Chapter 1.
INTRODUCTION

Partial Draft Chapter of *Tone Systems: Typology and Description* (written in 2010)

1.1. Goals of the book

This book is about tone, a property of sound systems which is found in almost all parts of the world, but especially in Sub-Saharan Africa, East and Southeast Asia, the New Guinea highlands, South-Central Mexico, the Northwest Amazon, and sporadically in North America and Europe. Although sometimes elusive, the presence of tone is easily ascertained when words contrast multiple pitch heights in isolation, as in the following examples:

(1.1) Two contrastive pitch heights in Halkomelem (Upriver) [HUR.4] (Galloway 1991: 3)

a. high tone : /qʷá:l/ ‘mosquito’ (→ [qʷːːl])
b. low tone : /qʷà:l/ ‘to speak’ (→ [qʷːːl])

(1.2) Three contrastive pitch heights in Sar [MWM.1] (Palayer 1970: vii)

a. high tone : ɓọ ‘pity’
b. mid tone : ɓɔ ‘entrust’
c. low tone : ɓɔ̀ ‘thick juice’

(1.3) Four contrastive pitch heights in Chatino (Yaitepec) [CTP.5] (McKaughan 1954: 27)

a. high tone : kú ‘I eat’
b. upper-mid tone : kũ ‘I grind’
c. lower-mid tone : kũ̀ ‘sweet potato’
d. low tone : kù ‘dove’

(1.4) Five levels: Kam (Shidong) [KMC.2] (Edmondson & Gregerson 1992: 566)

a. highest tone : ʈa₅ ‘cut down’
b. : ʈa₄ ‘step over’
c. : ʈa₃ ‘father’
d. : ʈa₂ ‘eggplant’
e. lowest tone : ʈa¹ ‘thorn’

In the above transcriptions the various accent marks indicate the contrastive tones, except in the last case where the integers 1 (lowest) through 5 (highest) indicate the pitch heights.

While examples such as the above unambiguously establish that there are word-level tone contrasts in Halkomelem, Sar, Chatino and Kam, the situation may be less clear in other systems, some controversial, which have been analyzed either with or without tone (a definition of which will be offered in §1.2). The purpose of this book is to look at tone systems of all kinds and from all parts of the world from a typological and descriptive perspective. In this and following chapters I will be concerned both with recurrent, cross-linguistically salient properties of tone, as well as with the ways tone systems can vary across
languages. Although the focus is self-consciously typological, the subject matter is tone systems—not surface inventories, as in much of the work in phonological typology. In order to conduct a more revealing phonological typology our preoccupation will be to analyze and thus reveal how tone functions in phonological systems. To this end we will be concerned with the input-output relations of tones, their distributional constraints, and the lexical and morphological functions in which tone engages. However, this will not be a top-down study showing how to implement tone within a preexisting framework. Instead, I will attempt to minimize the differences between frameworks and concentrate on the phenomena that are to be found (and analyzed) in tone systems from throughout the world.

In the following subsections we will in turn address the nature of tone, typology, and description. This will be followed by a conclusion and outline of the remaining chapters.

1.2. Tone

It is often estimated that somewhere around half of the world’s languages are “tonal”. It is however difficult to get an accurate number for several reasons: First, there are many languages whose prosodic systems have not yet been documented or sufficiently analyzed. Second, there are differences of opinion as to what counts as “tone”. These problems are particularly acute in languages where tone plays a minor lexical or grammatical role. A particularly interesting such case comes from Chimwiini [SWH.1], which has tonal paradigms such as the following (Kisseberth 2009: 3):

(1.5)

<table>
<thead>
<tr>
<th>singular</th>
<th>plural</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-jiːlé</td>
<td>chi-jiːlé</td>
</tr>
<tr>
<td>jiːlé</td>
<td>ni-jiːlé</td>
</tr>
<tr>
<td>jíːle</td>
<td>wa-jiːle</td>
</tr>
</tbody>
</table>

In the above forms, H(igh) tone is marked by an acute accent, while L(ow) tone is unmarked. In H tone has a strictly grammatical function, as there are no tonal contrasts on lexical morphemes such as noun- and verb stems. In the paradigm exemplified in (1.5), a H tone occurs finally when the subject is first or second person, but on the penult when the subject is third person. Since there is no overt segmental prefix in ‘you sg. ate’ and ‘s/he ate’, the only difference between jiːlé and jíːle is tonal.

