without indication of the level of representation, e.g. *cēkí*, or in phonetic brackets, e.g. [cēk]. That is, we will not be too concerned with the theory-internal questions of whether abstract morphophonemic or phonemic levels exist, rather with the input-output relations that are motivated by the tonal phenomena under discussion.

This is not to say that theory will be totally ignored, rather that I wish to minimize differences between frameworks and talk directly about how the facts motivate one vs. another interpretation. For example, while this study will not advocate a particular view of underspecification, we will want to focus on the relevant facts which have led to the analysis of two-height systems as /H, L/, /H/ vs. Ø, or /L/ vs. Ø (this last having just been referenced with respect to Western Apache and possibly Mulwi). Since a major goal is to determine what is possible in a tone system, we will have to take special care not to confuse the analysis with the phenomena themselves. For example, in (1.31) we considered some of the possible relations which can obtain at the different levels of representation. We see further evidence that a tone system may derive more tone heights in passing from morphophonemic to phonemic to phonetic representations. However, analyses such as in (1.38) which propose FEWER tone heights as one goes from deeper to more surface representations will probably be too abstract to be useful without reinterpretation.

(1.38)

morphophonemic	*phonemic*	*allophonic*
3	3	2
3	2	2

We will consider several such potential cases in §XX, not to argue that (1.38) is the right analysis, but rather to understand what it is about these systems that makes them different—and, by extension, what suggests an interpretation of underlying /H, M, L/ in a language which has only surface H and L.

In presenting and interpreting the descriptive facts we will be guided by two principles. The first is the principle of PHONOLOGICAL ACTIVATION, which Clements (2001: 2) describes as follows for phonological features:

> "... features are specified in a given language only to the extent that they are needed in order to express generalizations about the phonological system" (Clements 2001: 2)

This is the principle that will guide us in the analysis of two-height tone systems. If both tones are required to express the phonological generalizations (the nature of which will be discussed in §XX), the system is analyzed as /H, L/. If the only evidence is that one of the tones is activated in this sense, that one tone, /H/ or /L/, may instead contrast with Ø (the absence of tone). It is also possible that a tone can become active in the course of a derivation, perhaps in the case of the M tone in Ik.

The second principle that will guide us is the autosegmental insight in (1.39).

(1.39) Tones are SEMI-AUTONOMOUS from the tone-bearing units (TBUs) on which they are realized.

As Goldsmith (1976a,b) showed, tone has considerable autonomy from the segmental features of consonants and vowels. Whether one sees tones as a property of syllables, moras, sonorants

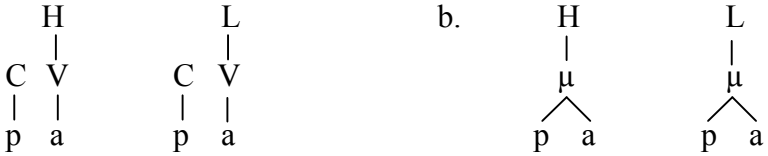
or voiced segments, the Chimwiini, Giryama and Urarina examples in §1.2 have already established the potential that tone has to wander and "link" at considerable distance from its point of origin. No other phonological property has such a potential. By placing tone on a separate tier, the autosegmental framework introduced by Goldsmith has provided the tools needed to express such long-distance tonal processes, as in (1.10b) and (1.11a). However, rather than being fully independent, the tonal tier is "semi-autonomous" in the sense that tones are linked by association lines to their respective TBUs.

At the time autosegmental phonology was first developed, one commonly referred to the semi-autonomy of the tonal and "segmental" tiers. Thus much of this work illustrated tones being associated directly to vowels, as in (1.40).

(1.40)

This was followed by two important innovations. First, a "core" or "skeletal tier" consisting of Cs and Vs, or Xs, ultimately moras (μs), was proposed to which both segments and tones linked. This produced representations such as in (1.41).

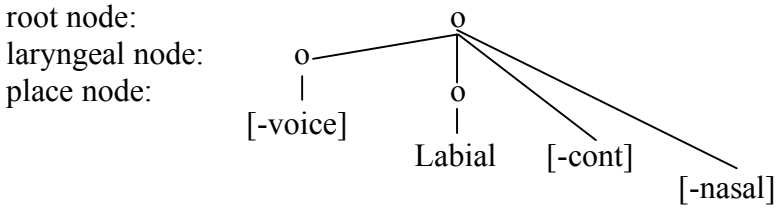
(1.41) a. b.



Although originally introduced to account for the templatic morphology of Arabic (McCarthy 1981) and reduplication (Marantz 1982), the CV framework was quickly expanded to account for syllabicity and length (Clements & Keyser 1983, Hayes 1986). As indicated in (1.41a), the V slot provided a natural TBU as does the moraic account in (1.41b), proposed by Hyman (1985). Although there is some variation and perhaps also difference of opinion, most studies assume that languages choose between the mora and the syllable as their TBU (cf. §XX). However, unless otherwise needed, we will often present tonal phenomena without explicitly formalizing the TBUs, i.e. as in the simplified representations in (1.40).

