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Tone in South Central Tibeto-Burman

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ABSTRACT

South Central Tibeto-Burman (or Kuki-Chin) languages have diverse systems of lexical and grammatical tone. Previous literature on South Central suggests that researchers can expect to encounter broad variation between languages and dialects. The goals of this paper are twofold: (1) to offer an overview of tone research in South Central languages, and (2) to prepare the linguistic field researcher to incorporate tone study into their data collection and analysis.

KEYWORDS

Kuki-Chin, South Central, Tibeto-Burman, Trans-Himalayan, tone, grammatical tone, tone sandhi, field research, phonology

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1 Introduction

Nearly all South Central Tibeto-Burman (SC, also called Kuki-Chin) languages are reported to make use of tone for lexical (and in some cases grammatical) contrasts, yet tone is one the least-investigated aspects of SC grammars. Many researchers have noted tone in their work on SC languages, but few have made systematic attempts to describe and analyze it, so accounts of tone in SC are often cursory, and most orthographies do not bother marking it at all. Depending on the language, leaving out tone marking may not cause difficulties for native speaker readers (the target audiences for these orthographies), but Chhangte, writing on Mizo, states that linguistic study "has been hampered by the absence of tone marks in our orthography" (1986: 17). The dearth of tone study in SC presents problems for phonetic, phonological, morphological, syntactic, and pragmatic analysis, since tone is relevant to each field of study, and only tonal analysis can tease underlying lexical tone apart from the various processes that affect surface pitch (Yip 2002; Leben 1973; Goldsmith 1976). This paper offers the field researcher a primer on SC tone research, as well as suggestions for incorporating tonal analysis into field research. [1]

The organization of this paper is as follows. A brief history of tone study in SC is given in Section 2, followed by discussion of SC pitch and tone inventories in Section 3. The relationship between tone and segments is considered in Section 4, which treats interactions with consonants, and Section 5, which treats interactions with syllable structure. The next two sections are concerned with the phonology of tone: the position of a tone within an utterance in Section 6, and common tone processes such as assimilation, absorption, and polarization in Section 7. Section 8 focuses on grammatical tone, with particular emphasis on tone involved in marking plurality and stem alternation. Section 9 provides an overview of methodology used for doing field research on tone. Section 10 concludes the paper.

2 Tone research in South Central

Early work on SC languages did not often involve discussions of tone, but as interest in and understanding of SC linguistics has grown, the relevance of tone to all aspects of these grammars has made it an unavoidable area of investigation. Stilson (1866: 19), writing on Kemī (or Mro-Khimi), discussed the prosodic phonology of the language in terms of the more familiar stress-accent systems

[1] This paper is adapted from the discussion of tone in Lotven (2021), which provides an expanded analysis of tonal phenomena in Lawngtlang Zophei. Special thanks to David Peterson, David Mortensen, Larry Hyman, Kelly Berkson, Stuart Davis, Samuel Obeng, and Kenneth J. de Jong for their comments on this paper, as well as to Zai Sung for sharing her intuitions on Lawngtlang Zophei.

found in Europe: "as an almost invariable rule, words of two or three syllables are accented on the last." And Savidge's (1908) description of Mara does not mark or mention tone, although later descriptions suggest extensive use (Arden 2010). However, Freyer's (1875: 48) early work on Khyeng notes the relevance of tone and foreshadows the abundance of future research potential, describing the language as "simple in its construction and expression, but elaborate in its tones." Since that time, it has become clear that SC languages described as non-tonal, such as Tarao (Singh 2002: 1), are rare.

Academic interest in SC tone was pushed forward by Osburne's (1975) treatment of tone in Zahao (a variety of Falam) and has grown since then, especially in the last two decades. Those researchers who take the time to describe SC tone, as Chhangte (1986) does for Mizo, note many processes that affect tone realization and list multiple exceptions to generalizations, suggesting SC languages are rich with opportunities for tone research. This growing attention paid to tone has been reflected in, for example, Reichle's (1981) description of Bawm, Thuan's (2008) work on Falam, Watkins' (2013) analysis of Myebon Sumtu (Sumtu), Zakaria's (2018) treatment of the phonetics and phonology of tone in Hyow, Peterson's analysis of Khumi tone (2014, 2019), and Ozerov's treatment of grammatical tone in Anal (2018).

Researchers of SC languages often note that tone systems differ by dialect. Take for example Bawm and Hyow. Reichle (1981: 13-15) describes Southern Bawm as having a two-way lexical distinction in nouns and verbs that she refers to as 'Flat' vs. 'Raised', where Flat is realized as a Fall after a Raised syllable.[2] Northern Bawm, on the other hand, has a three-way contrast between L, M (or Rising), and H pitches, with their distribution, in part, lexically constrained.[3] Considering Hyow, the Eastern Gungrupara dialect (E. Hyow), according to Zakaria (2018: 22, 75), has one contour contrasting with two level pitches: High-Falling [52], H [44], and L (realized as [11] in stop-final syllables and [22] elsewhere). The Western Gungrupara Laitu variety has two Rising pitch patterns, Kontu Hyow has two Falling pitch patterns, and Laitu Hyow has only contour pitch patterns, with a Convex [Rise-Fall] contour and two distinct Falling contours.[4] These differences in dialect indicate that researchers of SC tone must be careful in compiling data collected from different speakers, especially from different dialect regions.

In addition to these projects, which have incorporated tone into larger grammatical descriptions, a small body of theoretical research has also examined tone in some SC languages. Phonological analyses of tone processes have featured prominently in Hyman and VanBik (2002a, 2002b, 2004: Hakha Lai), Hyman (2007, 2010, 2014a: Thantlang Lai, Hakha Lai, Falam, Kuki-Thaadow), Yip (2004: Falam), and Lin (2005: Hakha Lai). VanBik (2009) also includes a reconstruction of Proto-South Central's tone system based on synchronic varieties, a difficult task given the amount of attested variation in SC.[5]

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[2] Reichle's description of Southern Bawm is based on discussions with Lorenz Löffler and previous research (Löffler 1972, 1973). Löffler (1972: 285) describes 7 pitch patterns (with no indication of dialect): L [22], M [33], H [44], HL [42], MH [34], H Rise [45], and "Passing" [21]. L, H, and HL are analyzed as permitted underlying tones.

[3] L appears in nouns, verbs, and some grammatical particles; H appears in adverbial, adnominal, and phrase-type markers; and the Rise appears in demonstrative/emphatic particles and phrase-type markers.

[4] SC languages with only contour tones are rarely described, however Lamkang is similarly reported to have a two-way contrast between a Rise and a Fall (Thounaojam and Chelliah 2007: 15).

[5] Few researchers have taken up the topic of diachronic tone change in SC languages. Of note is Konnerth (2018), which uses comparative analysis to connect the H vs. L tone distinction in Monsang to a simplification of PKC's 4-way distinction through category merger.

These articles have worked to bring the insights learned through SC tone study to the broader community of tonologists working, especially, on languages spoken in East Asia, Africa, and the Americas. Although Hyman and Schuh's (1974) article on universals of tone focused on African languages, Hyman's (2009: 6-7, 14-15) update, "Universals of Tone Rules: 30 Years Later," features language data from a few SC languages including Hakha/Thantlang Lai, Mizo, Falam, and Kuki-Thaadow (Thadou). Such work underlines the value of presenting SC tonal phenomena to the broader linguistics community. Kuki-Thaadow, for example, in addition to the typologically common phenomenon of High tone spread, also exhibits the typologically uncommon phenomenon of Low tone spread, offering opportunities for the study of a language with both processes. The extensive use of tone in SC languages suggests that its continued study will have far-reaching effects on our theoretical and typological understanding of tone in human language.

3 Surface pitch and underlying tone

Speakers manipulate the speed of vocal fold vibration (measured acoustically as f_0, in Hz) during voiced consonants and vowels, so it is measurable throughout much of an utterance. Some fluctuations in f_0 are meaningful, interpreted by listeners as changes to pitch. Yet, pitch is affected by numerous linguistic and extra-linguistic factors—in addition to pitch differences tied to tone, pitch can also be affected by phrase position, utterance position, and various pragmatic factors.[6] An additional degree of complexity arises because f_0 is not necessarily the sole correlate of pitch and tone. Languages may make use of additional cues in the realization of tonal contrasts, including phonation type (such as creaky or breathy voicing), vowel duration, and amplitude (Yip 2002). These and other cues may be used to indicate tone contrasts even in whispered speech (Gao 1999).

In discussing pitch patterns in SC languages, it is worth considering the broader typology of pitch and tone inventories.[7] Contours tend to be more marked than level pitch patterns, Rises more marked than Falls, and complex contours (Convex and Concave) more marked than simplex contours (Rises and Falls): HLH, LHL > LH > HL> H, L (Yip 2002: 27-30; Zhang 2002; Gordon 2001;

[6] Tone languages, like languages without tone, also make use of pitch in intonation for various functions, such as marking clause types or noting emotions like surprise (Downing and Rialland 2016). Usually an analysis of these processes superimposes an intonation contour on a prosodic phrase or places a boundary tone at the beginning or end of the phrase to affect the output pitch pattern. Zakaria (2017: 91) describes Hyow intonation as resulting in Rising or Falling contours associated with the final syllable of a clause. This effect varies based on, for example, whether it is a matrix or embedded clause and whether it is in declarative or imperative mood. As tone and intonation research is not widely pursued within SC linguistics, the interaction between the two has seen little linguistic attention.