The question is whether the difference between final vs. penultimate H should be identified as “tone”, rather than accent, or even stress (cf. Italian parlo ‘I speak’ with penultimate stress vs. parlò ‘s/he spoke’ with final stress). One additional fact which may be relevant is that the position of the H is determined not by the word, but by the phonological phrase. The (a) examples in (1.6) thus show a phrase-final H tone when the subject is second person vs. the (b) examples whose phrase-penultimate H occurs with the third person subject:

(1.6)

<table>
<thead>
<tr>
<th>a. jile: ŋamá ‘you sg. ate meat’</th>
<th>jile ma-tuːndá ‘you sg. ate fruit’</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. jile: ŋáma ‘s/he ate meat’</td>
<td>jile ma-túːnda ‘s/he ate fruit’</td>
</tr>
</tbody>
</table>

In fact, in longer sentences the contrast of a final vs. penultimate H can be observed on more than one constituent:
(1.7) a.  [[ wa-ti̇ndili̇le w-aaná ] źnamá ] ka: chi-sú ]
    'you sg. cut for the children meat with a knife'

b.  [[ wa-ti̇ndili̇le w-ääná ] źnama ] ka: chi-su ]
    's/he cut for the children meat with a knife'

To account for the multiple Hs and their placement, Kisseberth (2009: 13-14) proposes that the phonological phrases are “nested”, as indicated by the brackets in (1.7). As a result, when the subject of the verb is first person, a H is assigned to each syllable that immediately precedes a right bracket. In Chimwiini, every phonological phrase requires a H tone. Thus, in the absence of a grammatically conditioned final H, one will be assigned by default to each syllable which stands penultimate to a right phrase bracket, as in (1.7b).

There are certain other grammatical morphemes and construction types which also assign a final H in Chimwiini. The question is whether this is “tone”. If not, what is this H? Such questions cannot be answered in the absence of establishing a working definition of tone. In two early definitions, tone was said to exist in a language...

(1.8) “... having significant, contrastive, but relative pitch on each syllable” (Pike 1948: 3)

(1.9) “... in which both pitch phonemes and segmental phonemes enter into the composition of at least some morphemes” (Welmers 1959: 2)

Since Pike’s definition requires pitch to be contrastive on every syllable, Chimwiini clearly would not qualify as a “tone language”. Welmers’ definition, however, only requires that pitch phonemes (i.e. contrastive pitch) be a component of “at least some morphemes”. Since first (and second) person subjects assign a final H, this H appears to be a contrastive property of these morphemes, hence Chimwiini may be tonal, although very sparsely so. However, we note that the difference between first and second vs. third person subjects is not presence vs. absence of H, but rather the placement of phrase-level Hs.

To see how the Chimwiini contrast might be interpreted, consider the Giryama [NYF.1] forms in (1.10) (Philippson 1998: 321):

(1.10) a. ku-tsol-a ki-revu ‘to choose a beard’ /-tsol/- ‘choose’ (all L tone)

  b. ku-on-a ki-révu ‘to see a beard’ /-ôn/- ‘see’ (shift of H to penult)

In (1.10a) all of the vowels are underlyingly toneless, receiving output Ls by default. The utterance is thus all L. In (1.10b), the verb root /-ôn/- ‘see’ has an underlying H tone which, as indicated, delinks from its own vowel and shifts to the penult of the phrase. While Giryama does not require a H tone in every phonological phrase, the fact that it shows a long-distance shifting of an underlying /H/ can be perhaps useful in interpreting related Chimwiini.

A Chimwiini analysis in the spirit of Giryama would be to assume that first person and second person subject pronouns have a phonological /H/, which shifts to phrase-final position (vs. to the phrase-penult in Giryama), as in (1.11a), where Œ- indicates the position of the subject prefix.
(1.11) a. Ø-jile: ṇamá ‘you sg. ate meat’ b. Ø-jile: ñámá ‘s/he ate meat’

A phonological phrase lacking an underlying /H/, would receive an inserted H on its penult by default, as in (1.11b). Syllables lacking a H are pronounced L by default.