Representations such as in (1.40) simplify in another sense. The second innovation concerned the development of feature geometry (Clements 1985, Sagey 1986). Instead of a single segmental tier, both consonants and vowels were further differentiated into multi-tiered tree structures representing their articulatory properties. While there were (and continue to be) a wide range of proposals, a simplified feature geometry representation of the segment [p] is illustrated in (1.42):

(1.42)



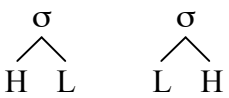
Since vowel segments were similarly analyzed in terms of articulator nodes and articulatory features, this raised the possibility that the laryngeal node might be a good prospect for TBU, especially in languages in which laryngeal features interact with tone (§XX). While it is certainly important to account for the recurrent interactions between consonant types and tone, e.g. the tendency for voiced obstruents to lower the pitch of a following vowel, non-syllabic onset consonants are non-moraic and typically do not contribute a TBU in languages which count moras in determining their tonal properties. We shall therefore continue to refer to the mora or syllable as the available TBUs, although again often taking the liberty of using simplified representations as in (1.40). For brief discussion of tonal geometry, see §XX.

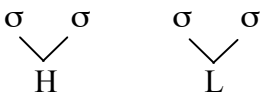
1.5. Autosegmental representation

As mentioned, the concept of tonal semi-autonomy is a traditional one reflected in the practice of transcribing tones with marks which are separable from consonants and vowels. Accent marks, numerals, pitch drawings, all point to the high isolability of pitch phenomena from the segments on which they are realized. The autosegmental formalism is explicit in recognizing this semi-autonomy. By establishing separate tiers, the framework both describes certain phenomena in a more straightforward way and makes certain predictions about tonal representations and processes, e.g. concerning the Obligatory Contour Principle (§1.5.1). In the following subsections we will consider how autosegmental representations account for three common relations holding between tones and their TBUs: (i) non-isomorphism; (ii) zero representation; (iii) stability effects.

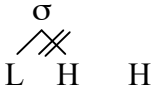
1.5.1. Non-isomorphism

There are two types of mismatch or non-isomorphism between the number of tones and the number of TBUs. Where more than one tone links to a single TBU, e.g. a syllable (σ), the result is a contour tone, as in (1.43a). Where a single tone links to more than one TBU, the result is a tonal geminate (or multiply branching tone), as in (1.43b).

(1.43) a. 

b. 

As shown in (1.43a), the insight about contour tones is that they consist of two (possibly three) tones linked to the same TBU. This allows us to express the Falam simplification of the /LH/ contour in (1.37b,c) as in (1.44a).

(1.44) a. 

b. R → L / __ H

As seen, the H of the LH contour delinks (marked by the two slashes) when followed by another H. This is a common case of "tonal absorption" (Hyman & Schuh 1974:XX) whereby the endpoint of a tonal contour is absorbed into a following like tone. Had the LH tone been instead expressed as a R (rising) tone, the resulting rule in (1.44b) would seem quite arbitrary:

Why should an R simplify to L before H? By representing the rising tone as LH we not only explicitly express the "masking" of the H endpoint of the rising tone, but also can relate the process to the general tendency for tones to be realized towards the end of their TBU (Akinlabi & Liberman 2000:5; Kingston 2003:86) and hence to spread rightwards, thereby causing the first H to submerge into the second (Hyman & Schuh 1974:XX). Note also in (1.44a) that the environment has been expressed as a H tone without indication of a TBU. Since a falling tone is represented as HL (and not as F), it automatically serves as a trigger for the rule, as can be confirmed in (1.37c).

The type of mismatch in (1.43a) was also acknowledged in pre-autosegmental phonology, where numerals or acute and grave accents were combined to produce transcriptions such as [^{31}], [^{13}], [ˆ] and [ˇ]. Among the few who recognized the mismatch in (1.43b) was Welmers (1962: 86) who set up the following five tonal patterns in Kpelle [XPE.1], where I have maintained his descriptions and transcription:

(1.45) a. High throughout

pá	'come'	ɓóa	'knife'
láa	'lie down'	píli	'jump'

b. Low throughout

kpòo	'padlock'	kpàki	'loom'
tɔ̀nɔ	'chisel'	tòloŋ	'dove'

c. High followed by low (low begins on the next vowel if there is one)

yɛ̂	'for you'	tôa	'pygmy antelope'
kpôŋ	'door'	kâli	'hoe'

d. Mid throughout

kpɔŋ	'help'	sua	'animal'
see	'sit down'	kali	'snake'

e. Mid with first vowel, then high followed by low

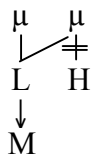
tɛɛ̂	'black duiker'	konâ	'mortar'
yuɔ̂	'axe'	kpanâŋ	'village'