[7] In this discussion of surface pitch and underlying tone, I make use of the following abbreviations: (H)igh, (M)id, and (L)ow, with contours written as a series (e.g., ML, HM, or HL "Fall", LM, MH, or LH "Rise"). Where pitch or tone is marked on vowels, H is noted with an acute accent (*x́*), L with a grave accent (*x̀*), and M with no marking (*x*). Contours are marked on one vowel when it is short (Rise <*x̌*>, Fall <*x̂*>) or two vowels when they represent a long vowel or diphthong (Rise <*x̀x́*>, Fall <*x́x̀*>). In addition, some sources make use of Chao's (1930) "tone numerals"—a numbering system from 1-5 wherein 1 is the lowest pitch and 5 is the highest—numbers are noted in brackets. Contours in this system are marked with multiple numbers (e.g., [53] "Fall" or [25] "Rise"). A superscripted <!> is used to indicate downstep (ꜜH). Syllable shapes are referred to using the following notation: C—onset consonant, V—short vowel, VV—long vowel, N—sonorant coda, T—(voiceless oral) obstruent coda, ʔ—glottal stop coda (or marking a short major syllable, depending on language/analysis).

Hyman 2009). More marked pitch patterns are more likely to be missing from the pitch inventory of a language, or to have restricted distribution.[8] For example in Lawngtlang Zophei, Falls are commonplace, but Rises are only found in derived environments. This section discusses pitch pattern inventories in Section 3.1, underlying tone and tone features in Section 3.2, and offers an example of tone analysis in Khumi in Section 3.3.

3.1 Pitch pattern inventories

Each language features a set of possible pitch patterns that may surface on a syllable. Table 1 provides a summary of some of the pitch pattern inventories for SC languages discussed in this paper. For each language, shaded cells indicate that at least one pitch of the indicated type has been identified in the language (H, L, M, Fall, Rise), with other pitch patterns also noted. All of the languages on this chart (besides Lamkang) have at least two level pitches, whether the contrast is analyzed as between H and M, or between H and L. Outside of Senthang, each language is reported to have at least one contour tone (Fall, Rise).

	High	**Low**	**Mid**	**Fall**	**Rise**	**Additional observations**	**Sources**
Zophei						2 Falls, 2 Rises, Concave	Lotven 2021
Mizo						Extra H	Chhangte 1986
Mara					-		Arden 2010
Senthang				-	-		Ngun Tin Par 2016
N. Bawm				-			Reichle 1981
K. Thaadow			-			L Fall[9], ˥H, ˥HL	Hyman 2010
Falam			-			Concave	Thuan 2008
Khumi			-			12 patterns[10]	Peterson 2014, 2019
E. Hyow			-		-		Zakaria 2018
Matu		-				2 Falls, 3 Rises	Shintani 2016[11]
Zotung		-			-		Shintani 2015
Lamkang	-	-	-				Thounaojam and Chelliah 2007

Table 1. Pitch pattern inventories in SC languages

[8] Restrictions may involve syllable shape and prosodic position (see Zhang 2002). Those involving syllable shape limit contours to syllables with longer vowels and/or sonorant codas, in some cases lengthening syllables to accommodate contours, as discussed in Section 5. Restrictions involving prosodic position restrict contours to prominent prosodic positions, often on the final edge of a prosodic word or phrase, addressed in Section 6.

[9] Pre-pausal L is realized as a Low Fall in Kuki-Thaadow (K. Thaadow).

[10] These 12 patterns in Khumi include 3 Lows (two checked), 4 Highs (two checked), Extremely H checked, 3 Rises (one with a final fall, one that is gradual, and one that rises rapidly), and a High Fall.

[11] Shintani (2016) analyzes Matu as having only two lexical tones (H and M).

Languages with only level pitches are rare in SC. Senthang is described as having such a system, but with the additional complication of a three-level distinction: L vs. M vs. H.[12] Some languages reportedly have only one Falling contour, as in Mara, E. Hyow, and Zotung.[13] Northern Bawm appears to break this tendency with only a Rise, which Reichle (1981) considers to be a variant realization of M tone. Other languages permit both Rises and Falls, such as Mizo, Kuki-Thaadow, Falam, Khumi, and Matu. In addition to level pitches and simple contours, Falam, and Zophei have concave (dipping) contours. These pitch inventories, taken together, show that SC languages possess a diverse typology of tone systems, in some cases exemplifying phenomena that are uncommon in the world's languages; for example, Lamkang and Laitu Hyow permit only contours.

3.2 Underlying tone and tone features

The inventory of relevant pitch patterns in a language of investigation, once established, employed in transcription, and analyzed in tandem with phonological and morphosyntactic considerations, can give way to a smaller inventory of underlying, contrasting tones or tone features. Take, for example, Chhangte's (1986: 38-50) analysis of Mizo. The language is described with six pitch patterns: L, M, H, Rising, Falling, and an extra-High also noted as optional for some lexical items. Yet, when syllable shape is taken into account, Mizo's L and M pitches are reduced to only one underlying L tone.[14] In addition, Mizo contours (Rising, Falling) are analyzed as combinations of L and H, (Rising = L+H, Falling = H+L), reducing the underlying inventory to four tones (H, L, HL, LH), composed of two primitives: L and H.

The decomposition of contours into L and H primitives is used in other analyses as well. Hyman (2010) describes seven surface pitch patterns for Kuki-Thaadow (L, H, HL, LH, L Fall, ꜜH, ꜜHL), yet his analysis makes use of only underlying L and H tone primitives, combined to form three attested underlying patterns: L, H, and HL (LH is not underlying in the language).[15] Hyman (2014a) offers similar analyses for other languages, making use of H and L primitives to decompose underlying contour tones for Hakha Lai (L, HL, LH), Thantlang Lai (L, H, HL), and Falam (H, L, HL, LH).[16]

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[12] The tone inventories of Maraic languages are often described as involving three pitch (and in some cases tone) levels. In addition to Senthang, Zophei and Mara are also reported to use three pitch levels, along with contours. Mara makes a lexical contrast between L, M, and H morphemes, with a HM Fall occurring in derived environments (Arden 2010: 49-50, 65). The Lutuv tone system is in need of more research, but preliminary fieldwork suggests the use of three pitch levels is also warranted. The only Maraic language as yet described without three pitch levels is Zotung, which has two level tones (H and M) as well as a ML contour (Shintani 2015: xxi).

[13] In addition to these languages that feature a Fall as part of their inventory, Chothe is described as having a two-way contrast between Level and Falling pitch patterns (Singh 2008: 26).

[14] L surfaces on smooth syllables and M on checked syllables. Syllable structure concerns, such as the smooth/checked distinction, are discussed in Section 5.

[15] Haokip's (2007) analysis of Thadou (Kuki-Thaadow) considers only three patterns to be relevant (Rising, Falling, and Level), analyzed as the realization of phonologically H, L, and toneless morphemes of all syllable shapes.

[16] Thuan (2008: 44-45) also analyzes Falam as having four tones: H [44], L [21], Rising (or Concave) [23 or 323], and Falling [52 or 42], with some minor contextual variation in the realization of contours.

Some analyses also make use of morphemes with no assigned tone, their pitch realization dependent on context. Zophei is analyzed in terms of an underlying H vs. L vs. toneless (Ø) distinction on all syllables (Lotven 2021). Surface pitch patterns include L, M, H, HM, ML, LM, MH, and HMH, where the latter three Rises appear only in derived (plural imperative) contexts. Of the remaining pitch patterns, the realization of HM and ML falling contours is dependent on the pitch height of the preceding syllable, with HM following H (H-HM), and ML following M (M-ML). This leaves L, M, H and Falling (HM/ML) pitch patterns as necessary for transcription purposes (with attention paid to the derived Rises LM, MH, and HMH). Yet for tone analysis, only H and L primitives are used. Underlying H tone morphemes are those which never surface as L; underlying L tone morphemes are those which never surface as H; and underlying toneless morphemes are not limited in their surface pitch.

Other analyses work to decompose underlying tones into their component features. Osburne's (1975) analysis of Falam includes only three underlying tones (L, H, and Rising).[17] This three-tone system is further analyzed as reflecting the distribution of a binary [+/- High] feature. On a long vowel there are two slots (moras) that hold such features, so L tone on a long vowel is underlying [-High, -High], H tone is [+High, +High], and Rising tone is [-High, +High].[18] A similar analysis has been used for Khumi.

3.3 Case study: Khumi

Peterson (2014, 2019) points out several relevant phonological processes in Khumi that affect the realization of tone. In his analysis, short syllables are considered monomoraic (CV) with one mora, while long syllables are considered bimoraic (CVV), with two moras. Like Osburne's (1975) analysis of Falam, a mora may be underlyingly [+/- High]. Thus, logical possibilities for tone on a syllable include CV, CV́, CVV, CV́V, CVV́, and (although the analysis does not make use of it) CV́V́.

In the absence of phonological and morphological processes that alter the realization of pitch, these underlying patterns are faithfully realized as shown in the second 'Faithful' column of Table 2. Monomoraic CV and CV́ are faithfully realized as L and H checked pitches (L^{ʔ}, H^{ʔ}), while bimoraic CVV, CV́V, and CVV́ are faithfully realized as L, HL, and LH pitches, respectively.

[17] The Falling tone was not included in Osburne's (1975) work, however her analysis does make reference to a Falling intonation contour. Yip's (2004: 979-980) analysis posits underlying HL syllables that may or may not surface as such based on dialectal variation.

