	[m ⁵⁵ .lot ²⁴]	[lot ⁵³⁵]	‘Elaeagnus conferta’
	44	/mak ²⁴ .moŋ ⁴⁴ /	[m ⁵⁵ .moŋ ⁴⁴]	[moŋ ⁵⁴]	‘mango’
	213	/mak ²⁴ .kɔ ²¹³ /	[m ⁵⁵ .kɔ ²¹³]	[kɔ ⁵²³]	‘pear’
	22	/mak ²⁴ .paw ²² /	[m ⁵⁵ .paw ²²]	[paw ⁵²]	‘coconut’
2. /bǎw ²⁴ / ‘NEG’ + morpheme	55	/bǎw ²⁴ .ha ⁵⁵ /	[m ²⁴ .ha ⁵⁵]	[ha ²⁵]	‘not look for’
	42	/bǎw ²⁴ .mi ⁴² / [bǎw ²⁴ .mi ⁵³]	[m ²⁴ .mi ⁵³]	[mi ²⁴²]	‘not have’
	24	/bǎw ²⁴ .mi ²⁴ /	[m ⁵⁵ .mi ²⁴]	[mi ⁵³⁵]	‘not stir’
	44	/bǎw ²⁴ .wa ⁴⁴ /	[m ⁵⁵ .wa ⁴⁴]	[wa ⁵⁴]	‘not say’
	213	/bǎw ²⁴ .xa ²¹³ /	[m ⁵⁵ .xa ²¹³]	[xa ⁵²³]	‘not kill’
	22	/bǎw ²⁴ .hu ²² /	[m ⁵⁵ .hu ²²]	[hu ⁵²]	‘not know’

Each fruit name in context (1) and each negative phrase in context (2) can be realized in three different ways, which vary in both syllabic structure and tone. The distribution of these patterns is conditioned by speaker age and language register, offering insights into the emergence of the six grammatical tones.

More specifically, both reduced disyllabic and monosyllabic patterns are attested in colloquial speech, with a clear age-based distribution. Consultants under the age of 50 exclusively use monosyllabic forms, whereas consultants over 50 retain partial knowledge of both reduced disyllabic and monosyllabic forms.¹² In other words, monosyllabic forms predominate among consultants under 50, while reduced disyllabic forms are confined to consultants over 50.

It is worth noting that both reduced disyllabic and disyllabic patterns were already reported by Fù et al. (1955), although minor tonal discrepancies between their data and those presented in Table 6 are attested in the disyllabic pattern.¹³ The age-correlated distribution of reduced syllabic forms among older speakers, together with their early documentation, suggests that this pattern should be regarded as traditional. By

¹¹ For ease of presentation, only disyllabic forms are given here. In polysyllabic forms with three or more syllables, tonal and segmental variations consistently affect the first two syllables (e.g., /mak²⁴xam⁵⁵pɔm²¹³/, [m²⁴xam⁵⁵pɔm²¹³], [xam²⁵pɔm²¹³] ‘olive’).

¹² Twelve native speakers of XSBN Tai Lue were consulted in the original study. For further details on the data collection procedures underlying Table 6, see Li-Naaijer & Wang (2026).

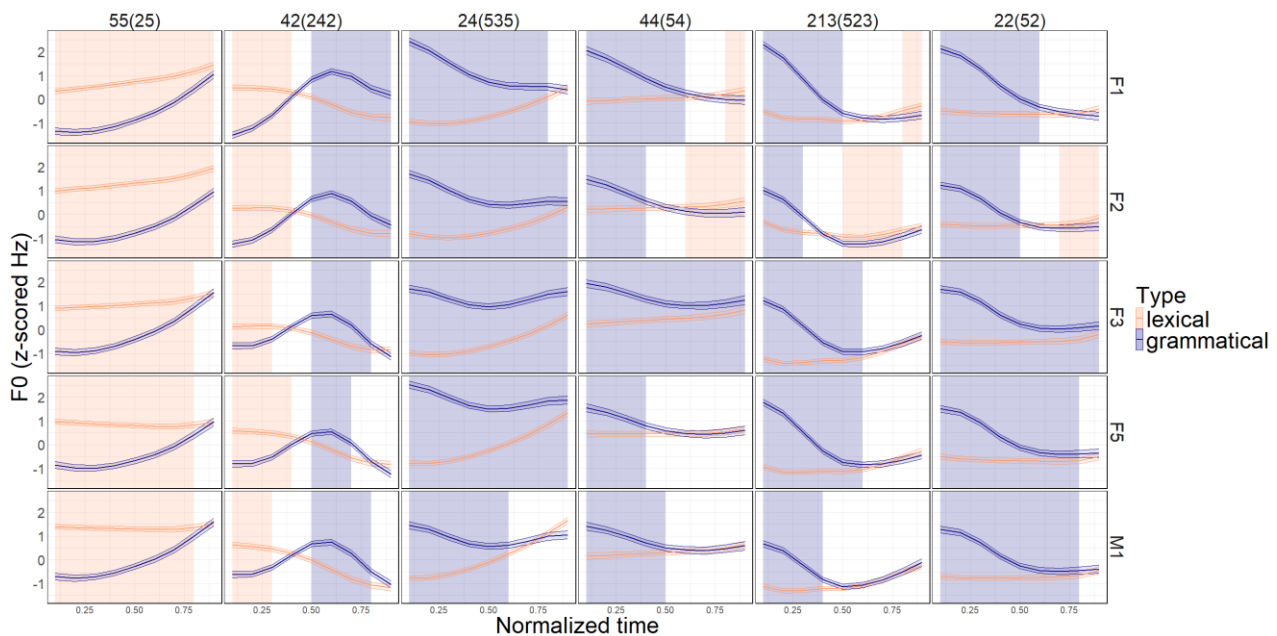
¹³ According to Fù et al. (1955), /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’, whether reduced or not, exhibit tonal alternation between [24] and [55]. By contrast, the data presented in Table 6 show that this alternation is only restricted to reduced disyllabic forms. This discrepancy can be explained by the declining use of the disyllabic pattern in contemporary Tai Lue, as most speakers now rely on Southwestern Mandarin or Standard Mandarin in formal register. For further discussion of this issue, see Li-Naaijer & Wang (2026).

contrast, the monosyllabic pattern can be characterized as innovative, as it is predominantly observed among younger speakers. The disyllabic pattern is considered canonical, not only because it is used in formal speech across all age groups, but also because it is the form recorded in the *Tai Lue-Chinese Dictionary* (Yù & Luó 2004).

Crucially, lexical tones are observed in disyllabic and reduced disyllabic forms, whereas grammatical tones occur in monosyllabic forms. In other words, lexical tones surface only when the segmental material of /mak²⁴/ ‘fruit’ or /bǎw²⁴/ ‘NEG’ is retained. This systematic correlation between tone type and syllabic structure indicates that, in XSBN Tai Lue, the emergence of grammatical tones is closely linked to the segmental deletion of /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’. Once the segmental material is lost, the lexical tone it originally bore is preserved due to the stability effect; it subsequently reassociates with the following syllable and fuses with that syllable’s lexical tone, yielding a new tonal contour.

Figure 2 presents a Generalized Additive Model (GAM) analysis highlighting the contrast between lexical and grammatical tones in XSBN Tai Lue.

Figure 2: GAM predicted *f*₀ trajectories (z-scored by speaker) as a function of normalized time and tone type. Shaded regions indicate time intervals in which differences between lexical and grammatical tones are statistically significant. The data are aggregated from five speakers (M1, F1, F2, F3, F5).¹⁴ Of the 120 tokens selected for acoustic analysis, 85 carry lexical tones and 35 carry grammatical tones (Li-Naijier & Wang 2026).



An examination of the phonetic properties of the six grammatical tones reveals that tonal fusion is based on the tonal realization of the reduced disyllabic pattern, rather than that of the disyllabic pattern. In the former, the reduced syllable [m̩] ‘fruit; NEG’ alternates in tonal realization between [24] and [55], depending on the lexical tone of the following syllable. By contrast, in the latter, the full syllables [mak] and [bǎw] consistently bear tone [24]. This underlying constraint is reflected in the formation of the grammatical tones [535], [54], [523], and [52]. More specifically, all four contours begin at pitch level 5 because they result from the fusion of the alternated tone [55] carried by the reduced syllable [m̩] ‘fruit; NEG’ and the lexical tone of the following syllable. If tonal fusion were instead based on the tonal realization of the disyllabic pattern—where the lexical tone of the full syllables [mak] ‘fruit’ and [bǎw] ‘NEG’ remains [24]—the onsets of these four grammatical tones would not be as high.

Beyond governing the tonal mapping of the fusion process, the central role of the reduced disyllabic pattern in the development of XSBN Tai Lue grammatical tones is further supported by articulatory considerations: syllabic reduction is an expected step preceding syllabic deletion. Prior to the complete segmental deletion of /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’, their full forms (i.e., [mak] and [bǎw]) are first reduced

¹⁴ All speakers were born in and raised in Jinghong city (seat of Xishuangbanna prefecture) and its suburbs.

to the syllabic nasal [m̩] in colloquial speech. This transitional pathway underscores the significance of the reduced disyllabic pattern. Consequently, investigations of stability-induced tonal fusion in Southwestern Tai languages should begin by examining the comparable use of the syllabic nasal *m̩* across this branch.