Although Welmers had worked on a number of tone systems in which each TBU carried its own tone, his intuition about Kpelle was that there was "one toneme between two open transitions" (p.86). In other words, he saw Kpelle as having five word-tone melodies, exactly as closely related Mende [MEN.1] would later be analyzed within the autosegmental framework (see especially Leben 1978). For this reason he proposed to mark the tone only on the first vowel, e.g. /kâli/ instead of /kálì/. It is clear from Welmers' description that a H pitch intervenes between two of his "Mid throughout" words:

> "In mid-mid, for the dialect being described here, the first mid has a slightly rising allotone.... In some areas, the first mid is level, but the second mid begins a little higher and drops quickly to the level of the first. In still other areas, both phenomena occur: the first mid ends a little higher, and the second begins a little higher. In all cases, the conjunction of two mids is accompanied by an upward pressure." (p.87, note 2)

A straightforward interpretation in (1.46) is that M words have an underlying /LH/ tone pattern, where the /L/ both raises to M before H, spreads to the following TBU, delinking the /H/ except in the context described in the above quote:

(1.46)



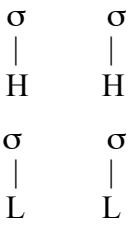
Since this also allows us to reinterpret his MHL as /LHL/, the resulting five tone melodies become exactly the same as Leben proposed for Mende: /H/, /L/, /HL/, /LH/, /LHL/. What this means is that the tonal melodies will map to bimoraic words as in (1.47).

(1.47)

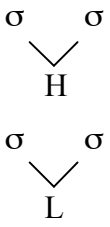
pili	tɔnɔ	kali	kali	kona
∨	∨	| |	| |	| ∧
H	L	H L	L H	L HL
			(→ M-M)	(→ M-HL)

Of interest are the /H/ and /L/ melodies which involve a single tone linking to more than one TBU. Although not easy to distinguish using accents to mark tone, by placing tones on their own tier, the autosegment approach in principle allows the distinct representations as in (1.48).

(1.48) a.



b.



The question is whether (1.48a,b) are both needed to express generalizations. The answer is yes. Consider first the case of Kukuya [KKW.1] insightfully described by Paulian (1975) and "translated" into the autosegmental framework by Hyman (1987). Like Mende and Kpelle, Kukuya distinguishes the five melodies /H/, /L/, /HL/, /LH/ and /LHL/ on prosodic stems which can have any of the shapes CV, CVV, CVCV, CVVCV and CVCVCV—i.e. up to two syllables containing three moras. In (1.49a) we see that the /H/ melody is mapped onto all of the available moras of the noun stem:

(1.49)

a. *medially*	b. *before pause*	
(mà-) bá	(mà-) bā	'oil palms'
(mà-) báá	(mà-) bāā	'cheeks'
(mà-) bágá	(mà-) bāgā	'show knives'
(lì-) báámá	(lì-) bāāmā	'liana'
(lì-) bálágá	(lì-) bālāgā	'fence'

The advantage of representing the stem tone as a single, multiply linked /H/ is seen in the forms in (1.49b) where the H tones are lowered to M before pause. As indicated below the last example, if the H → M rule is expressed solely on the tonal tier, the change of /H/ to M will automatically affect all of the TBUs. However, the need for two different representations of H-H is seen in the realization of /má-bá/ 'they are oil palms' and /wátá/ 'bell' in (1.50).

(1.50) a. *medially*

má-bá	wátá
H H	H

b. *before pause*

má-bā	wātā
H M	M

In (1.50a), the noun prefix of /má-bá/ occurs with the /H/ tone predicative marker. Since this H is a separate morpheme, two underlying H tones are indicated on /má-bá/ 'they are oil palms'. The prefixless noun /wátá/, on the other hand, consists of a single stem morpheme. As such it is expected to have a single /H/ linked to both of its moras. The prepausal realizations in (1.50b) confirm this: /má-bá/ becomes H-M, while /wátá/ is realized M-M before pause.

While one could alternatively state the lowering rule to affect only Hs which occur in the stem, or perhaps in the last morpheme, the autosegmental interpretation represents a purely phonological account. What is needed is a principle that would require /wátá/ and the all-H noun stems in (1.49) to be represented with a single /H/ tone. The mechanism enforcing such a representation in autosegmental phonology is known as the Obligatory Contour Principle (Leben 1973, Goldsmith 1976a), which McCarthy (1988:XX) states as follows:

(1.51) Obligatory Contour Principle (OCP)

Adjacent identical elements are prohibited.