[18] Yip (2004) offers a different analysis of Osburne's (1975) data. Based on the observation that toneless syllables all end in an oral stop, glottal stop, or glottalized sonorant, tone and laryngeal features are treated as part of the same contrast. So, a syllable is lexically assigned tone features [L], [H] or [ʔ], with each syllable carrying at least one, and not more than two, specifications.

Underlying	Faithful	Variant	Phonological process
CV	L$^{?}$	L	Deglottalization
		H$^{?}$	Peak Delay
CV́	H$^{?}$	L	Deglottalization, H-deletion
		L$^{?}$	H-deletion
CVV	LL	HL	Peak Delay
CV́V	HL	L	H-deletion
		H	H-retraction[19]
CVV́	LH[20]	HL	H-retraction

Table 2. Underlying contrasts and surface pitch patterns in Khumi (Peterson 2019)

However, in some phonological contexts, these underlying tones are predictably realized as the pitch pattern in the third 'Variant' column of Table 2. The processes that result in the variant patterns are found in the fourth 'Phonological Process' column, and further described below.

(a) Deglottalization: Non-final CV and CV́ lose their glottalization and surface as long.
(b) Peak Delay: CVV́ spreads H onto a following toneless mora.
(c) H-deletion: H deletes after H.[21]
(d) H-retraction: H shifts left to an immediately preceding toneless mora.

Peterson's study encountered more variant pitch patterns that surface in certain morphosyntactic contexts (locative, genitive, irrealis, negative, and imperative), with 12 total pitch patterns listed. For example, in the locative, the contrast between CVV and CVV́ is neutralized to a Gradual Rise, while the contrast between CV, CV́, and CV́V is neutralized to a long unchecked H.

In working to reduce the inventory of surface pitches that are useful for transcription to a smaller inventory of underlying tones, as Peterson does for Khumi, phonological and grammatical factors must be taken into account. The sections that follow treat these individual considerations in turn, including interactions between tone and consonants (Section 4), tone and syllable structure (Section 5), and tone and syllable position (Section 6). Section 7 discusses phonological processes involved in tone realization, while Section 8 focuses on morphosyntactic considerations.

4 Tone and consonants

Consonants are known to have an influence on f_0, in some cases leading to diachronic phonological change in tone systems. Since f_0 is tied to the speed of glottal vibration, relevant

[19] Only in non-final position.

[20] The Rise is more gradual in non-final position.

[21] H-deletion may also be related to the lack of underlying CV́V́.

consonantal features that tend to affect it are those involving the glottis. These include the voicing of onsets, and the presence of coda glottal stops /-ʔ/ and glottal fricatives /-h/, discussed in turn.

Onset voicing is known to have an influence on pitch realization; most commonly, voiced consonants are followed by lower f_0 on a following vowel than are voiceless or aspirated onsets. This relationship between onset voicing and lower tone has been observed across many languages from different families (Ohala 1973; Bradshaw 1999; Tang 2008). In English, the effect is localized to the initial edge of the vowel following the onset (Lisker and Abramson 1964; Chistovich 1969; Lea 1973), while in Japanese, it lowers f_0 for the duration of the vowel (Shimizu 1989; Oglesbee 2008). In languages where these effects are phonologized, consonants involved in pitch or tone lowering are called 'depressor consonants' or 'depressors'.

Laryngeal contrasts in Mizo onset stops have been linked to differences in the initial f_0 of the following vowel; and like English, the effect does not persist throughout the vowel. Lalhminghlui and Sarmah (2020) offer evidence from a nonce word production task that speakers of Mizo produce vowels with lower f_0 following voiced stops than following voiceless unaspirated or voiceless aspirated stops (with the highest initial f_0 following the aspirated series).[22] Working to mitigate this influence of surrounding consonants on pitch for automated tone detection in Mizo, Sarma, Sarmah, Lalhminghlui, and Prasanna (2015), opted to disregard the first and last 20% of the vowel; their model detected tones in a corpus with 70% accuracy. These types of study elucidate the relationship between f_0 (as measured) and pitch (as interpreted), helping us to understand the link between the phonetics and phonology of tone systems.[23]

Coda consonants, especially those with glottal features like /h ʔ/ have been known to affect pitch and condition diachronic tone change, for example in Vietnamese (Haudricourt 1954; Maran 1973; Matisoff 1973).[24] The tendency is for a final glottal fricative /-h/ to induce a falling pitch contour (due to the slackening of the vocal folds) and for a final glottal stop /-ʔ/ to induce a rising pitch contour (due to the tensing of the vocal folds).[25]

Ostapirat (1998), using comparative analysis and internal reconstruction of verbal stem alternation, suggests a similar tone split process may have occurred in Tedim (Tiddim) long syllables. In synchronic Tedim, all checked syllables (those with short vowels ending an oral or glottal stop) take L tone, but long syllables have three options: Level, Rising, or Falling tone. Ostapirat's analysis

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[22] Sarmah and Wiltshire (2010) also note statistically significant effects of consonant place and manner of articulation on f_0 in Mizo.

[23] These phonetic pressures tied to onset consonants may lead to diachronic change. Phonetic pitch lowering linked to onset voicing has been known to phonologize, as in the West African languages Ewe and Gengbe (Ansre 1961; Bole-Richard 1983; Lotven and Berkson 2019). One common result of this phonologization process is a phonotactic restriction, such as in Thai, where voiced stops are disallowed as onsets of syllables with H tone (Perkins 2011), and Kera, where the full range of tone contrasts is only available to syllables with sonorant onsets (Pearce 2005). This process may be responsible for the development of lexical tone (tonogenesis) or tone change, such as "tonal bifurcation," described in Hyman (2013) and exemplified by the Southern Bantu groups Nguni and Shona (Downing 2009). During tonal bifurcation, a voicing contrast (/*p*/ vs. /*b*/), realized in part through phonetic f_0 cues on the following vowel (/*pá*/ [*pá*] vs. /*bá*/ [*bă*]), is reanalyzed by speakers as a tone contrast (/*pá*/ vs. /*pă*/).

[24] Note that here the discussion of /-h/ refers to a voiceless glottal fricative, although often SC languages without coda /-h/ use an orthographic <h> to indicate a final glottal stop.

[25] Glottal stops are not always diachronically connected with pitch raising, since final glottal stops may be realized with attendant creaky voice on the preceding vowel, commonly associated with the realization of L or Falling pitch patterns (Hombert, Ohala, and Ewan 1979: 54).

treats this system as the result of a diachronic near-merger of open syllables with long vowels (*CVV), syllables with long vowels closed in a glottal stop (*CVV?), and syllables with long vowels closed in a glottal fricative (*CVVh). All three syllable types likely had underlying Level tone before the merger, but the tense glottal features of /-?/ were associated with a pitch rise and the lax glottal features of /-h/ were associated with a pitch fall; both pitch phenomena were reinterpreted as underlyingly contrastive. In modern Tedim, CVV syllables with Level tone derive from older open syllable rhymes, those with Rising tone derive from older glottal stop-final rhymes, and those with Falling tone derive from older glottal fricative-final rhymes.

Such interactions have likely conditioned tone change in other SC languages as well, especially in Maraic, which has seen especially radical reductions in coda consonants accompanied by an expansion of tonal contrasts (Lotven et al. 2019). It is for these reasons that segmental information and phonotactic restrictions on pitch pattern realization are necessary considerations in SC tone analysis.

5 Tone and syllable structure

Underlying tone and surface pitch realization often interact with syllable structure in SC. Common effects involve differences in pitch realization between syllables of different shapes. For example, in Zotung, a language with only CVV and CV? syllables, the underlying H vs. L contrast is realized as Convex [454] vs. Falling [42] on CVV syllables, but as High [55] vs. Low-Falling [31] on CV? syllables, when not neutralized (Shintani 2015: xxi).

Some analyses of SC tone do not appear to require reference to syllable structure. For example, in Sumtu, the contrast between L and H is realized on all minor and major syllables, although it is analyzed as underlying only for the latter (Watkins 2013: 84, 95); and Anal's contrast between L, H, and toneless morphemes applies to all major syllables, long and short, checked and smooth (Ozerov 2018: 712-713). Nonetheless, differences in tone realization based on syllable shape are commonly described in SC languages.

Some syllable shapes may be restricted to only one underlying tone. For example, all CVT syllables (where T refers to a voiceless oral stop—see footnote 7) are L in Falam, Kuki-Thaadow, Mizo, and Tedim; H in Thantlang Lai; LH in Hakha Lai; and HL in Tedim. CVVT syllables are all L in Hakha and Thantlang Lai; HL in Falam, Kuki-Thaadow, and Mizo; and LH in Tedim (Hyman and VanBik 2002a; Hyman 2007, 2014a; Ostapirat 1998). These cases may indicate that there are limited underlying tones available to certain syllable types, especially those with short vowels and/or obstruent codas, or that certain types are assigned a default tone. Regardless of analysis, the range of attested interactions between syllable shape and tone indicates that syllable structure phonotactics are crucial considerations in the investigation of SC tonal phonology.

In Tibeto-Burman languages more broadly, syllable shape descriptions often divide syllables first into minor and major syllables. This split describes the difference between the first and second syllables of an iamb, as in the Zophei word *pa hnaa* 'snore'. Matisoff (1989) refers to this minor+major syllable iambic structure as a 'sesquisyllable'. More than one minor syllable may precede a major syllable, but minor syllables are never found on the final edge of a prosodic word or phrase. Minor syllables are discussed in Section 5.1 and major syllables in Section 5.2.