The question, however, is: What is this phrasal /H/? It seems it is at the interface of several components of the grammar: (i) the morphology: a property of [+1st pers.] and [+2nd pers.] subject prefixes; (ii) the phonology: a property of the phonological phrase, which it attempts to demarcate; (iii) the syntax: a property of the syntactic configurations which define the phonological phrases. Since it marks the edges of potentially nested phrases, as in (1.7) and varies under contrastive focus (Kisseberth 2009), it also bears some resemblance to intonation. Given that a “first and second person subject intonation” is otherwise unheard of in language, maybe the final vs. penultimate H tones are something else? But are they “tone”?

Let us return to the two definitions offered above in (1.8) and (1.9), which show an interesting difference. Pike attempted to define tone PHONOLOGICALLY, i.e. as a surface-contrastive property of SYLLABLES. (We will see in §XX that the syllable is not always the appropriate tone-bearing unit (TBU).) Welmers, on the other hand, sought to define tone MORPHOLOGICALLY, i.e. as a property of MORPHEMES. We think Welmers had the right idea, as he pointed out two objections to Pike’s definition: First, a language can be quite tonal without tone contrasting on every syllable (TBU). As will be seen in §XX, this is particularly true in “privative” systems, e.g. those which contrast /H/ vs. Ø rather than /H/ vs. /L/. Second, a morpheme can consist of a tone without any segmental support. An oft-cited example is the genitive (“associative”) /H/ tonal morpheme of Igbo [IBO.1] (Hyman & Schuh 1974: 98-9):

(1.12) Central Igbo: āgbá + ‘ + ènwè → āgbá ènwè ‘jaw of monkey’
Aboh Igbo: ěgbá + ‘ + ènwè → ěgbá ènwè ‘jaw of monkey’

In the above examples both ‘jaw’ and ‘monkey’ are underlyingly /L-L/. However, in the ‘Noun1 of Noun2’ construction a /H/ tonal morpheme occurs between the nouns which produces the indicated outputs by linking to the preceding syllable in Central Igbo, but to the following syllable in Aboh Igbo.

Welmers’ second objection to Pike was that there are some segmental morphemes which may be underlyingly toneless—even languages where most morphemes have both a segmental and tonal component. Thus, Chelliah (2003: 428) describes the Meithei [MNI.2] tone system as follows:

“Meithei exhibits a two-way contrast on roots between low and high tone. Suffixes and prefixes have no tone associated with them; instead, the pitch values observed for these are derived through the spreading of lexically specified root tones....”

A number of languages have toneless prefixes, suffixes or grammatical morphemes, often restricting tonal contrasts mostly to lexical morphemes (cf. the discussion of Tucano [TUO.6] in (1.65) and Tangkhul Naga [MNF.2] in (1.66) below). An oft-cited example of toneless...
morphemes concerns the two Mende [MEN.1] postpositions illustrated in (1.13) (Leben 1973, 1978):

(1.13)  

<table>
<thead>
<tr>
<th></th>
<th>base noun</th>
<th></th>
<th></th>
<th>+ hu ‘in’</th>
<th>+ ma ‘on’</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>/H/</td>
<td>kó</td>
<td>‘war’</td>
<td>kó-hú</td>
<td>kó-má</td>
</tr>
<tr>
<td>b.</td>
<td>/L/</td>
<td>bèlè</td>
<td>‘trousers’</td>
<td>bèlè-hú</td>
<td>bèlè-mà</td>
</tr>
<tr>
<td>c.</td>
<td>/HL/</td>
<td>mbû</td>
<td>‘owl’</td>
<td>mbû-hú</td>
<td>mbû-má</td>
</tr>
<tr>
<td>d.</td>
<td>/LH/</td>
<td>mbà</td>
<td>‘rice’</td>
<td>mbà-hú</td>
<td>mbà-má</td>
</tr>
<tr>
<td>e.</td>
<td>/LHL/</td>
<td>nyâhâ</td>
<td>‘woman’</td>
<td>nyâhâ-hú</td>
<td>nyâhâ-má</td>
</tr>
</tbody>
</table>

In (1.13a,b) the underlying /H/ or /L/ spreads onto the toneless postpositions, while in (1.12c,d) the postpositions receive the second tone of the /HL/ and /LH/ contours. A similar realization is observed in (112e), where the final L of the /LHL/ sequence links to the postpositions.