Finally, note that when the syllable following /mak²⁴/ ‘fruit’ or /bǎw²⁴/ ‘NEG’ has lexical tone /42/, this tone first changes to [53] due to the allotonic variation process presented in Table 4 in and then fuses with lexical tone /24/ initially carried by /mak²⁴/ ‘fruit’ or /bǎw²⁴/ ‘NEG’ (see data highlighted in green in Table 6). Thus, two distinct tonal processes are involved in this specific context: allotonic variation and tonal fusion.

3.4 Phonological status of grammatical tones

At the current stage, the six grammatical tones of XSBN Tai Lue reflect an ongoing sound change, as relevant items continue to exhibit two coexisting variants in the casual speech of the same speakers: those aged 50 and above typically display mixed usage, alternating between the reduced disyllabic pattern and the monosyllabic pattern (e.g., [m̩²⁴xam⁵⁵] or [xam²⁵] ‘tamarind’; [m̩²⁴ha⁵⁵] or [ha²⁵] ‘not look for’). Table 7 summarizes the successive stages of development leading to the formation of the six grammatical tones in XSBN Tai Lue, with the original lexical tones and their derived grammatical counterparts highlighted in bold.

Table 7. Synchronic derivational processes of the six grammatical tones in XSBN Tai Lue, modified from Li (2022:145–178) and Li-Naaier & Wang (2026)

Initial stage	Intermediate stage (syllabic reduction, tonal alternation)	Final stage (syllabic loss, tonal stability, tonal fusion)	Meaning	Tonal operations
/mak ²⁴ .xam ⁵⁵ /	[m̩ ²⁴ .xam ⁵⁵]	[xam ²⁵]	‘tamarind’	24+55 → 25
/bǎw ²⁴ .ha ⁵⁵ /	[m̩ ²⁴ .ha ⁵⁵]	[ha ²⁵]	‘not look for’	
/mak ²⁴ .fɿŋ ⁴² / [mak ²⁴ .fɿŋ ⁵³]	[m̩ ²⁴ .fɿŋ ⁵³]	[fɿŋ ²⁴²]	‘starfruit’	24+42 → 24+53 → 242
/bǎw ²⁴ .mi ⁴² / [bǎw ²⁴ .mi ⁵³]	[m̩ ²⁴ .mi ⁵³]	[mi ²⁴²]	‘not have’	
/mak ²⁴ .lot ²⁴ /	[m̩ ⁵⁵ .lot ²⁴]	[lot ⁵³⁵]	‘Elaeagnus conferta’	55+24 → 535
/bǎw ²⁴ .mi ²⁴ /	[m̩ ⁵⁵ .mi ²⁴]	[mi ⁵³⁵]	‘not stir’	
/mak ²⁴ .moŋ ⁴⁴ /	[m̩ ⁵⁵ .moŋ ⁴⁴]	[moŋ ⁵⁴]	‘mango’	55+44 → 54
/bǎw ²⁴ .wa ⁴⁴ /	[m̩ ⁵⁵ .wa ⁴⁴]	[wa ⁵⁴]	‘not say’	
/mak ²⁴ .kɔ ²¹³ /	[m̩ ⁵⁵ .kɔ ²¹³]	[kɔ ⁵²³]	‘pear’	55+213 → 523
/bǎw ²⁴ .xa ²¹³ /	[m̩ ⁵⁵ .xa ²¹³]	[xa ⁵²³]	‘not kill’	
/mak ²⁴ .paw ²² /	[m̩ ⁵⁵ .paw ²²]	[paw ⁵²]	‘coconut’	55+22 → 52
/bǎw ²⁴ .hu ²² /	[m̩ ⁵⁵ .hu ²²]	[hu ⁵²]	‘not know’	

It is also important to note that, in casual speech, speakers younger than 50 use exclusively the monosyllabic pattern and never the reduced disyllabic one. The latter, which represents an intermediate stage in the formation of the six grammatical tones, is now attested only among speakers aged 50 and above. This apparent-time distribution indicates that reduced disyllabic forms are expected to be progressively replaced by monosyllabic ones. As a consequence, the derivational processes underlying the six grammatical tones are likely to become increasingly opaque, since tonal fusion is grounded in the tonal realization of the reduced disyllabic pattern rather than that of the disyllabic pattern.

Accordingly, although these newly formed contours have not yet been fully phonologized across all XSBN Tai Lue speakers, their systematic use in casual register by speakers under the age of 50 suggests that phonologization has likely run its full course within this age group. Further support for this hypothesis comes

from the formal speech of the same speakers, in which the lexical tone of the second syllable in food compounds has been replaced by the corresponding grammatical tone. Indeed, when younger consultants are prompted to add /mak²⁴/ ‘fruit’ to monosyllabic forms in order to produce disyllabic equivalents, they are no longer able to recover the original lexical tone of the second syllable.

Table 8 presents the two disyllabic food-compound patterns observed across speakers. Audio recordings illustrating both patterns are available in the [OSF repository associated with the present paper](#). Forms in the first column were pronounced by speaker M5 (aged 84 in 2018), while those in the second one were pronounced by speaker F2 (aged 23 in 2018).

Table 8. Variation of /mak²⁴/ ‘fruit’ + morpheme in formal speech

Disyllabic pattern (consultants aged 50 and over)	Disyllabic pattern (consultants aged under 50)	Meaning
/mak ²⁴ .xam ⁵⁵ /	/mak ²⁴ .xam ²⁵ /	‘tamarind’
/mak ²⁴ .fɿŋ ⁴² /	/mak ²⁴ .fɿŋ ²⁴² /	‘starfruit’
/mak ²⁴ .lot ²⁴ /	/mak ²⁴ .lot ⁵³⁵ /	‘Elaeagnus conferta’
/mak ²⁴ .moŋ ⁴⁴ /	/mak ²⁴ .moŋ ⁵⁴ /	‘mango’
/mak ²⁴ .ko ²¹³ /	/mak ²⁴ .ko ⁵²³ /	‘pear’
/mak ²⁴ .paw ²² /	/mak ²⁴ .paw ⁵² /	‘coconut’

This tonal reinterpretation is absent in negative phrases /bǎw²⁴/ ‘NEG’ + morpheme among consultants under the age of 50. This asymmetry is most plausibly attributable to morphosyntactic differences between the two constructions. More specifically, for a morpheme that bears a grammatical tone marking negation, speakers are expected to readily recover the lexical tone of the morpheme by recalling its tonal realization in non-negative context. For example, the form [pi²⁴²] ‘NEG.be fat’ will never be reconstructed in formal speech as [bǎw²⁴.pi²⁴²], but rather as /bǎw²⁴.pi⁴²/, since the lexical tone /42/ is consistently used when /pi⁴²/ ‘be fat’ occurs outside a negative context. This follows from the fact that the relationship between a lexical tone and its derived grammatical counterpart is semantically transparent, as seen in minimal pairs such as /pi⁴²/ ‘be fat’ vs. [pi²⁴²] ‘NEG.be fat’. Crucially, in this construction, the six grammatical tones function as tonal morphemes encoding negation, since their presence alone suffices to mark polarity (positive vs. negative).

By contrast, in the compounding structure /mak²⁴/ ‘fruit’ + morpheme, the second syllable either does not occur independently of /mak²⁴/ ‘fruit’ (e.g., *[xam⁵⁵] in /mak²⁴.xam⁵⁵/ ‘tamarind’ is unattested in contemporary XSBN Tai Lue), or it conveys a meaning that is not synchronically relatable to that of the compound (e.g., /fɿŋ⁴²/ ‘straw (material)’ vs. /mak²⁴.fɿŋ⁴²/ ‘starfruit’). As a result, speakers lack access to a recoverable lexical tone for the second syllable in this construction, creating favorable conditions for tonal reinterpretation among younger generations. From a diachronic perspective, one may expect a stage at which in formal speech, the construction /mak²⁴/ ‘fruit’ + morpheme is uniformly realized with grammatical tone on the second syllable across all XSBN Tai Lue speakers. In this context, the six grammatical tones do not function as a syntactic device, as they do in negation, but rather as a morphosyntactic vestige of the reduced disyllabic pattern—more specifically, of the deleted syllabic nasal [m] ‘fruit’.

In summary, given the presence of synchronic variation in relevant morphosyntactic contexts, together with age- and register- conditioned distributions of this variation, as well as the existence of minimal pairs such as /pi⁴²/ ‘be fat’ vs. [pi²⁴²] ‘NEG.be fat’ and /fɿŋ⁴²/ ‘straw (material)’ vs. [fɿŋ²⁴²] ‘starfruit’, one plausible outcome of this sound change is a doubling of the tonal inventory in XSBN Tai Lue. That is, the language may be transitioning from a system with six tonal categories to one with twelve. This hypothesis remains to be tested through subsequent perceptual experiments and longitudinal follow-up studies. For the purposes of the present paper, I now turn to an examination of whether comparable sound changes can be observed in other Southwestern Tai languages.