The "elements" in question here are tones: The representations in (1.48a) are OCP violations in the sense that two H or L tones immediately succeed each other on the tonal tier. As we have seen in (1.50), such violations do occur, especially when the identical tones belong to independent morphemes. While the heteromorphemic /H/ tones of /má-bá/ function independently in Kukuya, successive identical tones may "fuse" into a single multiply-linked tone in other languages, e.g. Tangale [TAN.1] (Kentowicz & Kidda 1987:XX). In this case they become indistinguishable from a multiply linked tautomorphemic tone. While the OCP may be violated across morphemes (and words), the question is whether it is inviolable within morphemes. Is it possible for H-H and L-L morphemes to have the representation in (1.48a) in one language, but (1.48b) in another? Can both representations be present and contrastive within morphemes in the same language?

Odden (1982) argues for this last possibility in Shambala [KSB.1], which he analyzes with an underlying /H/ vs. Ø contrast, toneless TBUs receiving L tone by default. As Odden shows, a downstep (↓) automatically occurs between two heteromorphemic /H/ tones, as in (1.52a), where L tones are unmarked:

(1.52) a. a-nge-ja → a-ngé-$^{\downarrow}$já ‘he should have cooked’
H H

b. ku-chi-shunth-a → ku-chí-shúnth-a ‘to wash it’ (cf. ku-shunth-a ‘to wash’)
H H

On the other hand, as seen in (1.52b), a /H/ will spread to the right if the following TBU is toneless. In this case there is no downstep between the output H-H sequence. The above contrast is as expected, since the two /H/ tones in (1.52a) belong to two morphemes, while there is only one input /H/ in (1.52b). A problem arises, however, from the contrastive tautomorphemic patterns in (1.53).

(1.53) a. nyóká ‘snake’ b. ngó$^{\downarrow}$tó ‘sheep’ c. ngó$^{\downarrow}$tó
H H H L H

While (1.53a) is expected (and general in the language), there are a small number of exceptional nouns whose monomorphemic stems have an internal downstep, as in (1.52b). Since these nouns are relatively rare, we could follow Odden’s analysis and allow an exceptional tautomorphemic violation of the OCP. Alternatively, we could just enter such nouns in the lexicon with a downstep, either as a feature or by means of an intervening L tone as in (1.52c).

While Shambala is exceptional, it is striking how few problematic cases have been presented for the following version of the tonal OCP, where TT stands for “tautomorphemic tone”:

(1.54) OCP(TT): Adjacent identical tones are prohibited within the same morpheme

Despite Shambala, OCP(TT) will clearly prohibit the tautomorphemic representation in (1.54a), where the two Hs are linked to two successive TBUs (here, syllables):

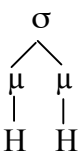
(1.55) a. σ σ b. σ
H H H H

The OCP(TT) clearly probibits the more extreme representation in (1.54b), where two identical, tautomorphemic tones link to the same TBU. While such a tautomorphemic representation is highly suspect (cf. §XX), such representations occasionally arise when the two Hs belong to separate morphemes. Thus consider the derivation of the H$^{\downarrow}$H contour syllable in the following Shambala example (David Odden, pers.comm. Nov. 13, 2010):

(1.56) u-a-kaang-a → wá$^{\downarrow}$á-$^{\downarrow}$káánga ‘you sg. killed’ (remote past)
H H H

As Odden points out, however, one could equally well maintain that mora is the TBU in Shambala, as in (1.56):

(1.57)



If correct, there would be no need for two identical tones to link to the same TBU (see §XX for more discussion concerning TBUs).

Another situation that has to be considered is where an unlinked tautomorphemic tone immediately follows (or precedes) an identical linked tone, as in (1.57).

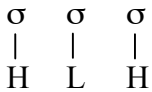
(1.58) a.

b.

In (1.58a) a linked H is followed by an unlinked (or "floating") H tone. If the unlinked H is a separate morpheme, i.e. a suffix, OCP(TT) is not violated. If it is tautomorphemic, we can distinguish two situations: The first is that the floating H maintains its proximity, just sitting there, perhaps protecting the preceding H from a final lowering effect, as a linked heteromorphemically H was seen to do in Kukuya in (1.50). In this case the effect of the floating H is contained within its own morpheme in both input and output. The second possiblity, however, is that the floating H links to a following morpheme (or word). Whether it links to an adjacent TBU, or to a TBU at some distance, as in Chimwiini and Giryama, the H would now be part of the realization of a different morpheme. Although the OCP(TT) is clearly intended as a constraint on the underlying representation of morphemes, it may also be invoked in outputs, including those involving larger word and phrasal domains.