What is particularly fatal for the Pike definition are cases where such morphemes remain toneless throughout the phonology. A particularly interesting case concerns CV morphemes in Hakha Lai [CNH.2] (Hyman & VanBik 2004, 2005), as illustrated by the proclitic ka ‘my’ in (1.14):

(1.14)  

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>ka + /HL/</th>
<th>ka râal</th>
<th>‘my enemy’</th>
<th>[kà räːl]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
<td>ka + /LH/</td>
<td>ka thlāan</td>
<td>‘my grave’</td>
<td>[kà thlāːn]</td>
</tr>
<tr>
<td>b.</td>
<td></td>
<td>ka + /L/</td>
<td>ka kòom</td>
<td>‘my corn’</td>
<td>[kâ kòːm]</td>
</tr>
</tbody>
</table>

In the above examples ka is followed by a noun carrying one of the three contrastive tones in the language, /HL/, /LH/ and /L/. Since all syllables must acquire pitch, the approximate phonetic realizations of [ka] are indicated to the right of the glosses. As seen, the pitch of [ka] is relatively low before the HL and LH tones, but relatively high before a L tone. There is good reason to believe that these pitches are not phonological tones. First, it should be noted that if /ka/ had a phonological L tone in (1.13), it would be expected to condition a change of HL to L on the following noun:

(1.15)  

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>/kòom/ ‘corn’ + /zûu/ ‘beer’</th>
<th>→</th>
<th>kòom zûu</th>
<th>‘corn beer’</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
<td>/râŋ/ ‘horse’ + /râal/ ‘enemy’</td>
<td>→</td>
<td>râŋ râal</td>
<td>‘horse’s enemy’</td>
</tr>
</tbody>
</table>

As seen the /L/ of /kòom/ and /râŋ/ condition this rule, but toneless /ka/ does not (cf. ka zûu ‘my beer’). A second argument for the tonelessness of CV morphemes comes from the fact that /CVV/ syllables often shorten to CV in context. When they do, they also become toneless:

(1.16)  

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>hnâa ‘ear’ + hmâa ‘wound’</th>
<th>→</th>
<th>hna hmâa</th>
<th>‘ear wound’</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td></td>
<td>kêe ‘leg’ + hmâa ‘wound’</td>
<td>→</td>
<td>ke hmâa</td>
<td>‘leg wound’</td>
</tr>
<tr>
<td>b.</td>
<td></td>
<td>sàa ‘animal’ + hmâa ‘wound’</td>
<td>→</td>
<td>sa hmâa</td>
<td>‘animal wound’</td>
</tr>
</tbody>
</table>

As seen, the three contrasting tones of /CVV/ syllables merge when vowel shortening applies. In the above examples [hna], [ke] and [sa] all have a relatively low pitch, but again do not convert the /HL/ of /hmâa/ to L (cf. /râŋ/ ‘horse’ + /hmâa/ → râŋ hmâa ‘horse’s wound’). In
order to carry a phonological tone, a syllable must be CVV, CVC or CVVC in Hakha Lai. In other words, it must have two moras (cf. §XX).

Although Meithei, Mende, and Hakha Lai are unquestionably “tone languages”, the above examples demonstrate that not every syllable (TBU) or morpheme need have a phonological tone. Hakha Lai also illustrates that a distinction must be drawn between “tone” and “pitch”: As in non-tone languages, pitch features may also be assigned at the utterance level, as in the case of intonational phrase and boundary tones. Bearing this in mind, let us now propose a modification of Welmers’ definition in (1.17).

(1.17) A language with tone is one in which an indication of pitch is lexically affiliated with at least some morphemes.

In this definition I maintain Welmers’ emphasis on morphology but make a number of changes. Each of the terms “indication”, “lexically affiliated” and “morphemes” require further comment.

The first change I have made over (1.9) is the substitution of “an indication of pitch” for “pitch phonemes”. Part of the reason is to update the terminology, as current work does not talk about pitch phonemes, rather pitch features (or elements), e.g. the H, M, and L used to refer to high, mid and low tone. However, the proposed definition does not refer simply to pitch, rather to “an indication of pitch”. This phrasing was chosen in an attempt to avoid identifying a language as tonal vs. non-tonal based on the analytic devices adopted by an individual researcher, rather on the properties of the system itself. This issue arises in languages whose pitch properties lend themselves to an “accentual” interpretation. Consider in this context the following data from Somali [SOM.1], where an acute accent marks H tone:

(1.18)    root       masculine       feminine
a. /inan/   inan  ‘boy’       inán  ‘girl’
    /naʃas/  naʃas  ‘stupid man’  naʃás  ‘stupid woman’
    /goray/  goray  ‘male ostrich’ goráy  ‘female ostrich’
b. /darmaan/ damáan  ‘colt’      darmaán  ‘filly’
    /ʃeesaan/ ʃeesáan  ‘young he-goat’ ʃeesáán  ‘young she-goat’
    /dameer/ dameér  ‘he-donkey’  dameér  ‘she-donkey’

As can be observed, a H tone is assigned to the penultimate vowel (or mora) when the noun is masculine, but to the final vowel in the corresponding feminine nouns (Hyman 1981, Saeed 1993, 1999). Other vowels receive phonetic pitch as follows: a post-H vowel is pronounced on a L pitch, while pre-H vowels are pronounced on a M pitch. The contrast in (1.18a) is thus between H-L and M-H, while the last syllables in (1.18b) contrast a HL vs. MH contour. In Somali a word can have at most one H tone which is limited to the above two positions. Words are however not required to have a H tone. For example, verbs are usually toneless, as in the following example in which the subject ‘boy’ is also toneless:

(1.19)  inan wáa dhaʃay  ‘a boy fell’
       boy 3sg.past fall
Somali is thus another language where a tone is not required on every syllable or morpheme—or even word. In these examples and elsewhere in the language, most of the H tones are assigned on the basis of grammatical information such as gender, number, and construction type (e.g. genitives and relative clauses assign a final H tone). But are these grammatical Hs really “tone”?

A number of scholars have instead used the terms “pitch-accent” or “tonal accent” to refer to systems with such sparse tones. Although I would now reject my earlier accentual analysis, in Hyman (1981) I assigned asterisks (*) to mark the places where H tones would later be spelled out. An equivalent diacritic marking would be to underline the penultimate or final vowel, as in (1.19).

(1.20)  

<table>
<thead>
<tr>
<th>root</th>
<th>masculine</th>
<th>feminine</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. /inan/</td>
<td>iän</td>
<td>iän</td>
</tr>
<tr>
<td></td>
<td>‘boy’</td>
<td>‘girl’</td>
</tr>
<tr>
<td>/našas/</td>
<td>našas</td>
<td>našas</td>
</tr>
<tr>
<td></td>
<td>‘stupid man’</td>
<td>‘stupid woman’</td>
</tr>
<tr>
<td>/goray/</td>
<td>goray</td>
<td>goray</td>
</tr>
<tr>
<td></td>
<td>‘male ostrich’</td>
<td>‘female ostrich’</td>
</tr>
<tr>
<td>b. /darmaan/</td>
<td>darmaan</td>
<td>darmaan</td>
</tr>
<tr>
<td></td>
<td>‘colt’</td>
<td>‘filly’</td>
</tr>
<tr>
<td>/¢eesaan/</td>
<td>¢eesaan</td>
<td>¢eesaan</td>
</tr>
<tr>
<td></td>
<td>‘young he-goat’</td>
<td>‘young she-goat’</td>
</tr>
<tr>
<td>/dameer/</td>
<td>dameär</td>
<td>dameär</td>
</tr>
<tr>
<td></td>
<td>‘he-donkey’</td>
<td>‘she-donkey’</td>
</tr>
</tbody>
</table>

As will be discussed further in §XX, determining how to characterize languages where the prosodic mark is “culminative” (at most one per word) has produced a rather non-productive controversy which has a considerable history in Somali itself (cf. Klingeneheben 1949): Should the Somali system be recognized as a restricted tone system in which /H/ tones have a significantly limited distribution, or should it be seen as a third type of system, called “pitch-accent”, because of the culminativity and perhaps other properties which are reminiscent of stress-accent languages?

If the field is going to be serious about typologizing prosodic systems, it will be necessary to “normalize” the analyses by factoring out the intuitions of individual scholars and adopt an explicit definition of tone, as in (1.17) above. After all, the goal is to typologize linguistic properties, not linguists. The proposed asterisks or underlining in Somali represent nothing but pitch, specifically, where to locate the H tones. Nothing else depends on these diacritic marks, e.g. they do not condition segmental effects as are often found in languages with stress-accent. Thus, whether one uses such diacritic devices/accents or assigns H tones directly, Somali meets the criterion of “an indication of pitch”.