4 Data collection procedure and participants

Data from LP Tai Lue, Northern Thai and Central Thai were collected between May and December 2023.¹⁵ Northern Thai and Central Thai participants were recorded in a sound-attenuating booth at the Institute of Linguistics, Academia Sinica, using a Zoom H4n Pro Handy Recorder (sampling rate: 16-bit/44.1 KHz; .wav files) and an AKG C4000B condenser microphone.

Data from LP Tai Lue were collected remotely via *Zoom* video conferencing software (version 5.16.2; .mp4 files). Previous research demonstrates that fundamental frequency (F0)—the primary acoustic cue for tone—is relatively robust and unaffected by the file format and recording device (e.g., professional recorders, laptops, and smartphones). It is worth noting, however, that in most of these studies, the materials consisted only of pure tones¹⁶ rather than lexical tones (cf. Uloza et al. 2015; Grillo et al. 2016; Maryn et al. 2017; Jannetts et al. 2019; Zhang et al. 2021). Nonetheless, two studies (Ge, Xiong & Mok 2021; Guan & Li 2021) specifically tested the reliability of remotely collected data for phonetic tonal analysis using materials from Mandarin Chinese. The choice of *Zoom* is justified by its good performance in sound quality, stability across varying internet conditions, and reliability in capturing F0 tracks (cf. Freeman & De Decker 2021; Ge, Xiong & Mok 2021; Guan & Li 2021; Williams et al. 2021; Zhang et al. 2021). Furthermore, to maximize the recording quality, both the consultants and I used laptops instead of smartphones, and recordings were made locally rather than saved to the cloud.

Findings on LP Tai Lue, Northern Thai and Central Thai are based on data from six native speakers—two per language (Table 9). The LP Tai Lue speakers have lived in their place of birth throughout their lives, while the Northern Thai and Central Thai speakers lived in their respective homeland before coming to Taiwan one to two years prior to the recordings. The average age of the consultants was 31.5 years. Controlling for age is important, as the innovative monosyllabic pattern in XSBN Tai Lue is predominantly attested among speakers in their 40s and younger.

Table 9. Sociolinguistic profiles of the speakers consulted in this study

Targeted language	Speaker	Year of birth	Place of birth	Other languages spoken
LP Tai Lue	F12	1986	Lampang, Thailand	Northern Thai; Central Thai
	F14	1988	Lampang, Thailand	Northern Thai; Central Thai
Northern Thai	F1	1995	Chiang Mai, Thailand	Central Thai; English
	F11	1994	Chiang Mai, Thailand	Central Thai; English
Central Thai	F5	1994	Bangkok, Thailand	English, Mandarin Chinese
	F7	1992	Bangkok, Thailand	English, Mandarin Chinese

The data collection focused on: **a)** food compound nouns whose first component is derived from the Proto-Tai etymon **mak^{DIL}* ‘fruit’, as reconstructed by Li (1977:75); and **b)** negative sentences in which the negator is derived from the Proto-Tai etymons **bǎw^B* ‘NEG’ or **mǐ* ‘NEG’, as reconstructed by Pittayaporn et al. (2014).¹⁷ These two morphosyntactic contexts are not only where XSBN Tai Lue’s grammatical tones are primarily attested but also where the syllabic nasal *m̩* has been reported in other Tai languages.

The data collection proceeded as follows: **a)** elicitation of Gedney’s tone box checklist (1972) to identify the lexical tones of each language; **b)** elicitation of food nouns using corresponding food photos as stimuli;

¹⁵ All materials related to the first-hand data collected in this study—including the informed consent form, recruitment announcement, financial compensation details, linguistic and extralinguistic stimuli, and questionnaire—were approved by the Institutional Review Board (IRB) for Humanities and Social Science Research at Academia Sinica (IRB number: AS-IRB-HS 23012).

¹⁶ The term is used in these studies to denote F0 in non-tonal languages.

¹⁷ Pittayaporn et al. (2014) propose that Proto-Tai had three negators: **bǎw^B*, **mǐ*, and **pǎj^B*. The present paper focuses on **bǎw^B* and **mǐ* because, according to Pittayaporn et al., the negator realized as *m̩* is etymologically ambiguous: *m̩* is the modern reflex for both **b-* and **m-*, making it impossible to determine whether this form developed from **bǎw^B* or **mǐ*.

and c) elicitation of simple negative phrases and their affirmative counterparts. For each language studied, tonal transcription and classification were conducted with the assistance of a native speaker.

5 Results

This section presents Tai Phake data from secondary sources, alongside first-hand data from LP Tai Lue, Northern Thai, and Central Thai. For each variety, the results include the tonal inventory and examples relevant to the two morphosyntactic contexts under investigation. Although examples were carefully selected to facilitate cross-linguistic comparison, it is not always possible to provide identical ones across all varieties. Therefore, the primary criterion for example selection is to ensure that all lexical tones of each variety are represented.

5.1 Tai Phake

One of the most important works on Tai Phake is *Phake-Thai-English Dictionary* (Banchob 1987), a privately published resource to which I do not have access. However, many of its observations are summarized in Morey (2005). The Tai Phake data presented in this paper are primarily based on descriptions provided by Diller (1992) and Morey (2005; 2008; 2014).

5.1.1 Lexical tones

Table 10 shows the tonal split patterns of Tai Phake in the Gedney tone box format.

Table 10. Patterns of tonal splits and tonal distribution in Tai Phake, adapted from Morey (2014:644)

Proto-Tai tone Initials at the time of tonal splits	Smooth syllable			Checked syllable	
	*A	*B	*C	*DS	*DL
Voiceless friction sounds	tone 6	tone 1	tone 3	tone 1	
Voiceless unaspirated stops	tone 2				
Glottal sounds		tone 2	tone 5	tone 4	tone 4
Voiced sounds					

Table 11 presents the main characteristics of lexical tones in Tai Phake, which are defined not only by pitch but also by length and phonation.

Table 11. Lexical tones in Tai Phake, adapted from Morey (2014:645-47)¹⁸

No.	Tonal features	Tone numerals	Hz values	Phonation	Duration	Example
1	level	44	223-223	modal		/na ¹ / ‘quarrel’
2	high rising then falling	452	223-262-166	modal		/na ² / ‘rice field’
3	creaky	31	198-151	creaky	0’44’’	/na ³ / ‘face’
4	falling	31	193-155	modal	0’36’’	/na ⁴ / ‘mother’s younger sister’
5	low (falling) and long	31	196-163	modal	0’66’’	/na ⁵ / ‘melt away’
6	rising	35	195-289	modal		/na ⁶ / ‘thick’

5.1.2 Changed tones

Among the previous works consulted, only a few basic descriptions of food compound nouns with the etymon **mak*^{D1L} ‘fruit’ are available. For example, Morey (2005:229–230), citing Banchob (1987:302; 312), notes that *mak*¹ and *mă*¹ function as prefixes denoting fruits in Tai Phake. Two concrete examples include *mak*¹*moŋ*⁵ ‘mango’ (Morey 2005:334) and *mă*¹*khə*⁶ ‘eggplant’ (Morey 2008:219). Due to the limited data, this specific morphosyntactic context is not considered for Tai Phake in the present study.

However, Tai Phake exhibits what Morey refers to as “changed tones” (2005; 2008), which involve tonal alternations in negatives, questions and imperatives. This paper examines the first two of these contexts. The negative tone is included due to its contextual relevance, while the questioning tone is noteworthy both for illustrating tonal stability in Tai Phake and for clarifying the redundancy issue of the negative tone.

5.1.2.1 Negative tone

Based on data from Morey (2005), Pittayaporn et al. (2014:178) reconstruct that the Tai Phake negators *mău*¹ ‘NEG’ and *mă*¹ ‘NEG’ are derived from **băw*^B ‘NEG’.¹⁹ Importantly, Morey (2005; 2008) reports that in this language, some verbs—typically those with tone 2—are pronounced with tone 6 when negated, as illustrated in example (4).

- (4) Tai Phake
*kon*² *yăŋ*² *hən*² *mă*¹ *yăŋ*⁶
 person be house NEG NEG.be Adapted from Morey (2005:131),
 ‘There are people but no houses.’ emphasis added

In (4), *yăŋ*² ‘to be’ and *yăŋ*⁶ ‘to be. NEG’ differ in their tonal realization. This example also shows that the negative tone in Tai Phake is redundant, functioning as a tonal alternation that typically appears on a verb already modified by the negator *mă*¹ ‘NEG’. By contrast, this is not the case in XSBN Tai Lue, where a grammatical tone used in negation allows speakers to switch—through a single tonal change—from the positive form of any morpheme that the negator *băw*²⁴ ‘NEG’ can modify to its negative counterpart (see example 5).

- (5) Tai Lue
*muŋ*⁴² *tsaŋ*⁴⁴ *tsaŋ*⁵⁴ *pak*²⁴ *kăm*⁴²*hɔ*²¹³
 2SG can NEG.can speak Chinese
 ‘Can you speak Chinese or not?’ Adapted from Li (2022:480)

¹⁸ Morey did not specify the exact duration of tones 1, 2 and 6.