5.1 Minor syllable tone

Minor syllables often do not have access to the full range of tonal contrasts available to major syllables, in part due to their shorter duration (Matisoff 1989; Henderson 1952; Thomas 1992; Butler 2014). For example, Lemi minor syllables do not exhibit a tonal contrast and are realized with default mid pitch (Herr 2011: 58); and while Sorbung's major syllables contrast L, M, and H tone, minor syllable tone is dependent on phonological context (Mortensen and Keogh 2011: 79-82).[26] In Hakha Lai, minor syllables are toneless, an analysis supported by evidence from compounding, wherein a major syllable loses its tone when shortened to a minor syllable. For example, when HL *hnáà* 'ear', LH *kèé* 'leg', and L *sàà* 'animal' appear as the first word in a compound, they are reduced to toneless minor syllables, realized with a "mid-to-high pitch," as in ***hna*** *hmáà* 'ear wound', ***ke*** *hmáà* leg wound' and ***sa*** *hmáà* 'animal wound' (Hyman and VanBik 2002a: 17).

In Zophei, tone is not predictable from syllable structure, and minor syllables can surface with L, M, or H pitch, as in the following words: ***tlà*** *sa?* 'let boil', ***ra*** *møø* 'bamboo', and ***rá*** *lɨɨ* 'ocean'. When a major syllable is shortened to a minor syllable, its tone remains; for example, when the negative marker *bè?* occurs before the 2nd person singular marker *tsi?*, the resulting iamb is realized as *bà tsi?*, retaining L tone on the minor syllable. While minor syllables in some SC languages like Lemi and Hakha Lai do not contrast in pitch, Zophei shows that SC researchers should take care to investigate tone across all syllable shapes.

5.2 Major syllable tone

Major syllables, those without restricted distribution or reduced inventories, are often divided into checked and smooth syllables in analyses of SC languages, such as Hakha Lai (Hyman and VanBik 2002a) and Hyow (Zakaria 2018). Checked syllables are closed with an oral or glottal stop (CVVT, CVT, CV?), while smooth syllables include open syllables and syllables closed with a sonorant (CVV, CVVN, CVN).

In many Sino-Tibetan languages (Bola, Maru, Tangkhul, Trung, Jingpho, Karen, Xiamenese, Cantonese), there are fewer tonal contrasts available to shorter or checked syllables (Hyman 2014a). For example, Tedim smooth syllables have Level, Rising, or Falling surface pitch patterns, while checked syllables have only Low pitch (Ostapirat 1998: 242). Likewise, Daai has a lexical tone contrast between H (realized as a High-Falling pitch) and L (realized variably as L, M, or H); this contrast shows up on CVV, CVN, CVVN, and CVVT syllables, but not CVT ones (So-Hartmann 2009: 47-49). And Bawm smooth syllables contrast L, H, and HL tone, while checked syllables only contrast L with H (Löffler 1972).

Checked syllables do not usually occur with contours, part of a cross-linguistic tendency for contour tones to prefer longer vowels (Gordon 2001; Yip 2002; Zhang 2002). In Vaiphei, for instance, L can be realized on all syllable shapes, but Falling and Rising tone cannot show up on syllables ending in glottal stops (Suantak 2013: 121). Such interactions between syllable structure and tone

[26] Minor syllables may have reduced segmental inventories as well, as discussed in Mortensen (2023). For example, only 10 out of the 22 onset consonants in Lemi can occur in a minor syllable (Herr 2011: 58), and minor syllable vowels may undergo harmony processes, described for Hyow (Zakaria 2017: 68-69) and Lamkang (Thounaojam and Chelliah 2007: 30-35).

have led some researchers to suggest final glottal stops in checked syllables are not segments, but rather a feature of tone (Chhangte 1986; Yip 2004; Peterson 2014, 2019).[27]

However, these restrictions do not exist for all SC languages, some allowing contour tones to surface on checked syllables. Zotung's Falling [31] tone occurs in syllables closed with a glottal stop (Shintani 2015). Lamkang allows for Falling and Rising tone realization regardless of syllable type (Thounaojam and Chelliah 2007) and Thantlang Lai checked syllables can surface with LH or HL contours (Hyman 2014a). Such contours are often described differently from smooth syllable contours: for example, Kuki-Thaadow is described as having "sharp" contours that usually occur on diphthongs and CV? syllables (Krishan 1980: 28-29).

Contouring may also involve vowel lengthening; and contour simplification may involve vowel shortening. In Falam, long vowels with a Rise are realized as extra-long and short vowels with a Rise are realized as half-long (or long, on the final edge of a word) (Osburne 1975: 54). Lengthening occurs in derived environments in Zophei, such as when H tone marking subject/object plurality appears on the CV? prohibitive marker *khe?*. When the stem is toneless, this plural H lengthens the final syllable to a MH rise, as in *miing khe?/**kheé*** 'Don't watch him/***them***', and to a HMH Concave tone when the stem is H, as in *báá khé?/**khéeé*** 'Don't feed him/***them***'.[28] In Mizo, if a process shortens a syllable with a contour, the tone is simplified according to the second member of the contour: LH to H and HL to L (Chhangte 1986: 45-49). These examples show that while some languages may limit contours to smooth syllables, others may lengthen checked syllables to accommodate contours.

5.3 Summary

Even in cursory descriptions of SC tone systems, the importance of syllable shape is commonly noted, indicating widespread relevance in SC languages. While smooth syllables usually have access to the largest inventory of tones in a language, minor syllables and checked syllables usually see a reduction. Minor syllables surface with default or context-dependent pitch in Lemi, Sorbung, and Hakha Lai. Likewise, checked syllables are analyzed as having limited underlying tones in Falam, Tedim, and Daai. Even in languages where contours show up on checked syllables, their realization is often described differently from contours on smooth syllables, as in Falam and Kuki-Thaadow. Synchronic processes where tone and syllable structure covary, as in Zophei and Mizo, offer opportunities for the study of their interaction. In addition to syllable-based phonotactic

[27] The contrast between CVV and CV? in SC languages may also be characterized, depending on language-specific processes, as a contrast between long /CVV/ and short /CV/ syllables (Lotven et al. 2019). The analysis of CV? as a short open syllable is less clear in languages where the final glottal stop may be analyzed as a consonant, for example, for the purposes of morphological operations as in Senthang (Ngun Tin Par 2016). However, some Maraic languages, like Mara (VanBik 2009) and Zophei (Lotven 2021), have undergone syllable restructuring by merging CVV and CV?, and then re-innovating CV? from CVT. In these languages a simple long vs. short distinction for open syllables may be appropriate. To avoid confusing minor syllables with short major syllables, I use the glottal stop <-*?*> to mark checked syllables in Zophei (a language that lacks obstruent codas).

[28] The Concave tone in Zophei is likely the result of both H tone spread from the stem onto the prohibitive marker, and the avoidance of two adjacent underlying H tones, resolved through contouring (see the Obligatory Contour Principle: Leben 1973; Goldsmith 1976; Odden 1986).

restrictions on underlying tone and surface pitch realization, the position of a syllable within a word or phrase is also a reported factor.

6 Tone and syllable position

In many SC languages, contours are limited to the final edge of a prosodic word or phrase, where contours are cross-linguistically more common (Gordon 2001; Yip 2002).[29] In Zotung, for example, all tonal contrasts and contours are limited to occurring "at the end of a semantic junction" and are neutralized elsewhere to a "slightly rising rhythm" (Shintani 2015: xviii). In Sumtu, pre-pausal H is realized as HL, which Watkins (2013) analyzes as involving a final boundary L tone that docks to the H to form a HL contour. In Southern Bawm, Reichle (1981: 13-14) describes 'Raised' tone as only occurring on demonstrative, emphatic, and phrase-type morphemes limited to phrase-final position where the vowel length contrast on Raised syllables is neutralized. Other SC languages permit non-final contours, such as Zophei, where Falls (but not Rises) appear non-finally (Lotven 2021).

Even closely-related SC languages and dialects differ in whether they permit non-final contours. Hakha Lai and Falam do, but Thantlang Lai does not. In Hyman's (2007) analysis, contour tones are disallowed before like tones in Falam (*LH-H, *HL-L), before unlike tones in Hakha Lai (*LH-L, *HL-H), and before any tone in Thantlang Lai. Thus, unlike in Falam where LH-L is a licit sequence, it is not found in Hakha Lai (ruled out by the fall between syllables), or in Thantlang (ruled out by the nonfinal contour).[30] While Hakha Lai avoids pitch changes between syllables and favors pitch changes within syllables (i.e., contour tones), Thantlang Lai and Kuki-Thaadow favor pitch changes between syllables, allowing contours to surface only at the end of an utterance. In effect, Kuki-Thaadow utterances *may* end in a contour (with level pitch also available to final syllables), but Thantlang Lai utterances *must* end in a contour Hyman (2007, 2010).

To account for the often constrained realization of contour tones, researchers consider two options: (1) level tones are underlying and may be realized as contours in some contexts (finally), or (2) contours are underlying and may be reduced to level tones in some contexts (non-finally). Shintani's (2016) analysis of Matu involves the former—Pre-pausal H and M on smooth syllables are realized as Rises. Zakaria's (2018) analysis of Hyow, on the other hand, involves the latter—HL tone only shows up in pre-pausal position and is reduced to H elsewhere. In competing analyses of Falam, both strategies have also been employed. Thuan (2008) makes use of contour simplification,

[29] Hyman and VanBik (2002a, 2004) note that three out of the four phonological changes to underlying tone observed in their Hakha Lai data affect the final tone of a sequence. And although final edge phenomena appear more often than initial edge phenomena in the SC literature and occupy the bulk of this discussion, initial edge phenomena are also attested. In Kuki-Thaadow, an initial boundary L tone conditions a change from %L + H to LH in utterance-initial or post-pause position (Hyman 2010).