Somali also meets the criterion of “lexically affiliated”, by which is meant that the contrastive tonal information must be indicated at the word level (the output of the lexical phonology). This is to exclude phrasal boundary tones and “intonemes” marking declarative, interrogative, imperative, or other utterance types. While final H tones may also be syntactic in Somali, e.g. marking genitives and relative clauses, the forms in (1.18) show that at least some of the tonal contrasts are lexical, i.e. marking word-level morphology. A prosodic system in which all pitch information is postlexical (phrasal) would thus not be characterized as tonal. By excluding postlexical indications of pitch, we also avoid the problem of determining whether boundary and other phrase-level tones are “morphemes” as well as utterance-level pitch properties that are formulaic (as in the English phrase uh oh).

In the remainder of this work we shall adopt the definition of tone in (1.17), recognizing at the same time that there may be borderline cases as well as languages which exploit both
tone and stress-accent in their prosodic system (§XX). Again, the crucial question to ask is whether a specific property is exclusively “an indication of pitch lexically affiliated with at least some morphemes”, in which case we recognize it as tone. If, on the other hand, this “indication” is invoked for purposes beyond pitch, e.g. it conditions consonant or vowel realizations, stress-accent is likely involved. Besides serving as a baseline as we examine different types of tone systems, (1.17) seems also to capture what researchers implicitly have in mind when they approach a language in the field: The question “Is my language tonal?” does not seek to know whether to use diacritics, but rather whether at least some morphemes have pitch exponents at the lexical or word level.

With the above definition established, we can now appreciate the problematics of Chimwiini, which is in fact one of the borderline cases referred to in the previous paragraph. It is clear from (1.11) that the final vs. penultimate realization of H tone is affiliated with “at least some morphemes”. However, as also seen, the tone is not realized lexically, but rather at the phrase level. This is the reason why I have chosen the phrase “lexically affiliated with” in (1.17) rather than “lexical realization” as in (1.21)

(1.21) A language with tone is one in which an indication of pitch enters into the lexical realization of at least some morphemes (cf. Hyman 2001: 1368, 2006: 229)

Let us consider for a moment the relation between a tone and its underlying vs. surface TBU. Two common situations are that a tone is underlyingly linked to a specific TBU, as in (1.1)-(1.4) or that it is assigned to a specific TBU by the morphology, as in (1.18). Unless the underlying tone is deleted by rule, the expectation is that it will surface on the same TBU or that a rule will result in its being realized on a neighboring TBU or TBUs. In case the tone shifts to another TBU, the process may either be lexical (word-bound) or postlexical (phrasal), as in Giryama in (1.10b). In (1.11a) I proposed an analysis of Chimwiini which mirrors the Giryama situation: A morpheme which conditions phrase-final H tone in the output has an underlying /H/.

While there are doubtless other possible interpretations of the Chimwiini facts, we must in any case acknowledge that not all phrasally realized tone can be neatly analyzed in this way. Thus consider the properties of Urarina [URA.6], where Olawsky (2006) groups words into the following four tone classes A-D:

(1.22) class tone pattern determined by the class of the phrase-initial word
A first word = all L; H is assigned to the initial syllable of following word
B first word = all L; H is assigned to the third syllable of following word
C first word = all L; H is assigned to the last syllable of final word of phrase
D first word keeps its final H tone with the following word being realized all L

When pronounced in isolation, Urarina words generally have a single final H, any preceding syllables pronounced on a L pitch. This is true of all four tone classes:

(1.23) A raaná ‘peccary (sp.)’
   B obaná ‘peccary (sp.)’
   C reemaé ‘dog’
   D makusajari ‘pepper’
However, the situation changes quite radically when the word occurs in a phrase. The sentences in (1.24) illustrate that the four tone classes condition different patterns on the following trisyllabic verb **ru.a.kaa** ‘carries/carried (3sg)’. In classes A-C, the word in question is pronounced all L. In addition, each class assigns a H the next word: to the first syllable (class A), to the third syllable (class B), or to the final syllable (class C). Class D words keep their final H with a following word realized as all L. (One additional complication is that class B assigns H to the second syllable of a trisyllabic word whose last syllable is short.)