¹⁹ *mău*¹ ‘NEG’ is the form used in writing (Morey 2005:355).

However, Tai Phake presents an exception in written texts,²⁰ where the stative verb *yǎŋ*² ‘be/have’ can, depending on the pragmatic context, be interpreted as carrying the negative tone (i.e., *yǎŋ*⁶ ‘be/have.NEG’) without being modified by *mǎ*¹ ‘NEG’ (see example 6; the preferred reading is in bold).²¹ In this rare case, the negative tone in Tai Phake is not redundant.

- (6) Tai Phake
*yǎŋ*⁶/*yǎŋ*² *nǎi*³ *yu*¹ *sǎu*² *hüŋ*⁶
 NEG.have get live.at stay long.in.time Adapted from Morey (2008:239),
 ‘(I) will not get time to remain here for a long time.’ emphasis added

Note that the negative tone described by Morey (2005; 2008) is essentially the same as the “*morphophonemic tone sandhi rule*” described by Diller (1992:19) (see data not highlighted in grey in Table 12).²² Specifically, the tonal change—an alternation to tone 6—typically targets verbs carrying tone 2. This change is redundant, given the obligatory presence of the negative marker *mǎw*¹ ‘NEG’. However, there are two cases where the lexical tone of the negated verb is not tone 2, but tone 1 and tone 3, respectively (see data highlighted in grey in Table 12).

Table 12. Tonal and segmental alternations in negation in Tai Phake, based on data aggregated from Diller (1992:19) and Morey (2005; 2008)

Diller (1992:19)				Morey (2005; 2008)				
Verb	Meaning	Negated form		Meaning	Verb	Meaning	Negated form	Meaning
ma ²	‘come’	mǎw ¹ ma ²	ṃ-ma ⁶	‘not come’	kǐn ²	‘eat’	mǎ ¹ kǐn ⁶	‘not eat’
yǎŋ ²	‘be’	mǎw ¹ yǎŋ ²	ṃ-yǎŋ ⁶	‘not be’	yǎŋ ²	‘be’	mǎ ¹ yǎŋ ⁶	‘not be’
ya ²	treat’	mǎw ¹ ya ²	ṃ-ya ⁶	‘not treat’	yam ²	‘wet’	mǎ ¹ yam ⁶	‘not wet’
mi ²	‘have’	mǎw ¹ mi ²	ṃ-mi ⁶	‘not have’	tɔ ²	‘weave’	mǎ ¹ tɔ ⁶	‘not weave’
					ka ¹	‘go’	mǎ ¹ ka ⁶	‘not go’
					hǎü ³	‘give’	mǎ ¹ hǎü ⁶	‘not give’

Morey suggests that the sporadic application of the negative tone to verbs with tones other than tone 2 may indicate an ongoing process in Tai Phake. By contrast, in Tai Lue—whether in a food compound noun with /mak²⁴/ ‘fruit’ or a negative sentence with /bǎw²⁴/ ‘NEG’—all six lexical tones are involved both in the tonal alternation of the reduced disyllabic pattern (i.e., when /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’ are reduced to the syllabic nasal [ṃ^{24/55}]) and in the tonal fusion of the monosyllabic pattern (i.e., when the segmental material of [ṃ^{24/55}] ‘fruit; NEG’ is dropped).

An important observation by Diller (1992:19) is that tonal alternation in Tai Phake occurs only when the full form of the negator *mǎw*¹ ‘NEG’ is reduced to the syllabic nasal *ṃ*. This distributional constraint is reminiscent of XSBN Tai Lue grammatical tones, where tonal alternation is attested in the reduced disyllabic pattern but not in the unreduced disyllabic one. Although Morey (2005; 2008) does not explicitly state a comparable restriction, it is noteworthy that tonal alternation is likewise not reported when the negator appears in its full form, transcribed as *mǎu*¹ ‘NEG’.

Moreover, Morey kindly provided me with the electronic version of *The Tai languages of Assam—a grammar and texts* (2005), which includes audio recordings of many of the examples presented in the book. I examined all available recordings containing the Tai Phake negators, namely *mǎu*¹ and *mǎ*¹ ‘NEG’. On the basis of this auditory inspection, *mǎ*¹ ‘NEG’ is frequently reduced to [mɤ¹] and [ṃ¹]. Taken together, the evidence

²⁰ Tones are unmarked in the Tai Phake script. For more details, see Morey (2005:199–201).

²¹ To better understand the context in which this sentence appears, it is helpful to know that it comes from the Tai Phake manuscript *Grandfather Teaches Grandchildren* (Morey 2008:239).

²² For ease of comparison, the tone numbering in Diller (1992) has been converted to match that in Morey (2005; 2008; 2014).

from XSBN Tai Lue and Tai Phake suggests that syllabic reduction creates an environment conducive to tonal alternation, at least in the context of negation.

5.1.2.2 Questioning tone

In Tai Phake, the standard way to ask a polar question is by using the sentence-final particle *nɔ̃⁶* ‘Q’, as shown in (7a), which is a reproduced example of (3a).

- (7) Tai Phake
 a. *kĩn² ni² nɔ̃⁶*
 eat good Q
 ‘Is it good to eat?’ Adapted from Morey (2008:236), emphasis added

Speakers can also express the same meaning without adding *nɔ̃⁶* ‘Q’. In this context, the questioning tone—transcribed as tone 7—appears and has a rising-falling contour in (7b), which is a reproduced example of (3b).

- b. *phăk¹ năi³ kĩn² ni⁷*
 vegetable/dish PROX eat good.Q
 ‘Is this dish good to eat?’ Adapted from Morey (2008:236), emphasis added

Morey (2005; 2008) suggests that the questioning tone—used only in the absence of the question particle *nɔ̃⁶* ‘Q’—may result from a fusion of the tone preceding *nɔ̃⁶* ‘Q’ and the tone of *nɔ̃⁶* ‘Q’. In other words, the questioning tone may originate from the loss of segmental—rather than tonal—material associated with *nɔ̃⁶* ‘Q’. This behavior demonstrates the presence of tonal stability in Tai Phake.

Note that, in contrast to XSBN Tai Lue—where the six grammatical tones have six different pitch contours corresponding to their six underlying lexical counterparts—Tai Phake’s questioning tone has only two phonetic realizations, depending on the tone of the syllable preceding *nɔ̃⁶* ‘Q’ (see Table 13). Specifically, when this syllable carries lexical tone 1, the questioning tone is phonetically identical to lexical tone 6 (i.e., a rising tone).²³ When the syllable carries lexical tone 2 or 6, the questioning tone is pronounced with a rising-falling contour.

Table 13. Tonal patterns of the questioning tone in Tai Phake, modified from Morey (2008:236)²⁴

	Tonal pattern	Phonetic description	Example	Meaning
(a)	1 + 6 → 7(6)	[44] + [35] → [35]	ka ¹ + nɔ̃ ⁶ → ka ⁷⁽⁶⁾	‘go.Q’
(b)	2 + 6 → 7	[452] + [35] → [rising-falling]	ni ² + nɔ̃ ⁶ → ni ⁷	‘good.Q’
(c)	6 + 6 → 7	[35] + [35] → [rising-falling]	hăn ⁶ + nɔ̃ ⁶ → hăn ⁷	‘see.Q’

From a phonetic perspective, the rising-falling contour of the questioning tone in patterns (b) and (c) suggests a possible fusion between the tone of the syllable preceding *nɔ̃⁶* ‘Q’ and the onset of tone 6 carried by *nɔ̃⁶* ‘Q’. Specifically, this fusion may have occurred between [452] and [3] of [35], as well as between [35] and [3] of [35]. Nevertheless, it is unlikely that the same phonetic process applies to pattern (a). This pattern is nonetheless instructive, as the rising questioning tone shares the same phonetic realization as the negative tone when the verb modified by the negator has lexical tone 1 (see data highlighted in green in Table 14).

Table 14 summarizes the tonal patterns of these two types of grammatical tones observed in Tai Phake. The underlying lexical tone of the TBU that carries the negative or questioning tone is indicated in bold.

²³ In this case, Morey (2005; 2008) transcribes the questioning tone as tone 6. In the present paper, the questioning tone is always transcribed as tone 7 to emphasize its grammatical function by numerically distinguishing it from lexical tone 6. When its phonetic realization is identical to tone 6, this will be indicated in parentheses, as shown in Tables 13 and 14.

²⁴ According to Morey (2008), tone 2 ([452]) and the rising-falling questioning tone are phonetically distinct, with the latter exhibiting a more pronounced rise.