[30] According to Hyman (2007: 12), Thantlang Lai avoids jumps from L to H across a syllable boundary, which works to unify both phrase- and word-level tone alternations. The effects of this ban on L-H are visible in the morphological process of compounding (or genitive marking). Underlying L-H in /*bòòy vóók*/ [*bòòy vŏk*] 'chief's pig' and underlying L-HL in /*bòòy zóòng*/ [*bòòy zòóng*] 'chief's monkey' both surface as L-LH, avoiding the L-H jump. Nominal compounds in Thantlang, thus, surface with only three tone patterns: H–LH, H–HL, and L–LH. These observations and analyses serve as the basis of an Optimality Theoretic treatment in Lin (2005).

claiming underlying LH and HL only surface phrase-finally. Osburne's (1975) analysis, on the other hand, treats LH as underlying and HL as derived.[31]

Observations and analyses of final-edge phenomena involving contour tones have been presented as part of the grammars of many SC languages. Some languages only permit contours on the final edge of a word, phrase, sentence, or utterance, while others, like Zophei, allow Falling contours to show up non-finally. These claims are supported by phonological and morphological phenomena involving final lengthening of checked syllables to accommodate contours and non-final shortening of smooth syllables, simplifying contours to level pitches. These and other phonological phenomena are further discussed in the following section.

7 Phonological processes

Hyman and Schuh (1974), Hyman (2009), and Cahill (2008) discuss phonological processes common in the world's languages, including tone spreading, contouring, and contour simplification. Many of the processes discussed in these sources are also found in SC languages, some included in Hyman (2009). This section describes some of these processes with exemplification from SC languages. Processes that affect tone height (vertical assimilation) are addressed in Section 7.1. Tone spread from one syllable to another, involving replacement or contouring (horizontal assimilation), is addressed in Section 7.2. The simplification of contours through tone absorption is briefly treated in Section 7.3. Section 7.4 discusses tone polarization, which is reported in multiple SC languages. Section 7.5 provides a discussion of Kuki-Thaadow tone processes from Hyman (2010, 2021).

7.1 Vertical assimilation

Vertical assimilation refers to a change in tone height, lowering H to M before/after L, or raising L to M before/after H (Hyman and Schuh 1974; Hyman 1975, 2009). Vertical assimilation is more commonly perseverative (affecting the second tone in a pair), and more commonly reported for rises (L-H realized as M-H or L-M) than for falls (H-L realized as H-M or M-L). Zophei offers an example of a (common) perseverative process that (uncommonly) works to avoid Falls. The language permits L-H Rises across a syllable boundary, but not H-L Falls. The usual result is a H-M Fall; for example, at the final edge of the prosodic word, the L negative marker *bè?* is raised to M after H, as in *báá be?* 'She didn't feed him', avoiding H-L in favor of H-M.

7.2 Horizontal assimilation

Horizontal Assimilation refers to spreading tone features from one syllable to another. Spreading rules are diverse, varying along a number of parameters that are discussed with examples below (Archangeli and Pulleyblank 1994; Hyman 2009):

[31] Thuan (2008) claims the simplification of contours is due to a dissimilation process that neutralizes both LH and HL contours to H before L(H), and to L before H(L). In this analysis, Falam avoids adjacent identical tones, so contours are simplified to preserve an alternating tone pattern (LH-LH-LH-LH surfaces as L-H-L-H). For Osburne (1975), underlying LH is realized as L before (L)H and as H elsewhere. In final position, where underlying LH surfaces faithfully, HL is derived, realized with a final Falling intonation contour. However, methodological and dialectal differences complicate comparison of these two analyses.

(a) ***Domain***: Does spread occur in a limited domain?

Some spreading processes apply when the right conditions are met in any prosodic word or phrase, while others are limited to only certain morphological contexts. In Hyow, some possessive and person-marking prefixes borrow tone from the following verb: H if the verb is H(L), and L if the verb is L, a process Zakaria (2018: 67) analyzes as only applying within words.[32] On the other hand, spreading processes that occur between words suggest that the domain in Hakha/Thanthlang Lai, Falam, and Kuki-Thaadow is the intonational phrase (Hyman 2007).

(b) ***Direction***: Is spread from left to right (common) or right to left (uncommon)?

Some processes in SC are described with rightward spread. In Falam, the tone of a toneless suffix is dependent on that of the preceding syllable. Only LH contours trigger the spread, so these morphemes are realized as H after a contour (LH) or L elsewhere (after a H or L) (Osburne 1975: 84). However, in some SC languages, tone spread is described as preferring the uncommon leftward direction, in some cases having to do with the realization of tone on minor syllables. For example, *tsə* 'anymore' in Senthang can be realized as L or H based on the following syllable tone. Ngun Tin Par (2016: 58) analyzes *tsə* as underlyingly H, which surfaces in most contexts, but the morpheme is realized as L before another L syllable.[33] Leftward spread is not limited to minor syllables however. In Zophei, the underlying H tone verb *báá* 'feed' is realized as HM before L in *a báa bà tsí?* 'You didn't feed yourself', where H partially assimilates to the following L since HL is not a licit Fall in the language (Lotven 2021).

(c) ***Extent***: Is the spreading bounded or unbounded within the domain? (i.e., does it affect adjacent syllables only or continue to a domain edge?)

Spreading processes in SC languages are usually described as bounded, limited to only adjacent syllables: see examples in (b), above.

(d) ***Attractors***: Does the process target a position? (e.g., the domain edge, a stressed or prosodically strong syllable)

When contours appear non-finally in the world's languages, they tend to target stressed syllables or those in strong prosodic positions (Zhang 2002). Since structure of the 'sesquisyllable' in SC languages favors iambic feet, prosodically *weak-**strong***, over trochaic feet, prosodically ***strong**-weak*, it is not often clear whether contouring is licensed by the final

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[32] In SC word-formation processes, non-final morphemes commonly undergo tone change. In Paite, Falling and Falling-Rising tones are both neutralized to Rising tone when they show up on the first member of a bi-syllabic compound (Singh 2006). And in Vaiphei, a L morpheme is realized with a Rise when it is the first member of a compound (Suantak 2013: 122).

[33] It is also worth noting that some word formation processes involve tonal allomorphy, wherein a morpheme's underlying form differs according to context. In Thantlang Lai, an agreement or possessive prefix is H before HL, and HL before H, which is not due to normal phonological processes in the language. In Kuki-Thaadow, person prefixes in the nominal and verbal domain also have tonal allomorphs: L before H(L) and HL before L. Tonal allomorphy is not limited to prefixal elements in Kuki-Thaadow—the postverbal dual and irrealis markers have L and HL allomorphs depending on the preceding tone, as well (Hyman 2010).

edge or the prominent syllable. See Section 6 for examples of processes that target this position.

(e) ***Inhibitors***: Do segments block spread? (e.g., depressor consonants)
Spread may continue within a domain until it is impeded by other segments, especially depressor consonants. Phonological depressor consonant effects have not been described for SC languages, and spreading is most often bounded, so inhibitor effects have not been reported for SC languages.

(f) ***Target delinking***: Is spread complete (e.g., L-H → L-L) or partial (e.g., L-H → L-LH)?
Spread that erases the tone of the target is considered complete, while spread that preserves the tone of the target through contouring is considered partial. Partial spread is described for Kuki-Thaadow (Hyman 2010), where underlying /L-H/ is realized as [L-LH] and /H-L/ is realized as [H-HL]. Complete spread is not usually noted for SC languages; and when spread that appears complete is observed, the target is often analyzed as toneless, so there is no loss of underlying tone.

(g) ***Trigger delinking***: Does tone spread (e.g., H-L → H-HL) or shift (e.g., H-L → L-HL)?
Tone spread where the trigger does not maintain its tone is considered tone shift. Hyman (2021) notes apparent examples of this phenomenon in Kuki-Thaadow, analyzed as the result of interactions between H and L tone spread. For example, a sequence of L+H+L, as in /*kèèl+góóng+gùùp*/ 'goat+thin+six', surfaces as L+L+HL in [*kèèl gòòng gúùp*] 'six thin goats'. Here, L on the first syllable spreads to the following syllable to form a LH contour (which cannot surface non-finally), and H on the second syllable spreads to the third syllable to form a HL contour. In the end, the second syllable H (which triggers H spread) does not surface on the trigger syllable, only on the final syllable.

(h) ***Iteration***: Does tone spread create the conditions to repeat the process?
Hyman and VanBik (2004: 832-834) offer an analysis of tone change from an underlying Rise to a surface Fall, which occurs in phrase-initial position, as well as after a Rising tone in Hakha Lai. Thus, a series of three underlying Rises LH-LH-LH is realized as %HL-HL-HL in initial position and as LH-HL-HL in non-initial position (not following a Rise). This process occurs iteratively such that a series of Rises is realized as series of Falls as long as the left-most underlying Rise is in phrase-initial position.

7.3 Absorption

Contours may simplify when next to like tones, in other words LH-H may simplify to L-H and HL-L may simplify to H-L, where the second tone of the contour merges with the following syllable. This process is more commonly progressive, as described for Mizo and Bawm. In Mizo, when a long vowel with LH tone appears before a syllable with H or HL tone, the vowel is shortened and /LH-H(L)/ is reduced to [L-H(L)] (Chhangte 1986: 49-50). In Bawm, HL is realized as H before a L, so the underlying sequence /HL-L/ surfaces as [H-L] (Löffler 1972: 286).