(1.25)  
A raaná → raana ru.a.kaa ‘he has carried a peccary’  
B obaná → obana ru.a.káa ‘he has carried a peccary’  
C reemá → reemae ru.a.káa ‘he has carried a dog’  
D makusajari → makusajari ru.a.kaa ‘he has carried the pepper’

However one interprets Urarina and systems which resemble it (see §XX; Hyman, in press), it must be acknowledged that the tonal realizations on the verb in (1.25) are the result of “an indication of pitch” being “lexically affiliated” with the preceding object. Rather than seeking different tonal representations, which may be elusive in this case, Olawsky’s analysis is to posit diacritics A-D. This option is also available in Chimwiini, or even Giryama where instead of positing the underlying /H/ on /-ón-/ ‘see’ as in (1.10b), one could place as asterisk or underline /-on/-, adding that whenever a diacritic accent is present on the head of a phrase, a H is inserted onto the penult of that phrase. Since the only purpose of the diacritic is to determine the realization of a lexically affiliated pitch property, (1.17) would still define the Giryama system as tonal. This is a good result as Giryama ultimately permits more than one H per word (see Volk 2007). Whereas (1.10a) showed that Giryama also allows toneless phrases, a phrase must have a H tone in Chimwiini and Uranina, thereby giving the impression of a phrasal “pitch-accent”. As will be seen in §XX, none of these languages have a “prototypical” tone system—the tones are too sparse and “syntagmatic”. By the definition in (1.17), they are still tonal, i.e. they deserve treatment in a work such as this one.

1.3. Typology

In the preceding section we were primarily concerned with establishing a working definition of tone. With the precise definition in (1.17), the hope is that we will be able to determine when a pitch property should vs. should not be identified as tone. Two further questions naturally arise from the attempt to be explicit in this way. First, if something is not tone, what is it? This presupposes that we have a full typology of prosodic systems, which minimally includes tone, stress-accent, intonation—and for those who find it a useful designation, “pitch-accent” systems. Since we will have to be precise about what is meant by stress-accent, pitch-accent and intonation, precise definitions of these will also be necessary (cf. XX). This in turn requires that we have an understanding of the full range of prosodic systems, particularly those which are relatively rare. This may be difficult as many of the outlier systems such as Chimwiini and Urarina have only recently been brought to the attention of the field. (See §XX however for discussion of Ijoid, Yagaria and Wuxi.) What is clear is that the long-distance phrasal realizations described in §1.2 are restricted to tone features—perhaps specifically to the placement of H tones: There is no known language where different words assign a final vs.
The second question concerns the range of variation within tone systems proper. To the extent that different languages meet the definition in (1.17) what are the major ways in which tones systems differ from each other? In this case we do not ask about the relation between tone and other types of prosodic systems, rather seek to determine the significant typological distinctions existing within the class of tone systems proper. Is it true that Southeast Asian tone systems are significantly different from those in Africa (§2.XX)?

Since the above questions are the topic of Chapter 2, we will not go into detail here. Instead, we will consider what is meant by typology and how one might go about determining typological distinctions within phonology and ultimately prosodic systems. Linguistic typology, a centuries-old field of inquiry, has recently shown extraordinary new growth and vitality worldwide. Definitions of the field and how typology should be practiced are many. To take a traditional view first, Hagège (1992: 7) defines typology as “...a principled way of classifying the languages of the world by the most significant properties which distinguish one from another.” The key words here are “classifying”, “languages”, and “most significant properties”. By classifying, the idea is to find the major classes or types which account for observed linguistic variation. In Hagège’s definition it is languages which are classified into types. Thus grammatical typology distinguishes “verb final languages”, “case languages”, “pro-drop languages” etc., meaning languages which have these properties. Similarly, within phonological typology “click languages” and “tone languages” are common designations, meaning languages with contrastive click consonants and contrastive pitch, as defined in (1.17). (On the other hand, “open syllable language” doesn’t mean a language with open syllables, rather a language which lacks closed syllables.) However, we often are not interested in characterizing languages, but rather the properties within them. As Greenberg (1974: 14) put it:

“...all synchronic typologies have this Janus-like nature in that the same data can be utilized either for a typology of linguistic properties or a typology of individual languages.”