Table 14. Tonal patterns of the negative tone and questioning tone in Tai Phake, based on data aggregated from Morey (2005; 2008)

Negative tone				Questioning tone			
Tonal pattern	Tone numerals	Example	Meaning	Tonal pattern	Tone numerals	Example	Meaning
1 + 1 → 6	44 + 44 → 35	mǎ ¹ + ka ¹ → mǎ ¹ ka ⁶	‘not go’	1 + 6 → 7(6)	44 + 35 → 35	ka ¹ + nɔ ⁶ → ka ⁷⁽⁶⁾	‘GO.Q’
1 + 2 → 6	44 + 452 → 35	mǎ ¹ + yǎŋ ² → mǎ ¹ yǎŋ ⁶	‘not be’	2 + 6 → 7	452 + 35 → rising-falling	ni ² + nɔ ⁶ → ni ⁷	‘good.Q’
1 + 3 → 6	44 + 31 → 35	mǎ ¹ + hǎü ³ → mǎ ¹ hǎü ⁶	‘not give’	6 + 6 → 7	35 + 35 → rising-falling	hǎn ⁶ + nɔ ⁶ → hǎn ⁷	‘see.Q’

In the green row of Table 14, the syllable *ka* in negative and interrogative²⁵ contexts results in the same contour, which is phonetically identical to lexical tone 6. In this case, the redundancy arising from the coexistence of the negator *mǎ¹* ‘NEG’ and the negative tone can be considered superficial. This apparent redundancy plays a functional role by distinguishing the questioning tone from the negative tone when the TBU in both cases has the underlying lexical tone 1. Additional support for this interpretation comes from the only example (see [example 6](#)) where the negative tone appears without *mǎ¹* ‘NEG’ in written text; in that instance, the TBU carries the underlying lexical tone 2, not tone 1. Therefore, the superficial redundancy of the negator *mǎ¹* ‘NEG’ provides a structural explanation for why Tai Phake does not undergo stability-induced tonal fusion in negation, whereas similar process is observed in the questioning tone.

5.2 LP Tai Lue

5.2.1 Lexical tones

LP Tai Lue has six lexical tones (Table 15). Tone /55/, which occurs only in checked syllables, lacks a phonetically similar counterpart in smooth syllables. This tonal distribution differs from that of the other four Tai varieties examined in this paper, in which all tones found in checked syllables have phonetically similar equivalents in smooth syllables.

Table 15. Patterns of tonal splits and tonal distribution in LP Tai Lue

Proto-Tai tone	Smooth syllable			Checked syllable	
	*A	*B	*C	*DS	*DL
Initials at the time of tonal splits					
Voiceless friction sounds	35				
Voiceless unaspirated stops		22	31	55	22
Glottal sounds	41				
Voiced sounds		33	41	33	

5.2.2 Food compounds with *mak^{D1L} ‘fruit’ and negation with *bǎw^B or *mǐ ‘NEG’

As shown in Table 16, the syllabic nasal /m²²/, meaning ‘fruit’ or ‘NEG’ depending on context, constitutes the sole modern reflex in LP Tai Lue of the Proto-Tai etyma *mak^{D1L} ‘fruit’ and *bǎw^B (and/or *mǐ) ‘NEG’. Audio recordings of LP Tai Lue food compounds are available in [the OSF repository associated with this paper](#).

²⁵ In the interrogative context, Morey uses small capitals to gloss *ka⁶* ‘GO.Q’, indicating a certain degree of grammaticalization, as the word functions as a past tense marker. However, *ka⁶* ‘GO.Q’ is not glossed simply as past tense because it still retains its original meaning of ‘go’. For more information, see Morey (2005:326–327).

Table 16. Tonal alternation involving /m²²/ ‘fruit; NEG’ in LP Tai Lue

Context	Underlying pattern		Surface output	Meaning
	Form of the 1st syllable	Tone of the 2nd syllable		
/m ²² / ‘fruit’ + morpheme	/m ²² /	35	[m ²² xam ³⁵]	‘tamarind’
		41	[m²²fɿŋ⁵²]	‘starfruit’
		22	[m ²² lot ²²]	‘Elaeagnus conferta’
		33	[m ³⁵ moŋ ³³]	‘mango’
		31	[m ³⁵ tāw ³¹]	‘watermelon’
		55	[m ²² nat ⁵⁵]	‘pineapple’
/m ²² / ‘NEG’ + morpheme	/m ²² /	35	[m ²² ha ³⁵]	‘not look for’
		41	[m²²mi⁵²]	‘not have’
		22	[m ²² ju ²²]	‘not stay’
		33	[m ³⁵ ho ³³]	‘not leak’
		31	[m ³⁵ xa ³¹]	‘not kill’
		55	[m ²² tat ⁵⁵]	‘not cut’

In the contexts under investigation, LP Tai Lue exhibits a high degree of similarity with XSBN Tai Lue (see [Table 6](#)). The first shared feature is that the modern reflexes of both the generic term ‘fruit’ and the negator ‘NEG’ can be reduced to the syllabic nasal *m*. The second is that the syllabic nasal *m* ‘fruit; NEG’ undergoes tonal alternation depending on the lexical tone of the following syllable (see the reduced disyllabic pattern in [Table 6](#) and the data highlighted in bold in [Table 16](#)).²⁶ The third shared feature, based on the data highlighted in green in [Tables 6](#) and 16, is tonal alternation affecting the modern reflex of the proto-Tai tone *A with voiced initials at the time of change, i.e., /42/ in XSBN Tai Lue and /41/ in LP Tai Lue. Specifically, when the syllable following *m* ‘fruit; NEG’ bears tone /42/ in XSBN Tai Lue, it is phonetically realized as [53]. In LP Tai Lue, an additional fusion of boxes *A3 and *A4 is observed, but the resulting tone /41/ retains a similar overall raising of pitch in the morphosyntactic contexts under investigation, being phonetically realized as [52].

Despite these commonalities, the segmental material of the syllabic nasal /m²²/ ‘fruit’; ‘NEG’ is preserved in LP Tai Lue across different language registers. Consequently, no stability-reduced tonal fusion is observed in the two morphosyntactic contexts. These findings suggest that internal factors, such as prominent syllabic reduction and tonal alternation, are insufficient to fully account for the emergence of fused tones in XSBN Tai Lue. Therefore, it is necessary to consider external influences, such as the sociolinguistic background of each variety. This issue will be addressed in [Section 6](#).

5.3 Northern Thai

5.3.1 Lexical tones

Northern Thai as spoken in Chiang Mai has six lexical tones ([Table 17](#)), four of which occur in both smooth and checked syllables.

²⁶ Within this specific shared feature, differences can be observed. In XSBN Tai Lue, the tone of the syllabic nasal *m* ‘fruit; NEG’ remains unaltered only when the following syllable bears tone /55/ or /42/, i.e., tones derived from the Proto-Tai tone *A (see [Table 2](#)). By contrast, in LP Tai Lue, the tone of *m* ‘fruit; NEG’ remains unaltered not only before /35/ and /41/ (also derived from *A), but additionally before /22/, which is derived from the Proto-Tai tone *B with voiceless initials (i.e., boxes *B5-7 in [Table 1](#)).

Table 17. Patterns of tonal splits and tonal distribution in Northern Thai

Proto-Tai tone Initials at the time of tonal splits	Smooth syllable			Checked syllable	
	*A	*B	*C	*DS	*DL
Voiceless friction sounds	25	33	44	25	33
Voiceless unaspirated stops					
Glottal sounds	34	32	131	44	32
Voiced sounds					

Table 18. Examples of compounds with /ba³³/ ‘fruit-’ and negation with /bo³³/ ‘NEG’ in Northern Thai

Context	Underlying pattern		Surface output	Meaning
	Form of the 1st syllable	Tone of the 2nd syllable		
/ba ³³ / ‘fruit-’ + morpheme	/ba ³³ /	25	[ba ³³ xam ²⁵] / [bɤ ³³ xam ²⁵]	‘tamarind’
		34	[ba ³³ fɾaŋ ³⁴] / [bɤ ³³ fɾaŋ ³⁴]	‘starfruit’
		33	[ba ³³ lot ³³] / [bɤ ³³ lot ³³]	‘Elaeagnus conferta’
		32	[ba ³³ muaŋ ³²] / [bɤ ³³ muaŋ ³²]	‘mango’
		44	[ba ³³ tǎw ⁴⁴] / [bɤ ³³ tǎw ⁴⁴]	‘watermelon’
		131	[ba ³³ paw ¹³¹] / [bɤ ³³ paw ¹³¹]	‘coconut’
/bo ³³ / ‘NEG’ + morpheme	/bo ³³ /	25	[bo ³³ kin ²⁵] / [ba ³³ kin ²⁵] / [bɤ ³³ kin ²⁵]	‘not eat’
		34	[bo ³³ ŋam ³⁴] / [ba ³³ ŋam ³⁴] / [bɤ ³³ ŋam ³⁴]	‘not beautiful’
		33	[bo ³³ ju ³³] / [ba ³³ ju ³³] / [bɤ ³³ ju ³³]	‘not stay’
		32	[bo ³³ ten ³²] / [ba ³³ ten ³²] / [bɤ ³³ ten ³²]	‘not dance’
		44	[bo ³³ xa ⁴⁴] / [ba ³³ xa ⁴⁴] / [bɤ ³³ xa ⁴⁴]	‘not kill’
		131	[bo ³³ hu ¹³¹] / [ba ³³ hu ¹³¹] / [bɤ ³³ hu ¹³¹]	‘not know’

5.3.2 Food compounds with *mak^{D1L} ‘fruit’ and negation with *bǎw^B or *mǐ ‘NEG’

In Northern Thai spoken in Chiang Mai, /ba³³/ ‘fruit-’ is the modern reflex of *mak^{D1L} ‘fruit’. The vowel [a] is often reduced to [ɤ] in colloquial speech, resulting in the variant [bɤ³³]. The Proto-Tai negators *bǎw^B ‘NEG’ and *mǐ ‘NEG’ have two modern reflexes: /bo³³/ ‘NEG’ (variants: [ba³³], [bɤ³³]) and /ma³³/ ‘NEG’ (variant: [mɤ³³]). According to my consultants who consistently use /bo³³/ ‘NEG’, younger speakers tend to prefer /bo³³/ ‘NEG’, while older speakers tend to prefer /ma³³/ ‘NEG’.