7.4 Polarization

Many SC languages are described as having tone processes where a morpheme takes the polar opposite tone from its neighbors. For example, the nominalizing suffix *-tí?* in Hyow alters underlying stem tone, rendering preceding H tone stems L (Zakaria 2018: 86-89).[34] Anal offers an example of spreading and polarization that occurs when a stem has two or more toneless suffixes. In (1-2), nouns are suffixed with two toneless morphemes: the plural marker *hin* followed by *tʰuŋ* 'inside'. The L tone from *kʰù* 'village' in (1) and the H tone from *ín* 'house' in (2) spread onto the plural marker, realized as L in the former and H in the latter. The second toneless affix *tʰuŋ* takes the polar opposite tone from the plural marker, H in (1) and L in (2), resulting in a LLH or HHL pattern across the word (Ozerov 2018: 714).

(1) *kʰù-hìn-**tʰúŋ***
village-PL-inside
'inside villages'

(2) *ín-hín-**tʰùŋ***
house-PL-inside
'inside houses'

In Sumtu, if two or more toneless morphemes, such as *-khɔ* 'also' or locative *-a*, are in a sequence, they take the polar opposite tone from each other, as well, resulting in an alternating HLHL or LHLH sequence according to the tone of the root (Watkins 2013). Sorbung offers evidence of a general dissimilation rule, where a sequence of two adjacent smooth syllables with H tone (/H-H/) is realized as [H-M] (Mortensen and Keogh 2011). Zophei similarly avoids sequences of L-L, with the most common repair strategy being raising of the second tone to M, resulting in a L-M sequence (Lotven 2021).

In polarization rules, contours may be treated differently depending on the language. For example, in Mizo, pronominal clitics take the opposite tone from the following syllable, a process which considers only the first tone in LH and HL contours (Chhangte 1986: 42-43). Northern Bawm phrase-type markers are analyzed as underlyingly M (or Rising), but they are realized as L before a morpheme with a higher tone (H or Rising) (Reichle 1981: 13-14).

7.5 Case study: Kuki-Thaadow

Hyman's (2010, 2021) analysis of Kuki-Thaadow identifies several processes discussed in this section, including tone spreading and absorption. Consider H tone spread, analyzed in Hyman (2021). When the H tone noun *zóóng* 'monkey' is followed by a H or HL modifier, there is no change to either tone, as in *zóóng thúm* 'three monkeys' and *zóóng gíèt* 'eight monkeys'. However, when it is followed by the L tone modifier *gùùp* 'six', H spreads to the second morpheme, resulting in a Fall: *zóóng gúùp* 'six monkeys'. L tone spread likewise fails to apply when a L tone noun like *kèèl* 'goat', is followed by a L or HL modifier, for example, in *kèèl gùùp* 'six goats' and *kèèl gíèt* 'eight

[34] Additionally, the expansive and diminutive suffixes in Hyow (both with HL tone) trigger a change in the stem tone from HL to H, or from H to L (Zakaria 2017).

goats'. When followed by a H tone modifier, L spreads rightward, resulting in a Rise, as in *kèèl thŭm* 'three goats'.

Table 3 summarizes these and other phenomena in Kuki-Thaadow. In (3a-c), a non-final HL contour is realized as H, accomplished through L tone spread (3a) or downstepping (3b-c), depending on context. In (3a), L spreads to the final syllable (where contours may surface in the language) and it associates with H to form LH. In (3b), L spread onto the following H cannot result in a non-final contour, so the following H is downstepped (ꜜH). (3c) similarly shows downstepping applied to HL to form a downstepped Fall (ꜜHL).

In (3d-e), as discussed above, H and L spreading derive final contours: HL from H spread, and LH from L spread. In (3f), no final contour surfaces due to a simplification of the prefinal HL to H before L, through absorption.

	Underlying	**Surface**	**Phonological process**
a)	HL + H	H-LH	L spread
b)	HL + H + H	H-ꜜH-H	Downstep
c)	HL + HL	H-ꜜHL	Downstep
d)	H + L	H-HL	H spread
e)	L + H	L-LH	L spread
f)	HL + L	H-L	Absorption

Table 3. Tone processes in Kuki-Thaadow (Hyman 2010)

Several of these processes have the effect of avoiding non-final contours. In (3a, d-e) final contours are derived through spreading, while in (3b-c, f) non-final contours are avoided through downstep and absorption. Research on Kuki-Thaadow reveals the complexities of SC tone systems and their value to our typological and theoretical understanding of contouring, contour simplification, downstep, and tone spread, among other phenomena.

Beyond the mechanics of these phonological processes, it is worth focusing, more specifically, on the domain of application. While some processes apply to any word or phrase that provides the appropriate phonological context, others are limited to certain word classes or even specific morphemes.

8 Grammatical tone

Tonal phenomena that are not attributable to the regular phonology of a language, and are limited in application to only certain morphological and syntactic contexts, are grouped together under the term 'grammatical tone' (Rolle 2018). Languages that make use of grammatical tone are often described as using it for multiple processes; for example, Anal uses tone in marking tense-aspect-modality (TAM) distinctions and person agreement in the verbal complex (Ozerov 2018). SC languages are reported to use tone in expressing a wide variety of grammatical concepts, including polarity, transitivity, mood, syntactic category, subordination, nominalization, and relativization, some of which are closely connected phenomena, both synchronically and diachronically.

There are many examples of tone tied to the exponence of certain morphological and syntactic processes in SC languages. This section addresses the connection between tone and morphological exponence in Section 8.1, before turning to the role of tone in marking plurality in Section 8.2 and stem alternation in Section 8.3.

8.1 Tone tied to morphological exponence

Identifying and analyzing grammatical tone involves consideration of the relationship between tone and meaning. Since tone is always realized on segments, it is the work of the analyst to decide whether a morpheme's tone is baked into its lexical entry, or whether it should be treated separately. Consider, first, a clear case of lexically-specified tone: the tonal minimal triplet *ley* 'tongue', *lěy* 'earth', and *lêy* 'bridge' in Sizang does not have transparent semantic connections, so it likely involves three words that have accidentally identical segments and differ in lexical tone (Sarangthem 2010: 76). A somewhat less clear case is found in Falam plural subject and object markers, which, in addition to a final *-n*, have H tone: compare the first person singular *ka-* to the plural *kán-* (Osburne 1975: 115). Here, like the unrelated lexical items in Sizang, we could analyze these surface forms as faithful realizations of underlyingly different morphemes. But, unlike the Sizang example, these two forms each include 1st person information, so we could alternatively split *kán* into two morphemes: (1) *ka*, a first person marker that is not specified for plurality, and (2) *x́-n* (where x is the base), marking plurality with a combination of tone and coda consonant.

Tone tied to agreement marking is commonplace in SC languages. For example, in Senthang, tone alone differentiates a singular (H) from a plural (L) subject proclitic in affirmative declarative contexts—*ká* (1st person singular subject) is distinct from *kà* (1st person plural subject) (Ngun Tin Par 2016: 92). Like the previous Falam example, the difference between these surface forms may be analyzed in terms of lexical tone (singular subject clitics are underlyingly H, plural subject clitics are underlyingly L) or grammatical tone (subject clitics are unspecified for plurality, which is indicated with H tone).[35]

A similar situation is reported in Hyow, where tone alone differentiates certain combinations of subject and object. The 1st person object and the 3rd person subject of a transitive verb are both marked with a vowel that harmonizes with the stem vowel (e.g., *o-* in the case of a verb root like *bop*). The 3rd person subject may be omitted before a 1st person object, leaving two cells in the agreement paradigm that are segmentally identical (involving just one harmonized proclitic vowel). So, L on that initial vowel in *ò-bóp* 'He beats me' indicates a 1st person object, and H on that vowel in *ó-bóp* 'He beat him' indicates a 3rd person object (Zakaria 2018: 74, 323-324).

Morphological processes where no segmental content is involved are widely attested in SC. According to Hyman (2010), Kuki-Thaadow makes use of H tone to mark genitives, disambiguating right- from left- branching noun phrases (i.e., 'goat's leg bone' vs. 'goat-leg's bone'), and agentive nominalizations from others (i.e., 'goat-biter' vs. 'goat-biting').[36] Hyman speculates that this marking

[35] Another similar example of grammatical or lexical tone (depending on analysis) involves the directional morpheme *va-* in Senthang which differentiates andative *vá séi?* 'go!' from venitive *và sèi?* 'come!' on the basis of tone—tone that also spreads rightward to the verb stem (Ngun Tin Par 2016: 40).

[36] Löffler (1972: 288) also notes this type of behavior in Bawm, linking it to L intransitive/H transitive pairs further discussed in Section 8.3, for example, *thìng chàr* 'dry wood' and *thìng chár* 'wood-drying' or 'dried wood', likely related to stem alternation.

may have developed diachronically from a genitive morpheme related to either the enclitic possessive marker *-áa* or the proclitic 3rd person possessive marker *a-*.

Zophei also uses tone to mark possession in limited contexts. Like many other SC languages, the third person singular possessive marker in Zophei is *a-*, and in Tlawngrang Zophei, the process is fully productive. In the Lawngtlang variety, on the other hand, this prefix fails to apply to nouns that begin with /*a*/ lexically. Words that have H tone on either syllable, (e.g., *ahmíí* 'food dishes', *ákyy* 'bee', and *ázoong* 'monkey') resist this prefix, resulting in gaps that may be filled through other periphrastic constructions. If the noun is toneless, however, it belongs to a small class of words that mark possession with a final H tone, as presented in Table 4.