The OCP(TT) violations in (1.55), (1.57) and (1.58) contain two tautomorphemic /H/ tones without an intervening non-H tone or TBU. Similarly, (1.59) would not present an OCP violation:

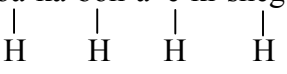
(1.59) a.



b.

However, what about (1.59b)? In this case the two H tones are adjacent on the tonal tier, but their TBUs are not adjacent. Pulleyblank (1986:XX) makes a distinction between the OCP violations in (1.55), (1.57) and (1.58), which are "skeleton-sensitive" vs. that in (1.59b), which is "skeleton-insensitive". Such representations are clearly needed heteromorphemically in many /H/ vs. Ø tone systems, for example, in Haya [HAY.1] (Hyman & Byarushengo 1984:XX):

(1.60)



'they saw a porcupine'

As examples of tautomorphemic (1.59b), Schadeberg (2000: 601) reports the following underlying patterns on nouns of five moras in Ekoti [EKO.1]:

(1.61)

m-péneméne	‘plant (sp.)’		li-káasíya	‘oar’		n-xúwaákhi	‘tree (sp.)’		
|	|		|	|		|	|	
H	H		H	H		H	H		

In the above words, the two /H/ tones are separated from each other by one toneless mora. While other languages might delete one or the other /H/, or “plateau” from one to the other to derive a H-H-H sequence, many languages tolerate tautomorphemic identical tones which are adjacent on the tonal tier, as long as their TBUs are not adjacent.

What is important in the preceding discussion is that the OCP constraints could not be stated without the distinctions in (1.48), which in turn are made possible by recognizing the possible non-isomorphisms between tones and TBUs in autosegmental phonology.

1.5.2. Zero representations

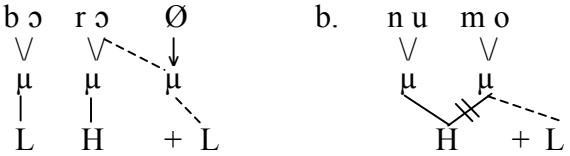
A second property which is directly captured by the two-tier representations of tones and TBUs is zero representation: A morpheme may be specified for tone, but lack segmental specification, and vice-versa. If a morpheme consists solely of a tone (or tones), without any segmental content, we speak of tonal morphemes. The /H/ genitive tone of Igbo [IBO.1] was seen as an example in (1.12). A second example involves a /L/ locative postposition in Jamsay [DJM.1] (Heath 2008:XX):

(1.62)

a.	H → HL	ká:	‘mouth’	kâ:	‘in the mouth’
b.	LH → LHL	gə̌:	‘granary’	gə̌̂:	‘in the granary’
		gŭn	‘back (body)’	gŭn̂:	‘behind’
c.	L-H → L-HL	bɔ̀rɔ́	‘bottom’	bɔ̀rɔ̂:	‘at the bottom’
d.	H-H → H-L	úró	‘house’	úrò	‘in the house, at home’
		númó	‘hand’	númò	‘in the hand’

While the nouns on the left end in a H tone, the forms on the right show the effects of the /L/ tonal morpheme marking locatives. In (1.62a-c), this L forms a contour with the preceding H (or LH). Since each tone of HL, LH, and LHL contours requires its own mora in Jamsay, the final vowel or nasal will be lengthened, if needed. In (1.62d), where the noun ends in two H tone moras, the L instead links to the last mora whose H is delinked. Lengthening and delinking are shown autosegmentally in (1.63).

(1.63)



While pre-autosegmental approaches could represent such sequences as /bɔ̀rɔ́ + ˋ/ and /númó + ˋ/, the semi-autonomy of tones from their TBUs is directly captured in the two-tier

approach. (As discussed above, the acute accent notation has no way to encode that /númó/ has a single underlying /H/ linked to both TBUs.)

The opposite situation obtains when a morpheme has segmental content, but no tone. This happens, of course, in lots of /H/ vs. Ø systems which often allow lexical morphemes as well as words and phrases to be toneless. However, we are more concerned with toneless morphemes in systems where every TBU otherwise has a specified tone. Such a case was cited in (1.13) where the Mende [MEN.1] locative postpositions /-hu/ 'in' and /-ma/ 'on' acquire their tone from the preceding stem. A not unusual situation is for some or most affixes to be toneless, either copying tone, as in Mende, or being pronounced on a default L or M pitch level. Karen (Bwe) [BWE.2] may have both: "The tone of the suffix is identical to the tone of the preceding stressed syllable, unless the suffix has a voiced initial and the preceding syllable is in the high tone, in which case the suffix is in mid tone" (Namkung 1996: 159). A rather interesting case comes from Tukano [TUO.6], which contrasts /H/, /LH/ and /L/ tones, assigned by morpheme (Ramirez 1997: 26):