Table 18 provides examples of compounds with /ba³³/ ‘fruit-’ and negative constructions with /bo³³/ ‘NEG’ in Northern Thai. Audio recordings of Northern Thai food compounds can be accessed via [the OSF repository linked to this paper](#).

No tonal alternation is observed in the morphosyntactic contexts under study. Neither /ba³³/ ‘fruit-’ nor /bo³³/ ‘NEG’, nor the syllables that follow them, undergo any tonal changes regardless of the surrounding tonal context. The absence of stability-induced tonal fusion is unsurprising, given that neither of my consultants reduces /ba³³/ ‘fruit-’, /bo³³/ ‘NEG’ or /ma³³/ ‘NEG’ to the syllabic nasal *m̩*. However, they report that their

grandparents occasionally use *m̩*. By contrast, their parents and they themselves avoid doing so, as this type of prominent syllabic reduction is socially devaluated and associated with speakers perceived as poorly educated.

5.4 Central Thai

5.4.1 Lexical tones

In Central Thai as spoken in Bangkok, there are five lexical tones, three of which occur in both smooth and checked syllables (see Table 19).

Table 19. Patterns of tonal splits and tonal distribution in Central Thai

Proto-Tai tone Initials at the time of tonal splits	Smooth syllable			Checked syllable	
	*A	*B	*C	*DS	*DL
Voiceless friction sounds	213	21	42	21	21
Voiceless unaspirated stops	33				
Glottal sounds					
Voiced sounds		42	334	334	42

5.4.2 Food compounds with **mak^{D1L}* ‘fruit’ and negation with **bǎw^B* or **mǐ* ‘NEG’

In modern Central Thai, **mak^{D1L}* ‘fruit’ is realized as /maʔ³³⁴/ ‘fruit-’ (variant: [ma³³]).²⁷ According to the reconstruction by Pittayaporn et al. (2014), no negator in Central Thai is derived from the etymon **bǎw^B* ‘NEG’. As for **mǐ* ‘NEG’, it has two modern reflexes: /mǎj⁴²/ ‘NEG’ (with a variant [mɯ⁴²] in casual speech among young speakers) and /mǐ³³⁴/ ‘NEG’. The latter occurs only in highly formal registers (e.g., legal documents) and is excluded from the present study due to its limited contextual use.

Table 20 illustrates compound nouns with /maʔ³³⁴/ ‘fruit-’ and negative constructions with /mǎj⁴²/ ‘NEG’ in Central Thai. Audio recordings of Central Thai food compounds can be found in [the OSF repository of this paper](#).

Minor syllabic reduction is attested with /maʔ³³⁴/ ‘fruit-’ and /mǎj⁴²/ ‘NEG’, which may be realized as [ma] and [mɯ], respectively. Furthermore, tonal neutralization is observed among these two morphemes when they are segmentally reduced. However, the degree of syllabic reduction is far less prominent than that seen with the syllabic nasal *m̩* in XSBN and LP Tai Lue. As a result, segmental deletion is not attested, nor is stability-induced tonal fusion.

²⁷ Pittayaporn et al. (2014) observe that in Proto-Tai, tonal irregularities between the proto-form of an etymon and its modern reflex(es) are particularly common among function words. While /maʔ³³⁴/ ‘fruit-’ is a prefix and thus not strictly a function word, it also does not qualify as a full content word. This intermediate status may account for its irregular tonal reflex of [334], instead of [21], the latter being the expected reflex of proto tone *D1L.

Table 20. Examples of compounds with /maʔ³³⁴/ ‘fruit-’ and negation with /mäj⁴²/ ‘NEG’ in Central Thai

Context	Underlying pattern		Surface output	Meaning
	Form of the 1st syllable	Tone of the 2nd syllable		
/maʔ ³³⁴ / ‘fruit-’ + morpheme	/maʔ ³³⁴ /	213	[maʔ ³³⁴ k ^h am ²¹³] / [ma ³³ k ^h am ²¹³]	‘tamarind’
		33	[maʔ ³³⁴ fɾaŋ ³³] / [ma ³³ fɾaŋ ³³]	‘starfruit’
		21	[maʔ ³³⁴ dɾa ²¹] / [ma ³³ dɾa ²¹]	‘fig’
		42	[maʔ ³³⁴ muaj ⁴²] / [ma ³³ muaj ⁴²]	‘mango’
		334	[maʔ ³³⁴ p ^h law ³³⁴] / [ma ³³ p ^h law ³³⁴]	‘coconut’
/mäj ⁴² / ‘NEG’ + morpheme	/mäj ⁴² /	213	[mäj ⁴² hen ²¹³] / [mɤ ³³ hen ²¹³]	‘not see’
		33	[mäj ⁴² kin ³³] / [mɤ ³³ kin ³³]	‘not eat’
		21	[mäj ⁴² ju ²¹] / [mɤ ³³ ju ²¹]	‘not stay’
		42	[mäj ⁴² k ^h a ⁴²] / [mɤ ³³ k ^h a ⁴²]	‘not kill’
		334	[mäj ⁴² ru ³³⁴] / [mɤ ³³ ru ³³⁴]	‘not know’

6 Factors conditioning stability-induced tonal fusion in the varieties studied

To summarize, in food nouns containing *mak^{DIL} ‘fruit’ and negative sentences modified by *bǎw^B ‘NEG’ or *mǐ ‘NEG’, XSBN Tai Lue exhibits extreme syllabic reduction (i.e., deletion) and tonal fusion, resulting in the emergence of six grammatical tones. In the same morphosyntactic contexts, there is no evidence of this process in Tai Phake, LP Tai Lue, Northern Thai and Central Thai.

6.1 Word structure (shaped by extreme syllabic reduction), tonal stability, and the need to distinguish tonal functions

It has been shown that in XSBN Tai Lue, one of the key factors triggering stability-induced tonal fusion is the loss of segmental material in /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’ (see Section 3.3). This extreme reduction is preceded by a partial but prominent reduction of the same syllables (i.e., /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’ > [m^{24/55}] ‘fruit; NEG’). According to first-hand data (see Sections 5.2, 5.3, 5.4), prominent segmental reduction of the corresponding syllables is absent in Central Thai and is disappearing in Northern Thai, which explains why these two varieties do not undergo stability-induced tonal fusion. However, while such reduction is attested in LP Tai Lue, the innovative sound change remains absent in this variety.

Interestingly, at least within the morphosyntactic contexts under study, significant syllabic reduction appears to be a characteristic feature of the Tai Lue language. This is evidenced by the use of the syllabic nasal /m²²/ ‘fruit; NEG’ in LP Tai Lue, a variety spoken by displaced Tai Lue people whose ancestors migrated from Chiang Rung in Sipsongpanna²⁸ to northern Thailand up to four hundred years ago (Smalley 1994:201). Nevertheless, unlike XSBN Tai Lue, LP Tai Lue’s syllabic nasal /m²²/ ‘fruit; NEG’—despite its highly eroded and unstressed segment—retains enough segmental material to prevent further loss and thereby halt the tonal fusion process.

Tai Phake is another language in which the negative marker mǎw^I ‘NEG’ can be reduced to a syllabic nasal m̩ (though we have limited information on food compounds with *mak^{DIL} ‘fruit’). It remains unclear whether this reduction is still active in contemporary Tai Phake, especially given that a similar process was reported for Northern Thai by Purnell and Hope (1962), yet the syllabic nasal m̩ is no longer used by my Northern Thai consultants.

More importantly, although the negative and questioning tones in Tai Phake affect only a subset of lexical tones—unlike in XSBN Tai Lue, where all lexical tones are subject to stability-induced fusion—their behavior provides valuable insights into the actuation problem discussed in this study. Specifically, a comparison of the

²⁸ Chiang Rung in Sipsongpanna = Jinghong in Xishuangbanna.

tonal patterns associated with these two grammatical functions reveals that the co-occurrence of the negator *mǎ*¹ ‘NEG’ with the negative tone is structurally motivated. Even when a verb carries the negative tone, the presence of *mǎ*¹ ‘NEG’ is still required. This co-occurrence serves to disambiguate the negative tone from the questioning tone, which would otherwise be indistinguishable when modifying a tone-1 morpheme, as both exhibit the same pitch contour (see Table 14). The need to maintain a contrast between these two grammatical tones thus explains why the negative marker *mǎ*¹ ‘NEG’ is segmentally preserved, while the question marker *nɔ*⁶ ‘Q’ is not. In the latter case, the loss of segmental material in *nɔ*⁶ ‘Q’, coupled with tonal stability, gives rise to tonal fusion in polar questions in Tai Phake, resulting in the questioning tone.