	Noun	**Gloss**	**Possessed noun**	**Gloss**
a)	*ahluo*	'saw'	*ahlúó*	'his saw'
b)	*athleeng*	'grave'	*athlééng*	'his grave'
c)	*atshɨɨ*	'sesame seed'	*atshɨ́ɨ́*	'his sesame seed'
d)	*atɯɯ*	'hoe'	*atɯ́ɯ́*	'his hoe'

Table 4. H tone as a possessive marker in Zophei

Grammatical tone research reveals tone phenomena that are synchronically and diachronically derivable from segmental morphology, offering evidence of their historical origins. For example, in Anal, some contexts allow the 1st person subject marker *níŋ* to be omitted, resulting in compensatory lengthening and/or tone change (Ozerov 2018: 721). SC languages offer opportunities for the study of diachronic change from morphemes with particular morphophonological tone behavior to morphemes without segmental material. The following section discusses evidence of the historical grammaticalization of tone in marking plurality.

8.2 Plural marking

Plural marking has been linked with H tone in several SC languages. As previously discussed for Falam (Osburne 1975), this plural H may show up on agreement morphemes, but in other languages, it may also surface on verb stems or other verbal morphology, as in Senthang and Zophei. In Falam, H tone (in addition to *-n*) redundantly marks plurality on agreement markers; Senthang, Zophei, and Sumtu distinguish some plural agreement morphology entirely with tone. In the latter, while dual forms take a LH pattern, plural forms take a HH pattern, notably rare for sequisyllables in a language previously mentioned for its tone polarization processes (Watkins 2013: 125).

In Senthang, H tone involved in plural marking is tied to the morpheme *há*^{i} but may be instead realized on a preceding morpheme, such as the verb stem or other post-verbal morphology. Consider the imperative negator *la*^{i}, which is realized as M in the singular in (3), as well as in the plural in (4) when followed by the plural marker *há*^{i}. In constructions where the segmental plural marker *há*^{i} is left out, *la*^{i} surfaces with both tones, and is realized with a MH Rise, as in (5) (Ngun Tin Par 2016: 96-100).

(3) ∅ *ɖʂɛŋ* *la*^{i} *tsì=ʔ*
3O beat.up NEG 2s=IMP
"Don't beat him up."

(4) ∅ *ɖʂɛŋ* *la*^{i} *há*^{i} *tsì* *ʔú=ʔ*
3O beat.up NEG PL 2s PL=IMP
"(Y'all) don't beat them up."

(5) ∅ *ɖʂɛŋ* *lă*^{i} *tsì* *(ʔú)=ʔ*
3O beat.up NEG.PL 2s (PL)=IMP
"(Y'all) don't beat him up."

In Zophei, similar phenomena are noted with the cognate plural marker *héé*, which triggers a change to the following or preceding morpheme depending on context. When this segmental morpheme shows up, it has H tone, as in (6), but in some non-final contexts, the segmental content is absent and the H tone remains. In (7b), contrasted with (7a), the plural H tone is realized on the following 2nd person marker only and the segmental *hee* marker does not appear.

(6) *naa* *mììng* *héé* *tsíʔ* *máa*
2S watch PL 2.PL Q
'Did y'all watch yourselves/each other?'

(7) a. *a* *mììng* *ma* *tsiʔ*
INTR watch NEG 2S
'You didn't watch yourself.'

b. *a* *mììng* *ma* *tsíʔ*
INTR watch NEG 2.PL
'Y'all didn't watch yourselves/each other.'

Segmental plural marking on Zophei transitive verbs is, in some contexts, optionally interpreted as applying to the logical subject or object; and this independence from participant agreement morphology also applies to the plural H tone marker. While in (7b) H tone on the *tsiʔ* 2nd person subject marker indicates subject plurality, the same may not be true of (8). In (8), even though the 2nd person subject marker may be interpreted as singular, it appears with plural H—which may be interpreted as indicating the plurality of an otherwise unexpressed 3rd person object.

(8) ∅ *báá* *ba* *tsíʔ*
3O feed NEG 2.PL
a. 'You did not feed them.'
b. 'Y'all did not feed him.'
c. 'Y'all did not feed them.'

Even when there is no segmental agreement morphology, as in the imperative constructions with 3rd person objects shown in (9-10), plural H tone can appear on other morphemes, like the

toneless prohibitive marker *khe?*. In (9) the toneless verb and toneless prohibitive marker both surface with M tone, but in (10) when the subject (the addressee) and/or the object is plural, H tone surfaces on the final edge of the prohibitive marker. This plural H lengthens the CV? syllable to accommodate the MH rising contour.

(9) ∅ *miing* *khe?*
3O watch PROHIB
'Don't watch it!' (singular addressee)

(10) ∅ *miing* *kheé*
3O watch PROHIB.PL
'Don't watch it!' (plural addressee)
or 'Don't watch them!' (singular/plural addressee)

When there is no post-verbal morphology, as in (11-12), plural H may surface on a morpheme to the left (as in Senthang), in this case on the verb stem. A toneless verb with singular arguments surfaces as M in (11) and as MH when one or both of the arguments are plural, as in (12).

(11) ∅ *miing*
3O watch
'Watch it!' (singular addressee)

(12) ∅ *miíng*
3O watch.PL
'Watch it!' (plural addressee)
or 'Watch them!' (singular/plural addressee)

In summary, H tone has been linked to plurality in several SC languages including Falam, Sumtu, Senthang, and Zophei. While all four of these languages use H tone in pre-verbal agreement to some extent in marking plurality, plural H also shows up on the verb stem or other post-verbal morphology in the Maraic languages Senthang and Zophei. Trade-offs between segmental *háʲ/héé* postverbal plural markers and plural H offer evidence of diachronic change and grammatical tone development. A notable difference between the behavior of plural H in these two languages is that in Senthang, it associates to the left of the position of the omitted segmental marker, but in Zophei, it associates to the right if there is an available host morpheme, or to the left if there is not.

Investigations of plural H in SC languages contribute to our understanding of grammatical tone and its diachronic development, especially in the phonologically innovative Maraic group of languages. The following section discusses stem alternation, a near-ubiquitous phenomenon in SC languages that Henderson (1967: 171) describes as, "one of the most straightforward examples of…tonal morphology."

8.3 Tone in stem alternation

Verbs in SC languages often take one of two or more stems, depending on language-specific syntactic and pragmatic factors (see Bedell et al. 2023). Factors that license specific stems are varied, and include polarity, transitivity, mood, syntactic category, subordination, nominalization, and relativization (King 2009). Differences between stem forms appear as segmental and/or tonal alternations, although the derivation of one stem form from another is often unpredictable or only partially predictable. Alternations themselves may involve stem forms that have different vowels, coda place features, glottalization (of vowels or sonorants), syllable structure (CVV vs. CVC), and/or tone. Tone is involved in stem alternations for many SC languages, including Falam (Osburne 1975; Thuan 2008), Sizang (Sarangthem 2010), Mizo (Chhangte 1986), Tedim (Henderson 1967; Bhaskararao 1994), Hyow (Zakaria 2018), Vaiphei (Suantak 2013), and Zotung (Shintani 2015).

While stem forms (often referred to as Stem I, II, III) may be idiosyncratic, some researchers have noted restrictions on Stem II formation (usually occurring in transitive contexts, among others). Commonly reported limitations include a reduction in the number of tonal contrasts available to Stem II forms. Examples are reported in several languages:

- In Hyow, Stem I verbs are most often L or HL, while Stem II verbs are usually H (Zakaria 2018: 263).
- In Kuki-Thaadow, nearly all Stem II forms are L tone, with a few exceptional HL forms that are partially predictable by syllable structure (Hyman 2010).
- In Falam, Stem II (but not Stem I) verbs are restricted to L and HL tone (Thuan 2008: 91).
- In Paite, alternations involving segments (coda oral or glottal stop addition or substitution) neutralize Stem I tones to a Stem II Rise, and those involving only tone change neutralize Stem I tones to a Stem II Fall (Singh 2006: 25-28).[37]
- In Senthang, only H and L (not M) are available to Stem II forms (Ngun Tin Par 2016).

Although it is not predictable which verbs will exhibit stem alternation, researchers often note patterns that can fully or partially derive Stem II forms from Stem I forms. In Hakha Lai, where 80% of verbs exhibit stem alternation with tonal and/or segmental changes, Stem II forms are mostly predictable from the tone and syllable structure of Stem I forms; and nearly all Stem II verbs have Rising tone (Hyman and VanBik 2002b). In Falam, verbs with CVV or CVN structure in Stem I have predictable Stem II tone. In addition to segmental changes, L in Stem I corresponds to HL in Stem II, while other Stem I tones (H, HL, and LH) correspond to L in Stem II (Thuan 2008: 87-90).

While Central Chin languages like Hakha Lai and Falam preserve coda consonants commonly used in stem alternation, Maraic languages do not, which has put pressure on the system to use different contrasts or be lost. In Senthang, a Maraic language that retains a few coda consonants /m mʔ n ŋ/, seven patterns for alternation are described, some of which rely entirely on tone (Ngun Tin Par 2016: 75). In Table 4, patterns (4a, e-h) involve differences in tone between

[37] Singh (2006) calls Stem I forms 'simple', which occur in most contexts, including declarative, interrogative, negative, and imperative; Stem II forms are called 'infinitive', which occur in nominalizations. It is worth noting that there is no standard for use of the terms Stem I and Stem II.

stem forms, with stem forms in (4f-h) differing only in tone. Senthang also has some verbs with three stem forms, for example *ɔ̀ʔ* 'sleep.I', *ɔ́ʔ* 'sleep.II', and *ɔ́ɔ́* 'sleep.III'.