(1.64) a. /were/ → [ʊɛ́rɛ́] 'warn'
H

b. /bara/ → [^{m}bàɾă] 'love-charms'
LH

c. /yawi/ → [yàwà] 'pie'
L

In Tukano most suffixes are "atonal" (Ramirez 1997: 70) and are realized L after a /H/ or /L/ root. However, a /LH/ root passes its rising contour onto the suffix (p.73):

(1.65) a. /apo/ → àpŏ [àa̰pɔ̄́] 'to repair'
LH

b. /apo-bi^{N}/ → apo-bĭ^{N} [àa̰pɔmĭ] 'he repairs'
LH

Similarly, prefixes can be toneless as in Tangkhul Naga [MNF.2] (personal notes), which otherwise contrasts /H/, /M/ and /L/. The following illustrates some of the lexical prefixes which occur on both nouns and verbs:

(1.66)

Ø-L		Ø-M		Ø-H	
aa-kúy	'head'	aa-kōr	'cover'	aa-khòŋ	'neck'
ma-khá	'cough'	ma-cō	'spit'	ma-nù	'laugh'
ka-shúy	'be startled'	ka-sāay	'be accustomed'	ka-tsàa	'be ill'
ŋa-níŋ	'stand'	ŋa-rēw	'play'	ŋa-nir	'wrinkle'

Such prefixes are pronounced L except in the context of H __ M, in which they are realized on a M pitch, e.g. XX. As indicated, one possibility is to say that Tucano suffixes and Tangkhul Naga prefixes lack an underlying specification on their tonal tier, receiving their surface pitch either from surrounding tones or by default. In §1.2 it was pointed out that both prefixes and suffixes are toneless in Meithei [MNI.2]. Chellia (2003: 429) describes their pitch as follows:

> "Low tone roots trigger upstep, which results in an augmentation of pitch throughout the word. High tone roots trigger downstep, which results in downscaling of pitch through the word." (Chelliah 2003: 428-9)

In this language it appears that adjacent affixes are lower than lexical /H/ and higher than lexical /L/. One way to conceptualize this is to say that toneless TBUs tend to have a mid-like pitch which adjusts upwards to and from a /H/, but downwards to or from a /L/. This is reiminiscent of the realization of toneless syllables in Fasu [FAA.3]. As exemplified in (1.66) a phonological word in Fasu has one "nuclear" syllable which contrasts /H/ vs. /L/ tone:

(1.67)

		H tone		*L tone*	
a.	σ	mé	'language'	mè	'taro'
b.	σ–σ	támo	'down below'	tàmo	'matches'
		kikí	'bone'	kikì	'tree type'
c.	σ–σ–σ	férepe	'bushknife'	èresa	'dark'
		sakáre	'arrow'	hiwàti	'eyelash'
		kenarí	'tree type'	kenarì	'bamboo type'

"Marginal" syllables are toneless and receive their pitch as follows:

> "High nuclear syllables usually pull following contiguous marginal pitchs towards high whereas low nuclear tones pull following contiguous marginal pitches toward low. (May & Loeweke 1964: 94).

Given that only one syllable may be marked for /H/ or /L/ per word, most TBUs will have a zero specification for tone in Fasu. Since toneless TBUs are both numerous and realized differently from both /H/ and /L/, the /H/ vs. /L/ vs. Ø analysis is motivated and relatively noncontroversial.

While toneless analyses have been proposed for Tukano and Tangkhul Naga toneless affixes, it would also be possible to analyze the non-contrasting affixal tone as /L/. Ambiguities of this sort typically arise in systems where (i) a tonal contrast is restricted to certain morphemes or TBUs; (ii) these TBUs have a relatively stable pitch realization, e.g. [L]; and (iii) there is no evidence that the non-contrastive tonal feature is phonologically activated, e.g. referred to in a phonological rule. The choice in such cases is whether to treat non-contrastive TBUs as toneless or to assign them one of the tones which contrast elsewhere. As a case in point, Rawang [RAW.2] contrasts /H/, /M/ and /L/ with a "neutral, non-contrastive tone" which is realized L before /L/, M before /M/ and "mid rising" before /H/ (Morse 1963: 18):

(1.68)

a.	H-M	rálōŋ	'to come to agreement'
	M-M	rālōŋ	'to accompany'
	L-M	ràlōŋ	'to become necessary'
b.	Ø-M	rəlōŋ	'to rise up'
		rətlōŋ	'to exterminate'
c.	H-Ø	kágəp	'to owe a debt'

	M-Ø	kāgəp	‘what range?’
	L-Ø	kàgəp	‘contract’
d.	Ø-Ø	kətgəp	‘that range’
		kəlaʔ	‘to bolt down’