Finally, Central Thai demonstrates that the mere presence of tonal stability does not render a Southwestern Tai variety more prone to stability-induced tonal fusion in the morphosyntactic contexts examined.

Taken together, these observations suggest that internal constraints—namely, word structure shaped by extreme syllabic reduction, tonal stability, and the need to maintain contrast between grammatical tones with identical phonetic output—cannot fully account for why the same tonal change occurs only in XSBN Tai Lue and not in the other four Southwestern Tai varieties, despite the presence of comparable structural conditions.

6.2 Interplay between language contact and analogy

As for potential external factors, language contact offers a promising explanation for the retention of the syllabic nasal /m²²/ ‘fruit; NEG’ in LP Tai Lue, versus its loss in XSBN Tai Lue. Specifically, most Tai Lue speakers in Thailand are multilingual—fluent in Northern Thai, sometimes Lao [lao, Kra-Dai], and often Central Thai (Smalley 1994:201). This multilingualism is confirmed by my LP Tai Lue consultants, who report that all members of their community also speak Northern Thai, the region’s *lingua franca*, and Central Thai, the country’s dominant language. A comparison of food compounds containing **mak*^{D1L} ‘fruit’ and negative sentences containing **bǎw*^B (or **mi*) ‘NEG’ across these three Tai varieties reveals a high degree of similarity in phonological pattern, word formation, and word order (see Table 21).

It is likely that the structural similarities between LP Tai Lue, Northern Thai and Central Thai disincentivize LP Tai Lue speakers from further reducing the segmental material of /m²²/ ‘fruit; NEG’, despite its highly eroded and unstressed form. This retention of /m²²/ ‘fruit; NEG’ through analogical maintenance is further supported by a consultant’s observation that /m²²/ ‘fruit; NEG’ cannot be omitted in LP Tai Lue, as it corresponds to /ma³³⁴/ ‘fruit-’ and /mǎ⁴²/ ‘NEG’ in Central Thai, and to /ba³³/ ‘fruit-’ and /bo³³/ ‘NEG’ in Northern Thai, respectively.

By contrast, in XSBN Tai Lue, once /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’ are reduced to the unstressed syllabic nasal [m^{24/55}] ‘fruit; NEG’, extreme reduction—i.e., deletion—ensues. With respect to languages in contact with XSBN Tai Lue, it is first worth noting that prior to Xishuangbanna’s establishment as an official administrative unit of China in 1953, the Tai Lue constituted the majority ethnic group in the region. For centuries, they maintained political, cultural, economic, and linguistic dominance (Hsieh 1989). Apart from the Chinese-speaking Han, the other major ethnic groups in close contact with the Tai Lue were the Hani [hni, Tibeto-Burman], Lahu [lhu, Tibeto-Burman], Jinuo [jiu, Tibeto-Burman], and Bulang [blr, Austroasiatic]. These four groups, however, occupied a lower social status, as they were considered *xa*²¹³ ‘slave’ by the Tai Lue. In fact, Tai Lue functioned as the region’s *lingua franca*, and few Tai Lue speakers knew how to speak any of the minority languages. It is therefore unlikely that these languages exerted any significant influence on Tai Lue.

Today, the two languages in closest contact with XSBN Tai Lue are undoubtedly Southwestern Mandarin [xghu, Sino-Tibetan] and Standard Mandarin [cmn, Sino-Tibetan], the former serves as the regional *lingua franca*, while the latter is the national language of China. In contemporary Xishuangbanna, it is extremely rare to find a Tai Lue who does not speak either Southwestern Mandarin or Standard Mandarin.

Table 21. Comparison of compounds with *mak^{D1L} ‘fruit’ and negation with *bǎw^B (or *mǐ) ‘NEG’ in LP Tai Lue, Northern Thai, and Central Thai²⁹

LP Tai Lue	Northern Thai	Central Thai
Food compounds with *mak ^{D1L} ‘fruit’		
/m̄ ²² xam ³⁵ / ‘tamarind’	/ba ³³ xam ²⁵ / ‘tamarind’	/maʔ ³³⁴ kham ²¹³ / ‘tamarind’
/m̄ ²² fɿŋ ⁴¹ / ‘starfruit’	/ba ³³ fɿŋ ³⁴ / ‘starfruit’	/maʔ ³³⁴ fɿŋ ³³ / ‘starfruit’
/m̄ ²² lot ²² / ‘Elaeagnus conferta’	/ba ³³ lot ³³ / ‘Elaeagnus conferta’	/maʔ ³³⁴ dɿa ²¹ / ‘fig’
/m̄ ²² moŋ ³³ / ‘mango’	/bɿ ³³ muaŋ ³² / ‘mango’	/maʔ ³³⁴ muaŋ ⁴² / ‘mango’
/m̄ ²² tǎw ³¹ / ‘watermelon’	/ba ³³ tǎw ⁴⁴ / ‘watermelon’	
/m̄ ²² paw ⁴¹ / ‘coconut’	/ba ³³ paw ¹³¹ / ‘coconut’	/maʔ ³³⁴ p ^h law ³³⁴ / ‘coconut’
/m̄ ²² nat ⁵⁵ / ‘pineapple’		
Negative sentences with *bǎw ^B (or *mǐ) ‘NEG’		
/m̄ ²² ha ³⁵ / ‘not look for’	/bo ³³ kin ²⁵ / ‘not to eat’	/mǎj ⁴² hen ²¹³ / ‘not see’
/m̄ ²² mi ⁴¹ / ‘not have’	/bo ³³ ŋam ³⁴ / ‘not beautiful’	/mǎj ⁴² kin ³³ / ‘not eat’
/m̄ ²² ju ⁴⁴ / ‘not stay’	/bo ³³ ju ³³ / ‘not stay’	/mǎj ⁴² ju ²¹ / ‘not stay’
/m̄ ²² ho ²² / ‘not leak’	/bo ³³ ten ³² / ‘not dance’	/mǎj ⁴² k ^h a ⁴² / ‘not kill’
/m̄ ²² xa ³¹ / ‘not kill’	/bo ³³ xa ⁴⁴ / ‘not kill’	
/m̄ ²² hu ⁴¹ / ‘not know’	/bo ³³ hu ¹³¹ / ‘not know’	/mǎj ⁴² ru ³³⁴ / ‘not know’
/m̄ ²² tat ⁵⁵ / ‘not cut’		

As shown in Table 22, the feasibility of segmental reduction and subsequent deletion of /mak²⁴/ ‘fruit’ and /bǎw²⁴/ ‘NEG’ in XSBN Tai Lue can be attributed to the fact that neither Southwestern Mandarin nor Standard Mandarin exhibits a high degree of phonological or morphosyntactic similarity in the relevant contexts.

Given the limited structural similarities between XSBN Tai Lue, Southwestern Mandarin, and Standard Mandarin in the relevant morphosyntactic contexts, it is reasonable to assume that XSBN Tai Lue speakers have not been subject to the same analogical influence as LP Tai Lue speakers. In the absence of comparable structures in the contact languages, there is no pressure on XSBN Tai Lue to halt the already ongoing lenition process, namely the deletion of the highly eroded syllabic nasal [m̄^{24/55}] ‘fruit; NEG’. This segmental deletion constitutes a crucial prerequisite for subsequent tonal fusion.

In parallel, language contact may also explain why the syllabic nasal *m̄*, documented by Purnell and Hope (1962), has disappeared from the speech of my Northern Thai consultants. According to them, prominent syllabic reduction is no longer considered fashionable, as it is perceived to indicate poor mastery of Central Thai norms.

²⁹ The lexical tones of the examples in each row derive from the same Proto-Tai tone. However, the LP Tai Lue data highlighted in orange show a single modern lexical tone, whereas the corresponding cognates in Northern Thai and Central Thai exhibit two distinct tones.