Pattern			**Example**			
CVV	↔	CV́ʔ	*tsoo*	↔	*tsóʔ*	'buy'
CV́h	↔	CV́V́	*hníʔ*	↔	*hníí*	'know'
Cúú	↔	Cáih	*túú*	↔	*táíʔ*	'sharpen'
Cúú	↔	Cámʔ	*kúú*	↔	*kámʔ*	'shoot'
CVŋ	↔	CV̀n	*tsɔŋ*	↔	*tsɔ̀n*	'learn'
CV́N	↔	CV̀N	*kún*	↔	*kùn*	'enter'
CV́V́	↔	CV̀V̀	*séí*	↔	*sèì*	'go'
CV̀V̀	↔	CV́V́	*vàì*	↔	*váí*	'visit'

Table 4. Stem alternation patterns in Senthang (adapted from Ngun Tin Par 2016: 75)

Zophei, a Maraic language that has lost all codas except for *-ŋ*, has limited stem alternation with only eight attested examples in Lotven (2021), all of which are underlyingly toneless (with tone realization dependent on context): *nuu/naʔ* 'hide', *lau/laʔ* 'get', *r~~ɯɯ~~/ruʔ* 'steal', *pii/piʔ* 'give', *tsuu/tsaʔ* 'buy', *ruu/raʔ* 'break', *phɯ̈/phiʔ* 'sweep', and *ɯ̈ saʔ/iʔ saʔ* 'let sleep'. Even the root verb in the last example has lost its stem alternation in favor of the Stem II form *iʔ* 'sleep' when not suffixed with the causative *-saʔ*.

As previously mentioned, stem alternation often involves changes to transitivity; and, although not always synchronically linked to stem alternation, many SC languages mark transitivity with tone. Löffler (1972: 288) describes links between tone and transitivity in Bawm, most clearly illustrated with intransitive/transitive verb pairs such as *chàr* 'to be dry' and *chár* 'to dry', predictably distinguished by L tone in the intransitive and H tone in the transitive. In Senthang, in addition to its involvement in stem alternation, tone reportedly differentiates indicative from imperative, and transitive from intransitive (Ngun Tin Par 2016). Tone interacts with transitivity in Hyow as well, with the same segmental verb stem showing up with L tone in transitive contexts and H tone in intransitive contexts (Zakaria 2018: 265).

In Southern Bawm, verbs with long vowels are realized as L in intransitive contexts, and (with a few CVVT exceptions) as M in transitive contexts. In addition, when a transitive verb is used as a reflexive or reciprocal, it has L tone like other intransitive verbs (a phenomenon that also occurs in Zophei). Checked syllables take the opposite pattern, and are L in transitive and M in intransitive (reflexive/reciprocal) contexts (Reichle 1981).

Although stem alternation is largely absent in Zophei, transitivity is productively tied to tone on the verb stem. In the transitive context in (13), the toneless stem *miing* 'watch' and the H stem *báá* 'feed' surface faithfully as M and H, respectively. However, examples (14-15) offer evidence of L tone associated with intransitivity: the toneless stem *miing* 'watch' is realized as L, while the H

tone stem *báá* 'feed' is realized as a Fall in phrase-final position in (14), and as M in phrase-medial position in (15).[38]

(13) *aa* ∅ *miing/báá*
3PS 3O watch/feed
'They watched/fed him.'

(14) *aa* *mìing/báa*
3S watch/feed
'She watched/fed herself.'

(15) *aa* *mìing/baa* *héé*
3PS watch/feed PL
'They watched/fed themselves.'

The relationship between tone in stem alternation and transitivity merits further study, especially in Maraic languages, where coda consonants are few and grammatical tone is widespread.

The study of grammatical tone in SC languages reveals diverse phenomena involving tone tied to the exponence of varied morphology. For the researcher working to incorporate tone description and analysis into their program, the complexities of these phenomena may make analysis feel out of reach. However, Hyman (2014b) suggests that studying tone is not very different from studying segmental phenomena; the researcher needs to develop prior knowledge of attested phenomena, and to work through data description and analysis systematically. The following section describes one such program for tone research based on Snider (2018).

9 Fieldwork on tone

Between the many SC languages without a written tradition, and the lack of tone marking in those standardized SC orthographies in use, the task of tone research falls on the linguistic fieldworker.[39] In the highly recommended guide *Tone Analysis for Field Linguists*, Snider (2018) lays out a program for tone study that can proceed alongside database creation that includes word list elicitation and naturalistic speech collection. This program involves (1) marking pitch based on the intuitions of the linguistic field worker and the native speaker language assistant, (2) inputting pitch and other relevant information in a lexical database, and (3) eliciting instances of the same word in many contexts, and instances of the same context for many words.

[38] This phenomenon is similar to Hyman's (2010) analysis of Kuki-Thaadow, where a non-final L+H on the same syllable (here, in a position before H,) is realized as a downstepped ꜜH tone. The analysis of Zophei in Lotven (2021) makes use of only M rather than ꜜH, but recognizes that future work may reanalyze M tone in this and some other contexts as ꜜH.

[39] The paucity of tone research in SC is not limited to this language group, and is echoed in the larger linguistic community's experience with, and attitudes towards, tone research. In a survey of 518 linguists from around the world, only 34% had "tone as part of their formal training," 57% "found tone difficult to work with," 44% were "intimidated by tone," and only 56% "always mark tone" (McPherson 2019: e189). This paper is presented in an attempt to provide tools to address this gap.

The first task of tone data collection is training yourself and the language assistants you are working with to recognize pitch changes within and between syllables. This development of pitch pattern awareness is much like learning to distinguish two unfamiliar and contrasting consonants or vowels in a new language of research: it takes directed effort, and time to develop familiarity. Yet, Snider (2018: 25-26) reassures the reader that the task is not insurmountable. He points out that all speakers manipulate and interpret pitch in their own language for tone or intonation purposes and that all people, to some extent, require training to perform pitch transcription tasks, regardless of their language and linguistic experiences. What is important is to focus your observations and perceptions: where do you perceive the pitch to rise, fall, or stay the same? Pitch observations can progress alongside segmental transcription and, much like mis-transcribed consonants and vowels in early fieldwork, errors in pitch transcription will eventually be corrected.

The second task in this program involves collecting phonological, morphological, semantic, and syntactic information relevant to tonal analysis while creating a lexical database. Phonological information includes the shape of the rhyme (especially vowel length and obstruent vs. sonorant codas), and the possible additional relevance of onset consonant, vowel phonation, voicing, and/or stress in some languages. Morphological and semantic data includes whether a word in the database is morphologically complex, whether it is a loanword or ideophone, and (as relevant for SC verbs) what stem form it represents. Syntactic information includes the part of speech (noun, verb, etc.), along with any other relevant information on the word's distribution, such as verb transitivity. With this information in the database, it will be easier to use search and sort functions to form hypotheses about tone in a language.

The third task in this program is to use observations of patterns (as well as inconsistencies in transcriptions) that are found in word list and naturalistic data to identify contexts to target for further investigation. The pitch of a given syllable is relative to those of the surrounding syllables, so the pitch of a word in isolation may be difficult or impossible to determine, and tone researchers need to carefully consider both phonological and syntactic contexts. In starting this type of data collection and analysis, Snider (2018: 52) suggests beginning with words and contexts that have fewer potential variables before moving to more complex considerations. In other words, it is less daunting and more productive to first address morphologically simplex words with the most common pitch patterns in the most productive contexts. By considering varied words in the same context and varied contexts for the same word, the researcher may begin to group words with like tonal behavior into categories to form the basis for tone analysis.

The reader is also directed to a similar program, as described and exemplified in Hyman (2014b), which is broken into three steps: (1) determining relevant pitch contrasts, (2) discovering tonal alternations, and (3) doing tonal analysis. Although there are many considerations in the study of SC tone, by incorporating pitch into transcription and tone into analysis, the researcher will be able to pursue a more complete understanding of the grammars under investigation.

10 Conclusion

In many descriptions and analyses of SC languages, researchers make reference to tone in the realization of lexical and grammatical morphemes, yet tone is one of the least-investigated aspects of SC grammar. The avoidance of tone comes at a cost, as the expression of numerous concepts has been tied to tone in SC languages, including transitivity, plurality, negation, agreement, possession,

subordination, irrealis, direction, reflexives/reciprocals, and sentential mood. Awareness that tone may be involved in these and other phenomena is useful information for the field researcher looking to avoid potential missteps in transcription, description, and analysis.

Tone is more than an obstacle to avoid, to dismiss, or to deal with later. With this richness of tonal phenomena, research in SC languages has great potential to contribute to theoretical and typological research on tone. SC language researchers should take care in marking pitch differences early in transcriptions, working towards consistent written representations of tone.[40] Researchers should also be aware that various factors may obscure tonal contrasts in naturalistic data, and that targeted elicitation can help elucidate tonal phenomena; established methods are discussed in Snider (2018), Hyman (2007), and Hyman (2014b). Finally, despite broader trends avoiding tone (especially grammatical tone) in linguistic pedagogy (McPherson 2019), researchers should use attested phenomena in SC languages as illustrative examples to teach about and train others in tonal analysis.

Abbreviations

2S	2nd person subject	IMP	imperative
3S	3rd person subject	NEG	negative
3O	3rd person object	PL	plural
3PS	3rd person plural subject	PROHIB	prohibitive
INTR	intransitive	Q	question (polar)

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[40] See Cahill (2019) for orthographic considerations.

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