The forms in (1.68a) have two phonological tones and exhibit a minmal triplet of /H/ vs. /M/ vs. /L/ on their first syllable. The forms in (1.68b) show the two types of toneless syllables in Rawang: a non-final open syllable with schwa /Cə/ and a syllable which ends with a stop. The latter is exemplified in final position in (1.68c), where the toneless stopped syllable is preceded by each of the three lexical tones. Finally, (1.68d) shows that a word can be entirely toneless, consisting either of two stopped syllables or a /Cə/ syllable followed by a stopped syllable. However, concerning stopped syllables, Morse (1963: 18) goes on to say:

> “Another interpretation is possible, in which this tone is assigned to one of the other three tonemes, more generally the mid-toneme which it resembles most of the time, and final stop considered the conditioning environment.”

The situation which Morse describes is quite widespread in Southeast Asia, where there may be no tonal contrast on syllables ending in a voiceless stop, as in Rawang, or a reduced set of contrasts (cf. §XX). If /M/ were assumed, it would have to be lowered to L before /L/ and produce a MH rise before /H/. Since there is no evidence that this tone functions the same as contrastive /M/ on more full or sonorous syllables, there is little reason not to assume that stopped and internal /Cə/ syllables are toneless.

1.5.3. Stability

The third tonal property which is easily described in the autosegmental framework is stability: Although an underlying representation may begin with specifications of both TBUs and tones, either may be modified or deleted without affecting the other. In Mondo [MUH.1], for instance, when initial vowel of the demonstrative /éngū/ is deleted in rapid speech, its H tone is realized on the preceding vowel (Vallaeys 1991: 17):

(1.69)	kpárā	+	éngū	→	kpárá ngū	‘that man’
	kītī	+	éngū	→	kītí ngū	‘that village’
	wōrēsē	+	éngū	→	wōrēsé ngū	‘that woman’
	wɔ̀dzàdzī	+	éngū	→	wɔ̀dzàdzí ngū	‘those children’

If we assume that both the vowel /e/ of /éngū/ and its TBU in (1.70a) are deleted, the result will be an unlinked H tone in (170b):

(1.70)

(a)		(b)		(c)
kpara engu	→	kpara ngu	→	kpara ngu
HM H M		HM H M		H M H M

In (1.70c) this H reassociates to the preceding TBU, thereby delinking its M.

Such cases of tonal stability are extremely common and lend strong support to the autosegmental representation of tone, particularly as concerns the OCP. As a case in point, consider the Tangale [TAN.1] which Kenstowicz & Kidda (1987) analyze as a /H/ vs. Ø system, with the syllable being the TBU. As seen in (1.71a), when the second vowel of the /Ø-H/ word /tuužé/ 'horse' is deleted in "close juncture", its H remains, ultimately relinking to the following syllable. and underlyingly toneless /lawo/ 'child' is realized [H-L]:

(1.71) a. tuuže lawo → tuuž lawo → tuuž láwo [tùuž láwò] 'a child's horse'
H H H

b. yaara lawo → yaar lawo [yáar làwò] 'a child's arm'
H H

c. yaara lawo → yaar lawo → yáar láwo *[yáar láwò]
H H H H H H

Compare this with the lack of a tonal stability effect in the derivation in (1.71b), where vowel-deletion applies to the [H-H] noun /yáará/ 'arm'. Since the OCP(TT) enforces the representation of a single /H/ associated to the two TBUs, when the latter is deleted, the H remains linked to the one remaining syllable, and /lawo/ is realized [L-L]. Had the representation involved the OCP violation in (1.71c), an unlinked H would have been produced with potentially incorrect results. The prediction of the OCP is that only a singly-linked tone will persist in case its TBU is deleted.

The above example shows how a tone may remain behind when its vowel (TBU) is deleted. The same may occur when instead of deletion, a vowel undergoes gliding to [w] or [y]. As an example, consider the realization of the L tone plural class 8 prefix /bì-/ in Abo [ABB.1] (personal notes):

(1.72) a. /bì-kék/ → bìkék 'things'
/bì-táŋ/ → bìtáŋ 'insects'
b. /bì-át/ → byăt 'nails, claws'
/bì-úŋ/ → byŭŋ 'skylarks'

In (1.72a), where the stem begins with a consonant /bì-/ is realized with its L tone. However, when the stem begins with a H tone vowel, as in (1.72b), the prefix becomes *by-*, losing its ability to carry tone. As a result, the L+H tone sequence fuses to produce a LH rising tone on the one syllable.