Table 22. Compounds with /mak²⁴/ ‘fruit’ and negation with /bǎw²⁴/ ‘NEG’ in XSBN Tai Lue and their corresponding forms in Southwestern Mandarin and Standard Mandarin³⁰

XSBN Tai Lue	Southwestern Mandarin	Standard Mandarin	Meaning
Food compounds			
/mak ²⁴ xam ⁵⁵ / - [m ²⁴ xam ⁵⁵] - [xam ²⁵]	/suan ⁴⁴ teo ³¹ /	/suan ⁵⁵ teau ²¹⁴ /	‘tamarind’
/mak ²⁴ fɿŋ ⁴² / - [m ²⁴ fɿŋ ⁵³] - [fɿŋ ²⁴²]	/jaŋ ³¹ t ^h au ³¹ /	/jaŋ ³⁵ t ^h au ³⁵ /	‘starfruit’
/mak ²⁴ lɔt ²⁴ / - [m ⁵⁵ lɔt ²⁴] - [lɔt ⁵³⁵]	/jaŋ ³¹ nai ⁵³ ko ³¹ /	/jaŋ ³⁵ nai ³⁵ kuo ²¹⁴ /	‘Elaeagnus conferta’
/mak ²⁴ moŋ ⁴⁴ / - [m ⁵⁵ moŋ ⁴⁴] - [moŋ ⁵⁴]	/maŋ ³¹ ko ³¹ /	/maŋ ³⁵ kuo ²¹⁴ /	‘mango’
/mak ²⁴ kɔ ²¹³ / - [m ⁵⁵ kɔ ²¹³] - [kɔ ⁵²³]	/li ³¹ /	/li ³⁵ /	‘pear’
/mak ²⁴ paw ²² / - [m ⁵⁵ paw ²²] - [paw ⁵²]	/jɿ ⁴⁴ tsɿ ³¹ /	/jɿ ⁵⁵ tsɿ ²¹⁴ /	‘coconut’
Negative sentences			
/bǎw ²⁴ ha ⁵⁵ / - [m ²⁴ ha ⁵⁵] - [ha ²⁵]	/pu ²¹² tɕau ³¹ /	/pu ⁵¹ tɕau ²¹⁴ /	‘not look for’
/bǎw ²⁴ mi ⁴² / - [m ²⁴ mi ⁵³] - [mi ²⁴²]	/pu ²¹² jou ⁵³ /	/mei ³⁵ jou ²¹⁴ /	‘not have’ ³¹
/bǎw ²⁴ mi ²⁴ / - [m ⁵⁵ mi ²⁴] - [mi ⁵³⁵]	/pu ²¹² pan ²¹² /	/pu ³⁵ pan ⁵¹ /	‘not stir’
/bǎw ²⁴ wa ⁴⁴ / - [m ⁵⁵ wa ⁴⁴] - [wa ⁵⁴]	/pu ²¹² ɕuo ³¹ /	/pu ⁵¹ ɕuo ⁵⁵ /	‘not say’
/bǎw ²⁴ xa ²¹³ / - [m ⁵⁵ xa ²¹³] - [xa ⁵²³]	/pu ²¹² ɕa ³¹ /	/pu ⁵¹ ɕa ⁵⁵ /	‘not kill’
/bǎw ²⁴ hu ²² / - [m ⁵⁵ hu ²²] - [hu ⁵²]	/pu ²¹² tɕɿ ⁴⁴ tau ³¹ /	/pu ⁵¹ tɕɿ ⁵⁵ tau ⁵¹ /	‘not know’

Taken together, the segmental maintenance of the syllabic nasal /m²²/ ‘fruit; NEG’ in LP Tai Lue and the near-disappearance of its equivalent in Northern Thai—where the corresponding full forms /ba³³/ ‘fruit-’ and /bo³³/ ‘NEG’ are now preferred—are consistent with Kuryłowicz’s (1945) sixth law of analogy, whereby the base of an analogy may originate in a more prestigious variety and reshape a corresponding form in a recipient variety that imitates it.

Moreover, although language contact and analogy are often analyzed separately, their potential interaction has been noted by Willis (2017:492) : “[...] syntactic analogy may be favoured if the input to acquisition is limited by the presence of another language in the community [...]”. While Willis’s observation pertains to syntax, a similar phenomenon in morphology is reported by Gębski (2023) in Jewish dialects of North African Arabic. Gębski argues, for example, that the emergence of the /t-/ passive stem in certain Jewish dialects of the region may have been stimulated by contact with Berber, in which the /t-/ prefix serves as a passive marker in many varieties.

Table 23 summarizes the factors considered in this paper. It is important to note that the absence of stability-induced tonal fusion in Tai Phake refers specifically to context of food compounds containing *mak^{DIL} ‘fruit’ and that of negative sentences with *bǎw^B (or *mǐ) ‘NEG’, as the same type of tonal process does occur in polar questions (see [Section 5.1.2.2](#)).

³⁰ The examples for Southwestern Mandarin and Standard Mandarin were generated by the author, a native speaker of both varieties.

³¹ In Standard Mandarin, two negative markers are used to express standard negation: 不 /pu⁵¹/ and 没 /mei³⁵/ (variant: 没(有) [mei³⁵jou²¹⁴]). When the verb in a sentence is 有 /jou²¹⁴/ ‘have’, the negator is always 没 /mei³⁵/. Generally speaking, 不 /pu⁵¹/ indicates neutral negation, whereas 没 /mei³⁵/ typically negates the completion of an event. For further discussion on the subject, see Li & Thompson (1981:415–441).

Table 23. Cross-linguistic correlation of stability-induced tonal fusion in Southwestern Tai with related morphosyntactic and phonological features (+: present, -: absent, +/- limited evidence or variable usage)

Language \ Feature	Stability-induced tonal fusion	Tonal stability effect	Reduction of * <i>mak</i> ^{DIL} ‘fruit’, * <i>ǎw</i> ^B ‘NEG’, <i>mǐ</i> ‘NEG’ to <i>m̩</i>	Segmental loss of <i>m̩</i> ‘fruit; NEG’	Tonal function differentiation	Analogical maintenance of <i>m̩</i> ‘fruit; NEG’ due to language contact
XSBN Tai Lue	+	+	+	+	-	-
LP Tai Lue	-	-	+	-	-	+
Tai Phake	-	+ (polar question)	+/- (evidence limited to negation)	-	+	-
Northern Thai	-	-	+/- (<i>m̩</i> attested but obsolete)	+/- (ongoing)	-	- (analogical elimination of <i>m̩</i>)
Central Thai	-	+ (language game)	-	-	-	-

XSBN Tai Lue shows the strongest alignment between stability-induced tonal fusion and the other variables considered, whereas Central Thai provides minimal evidence for such correlations. As demonstrated by Central Thai, the presence of tonal stability and genealogical proximity alone does not render a language more susceptible to stability-induced tonal fusion in the morphosyntactic contexts examined. Nevertheless, the Central Thai data are crucial for comparison, because they provide a sociolinguistic account of the actuation problem in LP Tai Lue and Northern Thai.

As argued in Section 3.3, a crucial intermediate step in the emergence of grammatical tones in XSBN Tai Lue involves the prominent segmental reduction of the modern reflexes of *mak*^{DIL} ‘fruit’ and **ǎw*^B (or **mǐ*) ‘NEG’ to the syllabic nasal *m̩*. This reduction creates a pathway both for the potential segmental deletion of *m̩* and for subsequent tonal fusion. Apart from XSBN Tai Lue, this reductive process is clearly attested in LP Tai Lue, and to a lesser extent in Tai Phake and Northern Thai. Among these four varieties, however, only XSBN Tai Lue has undergone complete segmental loss of *m̩* ‘fruit; NEG’. In the remaining cases (see grey cells in Table 20), segmental deletion in LP Tai Lue is blocked by analogical maintenance tied to language contact with Central Thai and Northern Thai; it is halted in Tai Phake by the need to maintain contrasts between grammatical tonal functions; and it is ongoing in Northern Thai—not as a result of extreme phonetic reduction, but rather due to the near obsolescence of *m̩* ‘fruit; NEG’ through analogical elimination under contact influence with Central Thai.

7 Conclusion

This paper has investigated why the emergence of six grammatical tones in XSBN Tai Lue currently constitutes a special case within the Southwestern Tai language group. These grammatical tones occur in food compounds (the modern reflex of **mak*^{DIL} ‘fruit’ + morpheme) and in negative phrases (the modern reflexes of **ǎw*^B/*mǐ* ‘NEG’ + morpheme). Their development results from tonal fusion between the two lexical tones involved in each construction. This fusion is triggered by the segmental deletion of the first TBU—namely, the segmental material of the reflexes of **mak*^{DIL} ‘fruit’ and **ǎw*^B/*mǐ* ‘NEG’—in combination with the effect of tonal stability. The description of synchronic variation associated with these newly formed grammatical tones provides a rare opportunity to directly observe tone change in progress, thereby laying the groundwork for future diachronic reconstruction.

Comparative data from Central Thai show that the presence of tonal stability is a necessary but not sufficient condition for the development of stability-induced tonal fusion in the morphosyntactic contexts examined. More importantly, a comparison between XSBN Tai Lue and LP Tai Lue—two varieties of the

same language—reveals that segmental loss of the first TBU is blocked in LP Tai Lue by analogical maintenance, influenced by language contact with Northern Thai and Central Thai, two more prestigious neighboring Tai varieties. Another key factor is tonal function differentiation in Tai Phake, where retention of the segmental material of the negative marker serves to prevent ambiguity between negative and questioning tones when these share the same phonetic realization.

By demonstrating how structural constraints and sociolinguistic factors interact to condition the occurrence of stability-induced tonal fusion across four Southwestern Tai languages, this study offers new insights into the actuation problem in sound change and deepens our understanding of the mechanisms underlying tone change in already tonal languages. Finally, the present paper identifies potentially relevant tonal features in Tai languages and outlines plausible directions for further research on these languages' tonal systems.

Data availability statement

Audio files related to Tables 5, 13, 15, and 17 are archived in the OSF repository accompanying this study: <https://osf.io/26v5g/>.

Abbreviations

2	second person
3	third person
NEG	negative
PROX	proximal
Q	question marker
SG	singular

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