While such processes are common, it should be noted that tonal stability is not universal. Thus, in Lele [LLN.1], "if a morpheme, lexical or grammatica, loses its vowel, it also loses its tone" (Frajzyngier 2001:39), and similarly in Shilluk [SHK.1], "Since only vowels bear tone in Shilluk, if a vowel is delinked from the timing tier, its tone will receive no phonetic realization." (Gilley 1992:164). Finally, in a V+V sequence, it is possible for one vowel to

delete, but the tone of the other to remain. A case in point comes from Lomongo [LOL.1], where a syllable is assumed to support up to a four-tone LHLH contour (Hulstaert 1961:164):

(1.73) /èmí là wɛ̌ bǎsàngì/ → [èmâwǎ˘sàngì] 'it's you and I who are related'

In this example, when the [b] prefixal *bǎ-* is deleted, the remaining *ǎ-* fuses with the preceding pronoun *wɛ̌* 'you', producing the tonal complex syllable [wǎ˘].

If tones can remain behind when their TBU is deleted, the same can be said concerning the stability of TBUs whose tones are deleted. Recall the Hakha Lai [CNH.2] derivations in (1.16) above. There it was seen that when a CVV syllable is shortened to CV, it loses its tone, since all CV syllable are toneless in Hakha Lai. Such examples show that although the syllable is the TBU in this language, a tone-bearing syllable must be bimoraic. In Hakha Lai this means CVV, CVC or CVVC, but not CV (Hyman & VanBik 2004, 2005).

Given the independent autosegmental representation of tones, TBUs, and consonant and vowel segments, each of which can be deleted alone or in combination, there are six logical types of phonological stability:

(1.73)		*stable (remaining)*	*deleted*
	a.	tone	TBU, segment
	b.	segment	tone, TBU
	c.	TBU	tone, segment
	d.	tone + segment	TBU
	e.	tone + TBU	segment
	f.	segment + TBU	tone

Among the above situations, (1.73f) has received the greatest attention. A final possibility is for all three (tone, segment, TBU) to be deleted, in which case there is no stability, as in Lele [LLN.1]: "If a morpheme, lexical or grammatical, loses a vowel, it also loses its tone" (Frajzyngier 2001:39). Similarly in Shilluk (XX): "Since only vowels bear tone in Shilluk, if a vowel is delinked from the timing tier, its tone will receive no phonetic realization." (Gilley 1992:164).

1.6. Conventions

1.6.1. Citing languages and sources

Throughout this work languages will be cited with their ISO (Ethnologue) identification followed by an integer from 1 to 7 representing the geographic location of the language:

(1.74)	*location*		*example*	
	1	Africa	MWM.1	Sar
	2	Asia	MNI.2	Meithei
	3	Pacific	AFZ.3	Obokuitai
	4	North America	HUR.4	Halkomelem
	5	Mexico	CTP.5	Chatino (Western Highland)
	6	South America	TUO.6	Tukano

7 Europe LIM.7 Limburgish

As seen, an attempt is made to cover a wide range of geographic and geneological diversity among the world's tone systems. The facts and data cited are referenced from a database of over 600 tone systems which I have been cataloguing over the past several years. This includes information about the number of underlying and surface tones, tone heights, contours, as well as information on the distribution of tones, tone rules, interaction with syllable structure, segmental features, and phonation, interfaces with morphology and syntax, and other properties that struck me as interesting. As mentioned in §1.2, it has sometimes been necessary to reinterpret analyses (e.g. sometimes converting the integers 3, 2, 1 to H, M, L). Since both the data and the "normalization" process are not always complete, attempts have been made to cite the more reliable sources wherever possible. Because of the nature and tentativeness of the database, still under construction, I have used it mostly as a means of finding examples of the different phenomena under examination.

1.6.2. Transcription and abbreviations

1.7. Outline of the book

The (tentative) contents of the this book are outlined as follows:

PART I. GENERAL.

Chapter 1. Introduction

1.1. Goals of the book
1.2. Tone
1.3. Typology
1.4. Description
1.5. Autosegmental representation
  1.5.1. Non-isomorphism
  1.5.2. Zero representation
  1.5.3. Stability
1.6. Conventions
  1.6.1. Citing languages and sources
  1.6.2. Transcription and abbreviations
1.7. Outline of the book

Chapter 2. Word-prosodic typology

2.1. Goals of prosodic typology
2.2. Definitions of prosodic systems
  2.2.1. Tone
  2.2.2. Stress
  2.2.3. Accent

12.2. Evolution of tonal processes
- 12.2.1. phonologization
- 12.2.2. morphologization
- 12.2.3. lexicalization

12.3. Tonoexodus
- 12.2.1. from unrestricted to restricted tone
- 12.2.2. from restricted tone to phrasal prosody

12.4. Diachrony and tone system typology
- 12.4.1. Synchronic vs. diachronic explanation
- 12.4.2. Speculations concerning future of prosodic systems (are they becoming more vs. less tonal?)

Appendix: Geographic and genetic identification of languages cited along with their tonal inventories
References
Language index
Subject index

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