As an example, one might seek to typologize how the property of contrastive nasality is instantiated within different linguistic systems. The resulting typology might then look like that in (1.26) (cf. Cohn 1993, Clements & Osu 2003):

(1.26) Distribution of contrastive nasalization
a. on consonants and vowels /m, n, ŋ/ /ɨ, ũ, ā/
b. on consonants only /m, n, ŋ/
c. on vowels only /ɨ, ũ, ā/
d. on whole morphemes /bad/N → [mân]
e. absent entirely

As seen, nasality may be contrastive on consonants and vowels, on consonants only, on vowels only, or on whole morphemes (as a prosody). The options in (1.26a,b) are the most familiar; those in (1.26c,d) represent structural analyses of systems where the nasal feature is nonetheless realized phonetically on both consonants and vowels. A nasalization contrast is
not universal, however, as it is absent entirely in Lushootseed, Quileute, Pirahã, Rotokas and a
number of Lakes Plain languages of Indonesia (Papua). Of course the above is not the whole
story as we may wish to know which nasal consonants are found in which positions, e.g.
whether the language has a velar nasal in onset vs. coda position, also what the relation is
between the set of oral vs. nasalized vowels (see Hajek 1997, for instance). However,
typologizing nasality has been considerably easier—and less controversial—than typologizing
tone. While much of the practice of word prosodic typology has been to provide labels for
different systems, e.g. “tone” vs. “pitch-accent”, designations such as “nasal consonant
language”, “nasalized vowel language” and “nasalized consonant and vowel language” don’t
seem very revealing, nor would we likely refer to (1.26e) as an “oral language”. There are two
reasons for this.

The first is that the typology in (1.26) is not based on who has what in surface outputs,
e.g. phonetic nasalized vowels. If it were, we might classify English as a (1.26a) language,
since a word like can’t /kænt/ is often realized [kæt]. Instead, (1.26) is based on a structural
analysis of the relation between underlying representations and surface realizations. This is
the approach we will take in attempting to typologize tone systems. We will not only be
interested in how many tones contrast on the surface, but also in their relation to the
underlying representations. For example, we saw in (1.3) that Chatino (Yaitepec) [CTP.5]
contrasts four pitch heights on the surface—as presumably in underlying representations as
well. Ngamambo [NBV.1] also contrasts four pitch heights on the surface, but has only two
tones, /H/ and /L/, in underlying representations (§XX). Whereas a surface typology would
identify Chatino and Ngamambo as being of the same tonal type, a deeper analysis would
insist that they are significantly different.

The second reason for balking at designations such as “oral language” is that we are
interested in typologizing systems, not languages. I have already hinted at this in expressing
some reservation about recognizing a class of “pitch-accent languages”. As will be further
examined in Chapter 2, studies along these lines have often grouped languages together which
have quite disparate properties. When one examines the criterial properties individually, one
finds that all of them can be attested in a bona fide tone system as defined in (1.17). While
some of these properties are reminiscent of stress-accent systems, even the most cursory
examination of the alleged pitch-accent studies in Smith & van der Hulst (1988) a lack of
cohesion. As a result, one can neither define nor is there any prototype of the notion “pitch-
accent language” (§2.XX).

In this work we will be interested in typologizing by linguistic properties, specifically in
a PROPERTY-DRIVEN TYPOLOGY of tone. We thus agree with Plank (2001: 1399):

“Typology... is not so much about the classification of languages as about the
distributions of individual traits—units, categories, constructions, rules of all kinds—
across the linguistic universe; these distributions, not languages as such, are the primary
objects of comparison.”

We will be interested in these properties both individually and in combination with each
other—and, as has been pointed out, at all levels of representation. In this sense, there will not
be a great difference between the view of phonological typology taken here and doing
theoretical cross-linguistic phonology. Phonology has been typologically oriented since its
inception, as can be seen from Sapir’s (1925:XX) point that languages can have the same
sounds but very different phonological structures, and vice-versa. As we will see in a number of tone systems, the same phonetic contrast can have a quite different phonological status in different languages. This is of course not a surprising discovery, as the same point can and has been frequently made concerning segmental phonology. For example, the presence of both phonetic voiceless and voiced stops, e.g. [t] and [d], in a consonant system can be:

(i) Underlyingly contrastive. In this case it is possible to get lexical minimal pairs as in English ten /ˈten/ and den /ˈdɛn/.

(ii) Demarcative. In this case it is also possible to get surface minimal pairs, but the difference between [t] and [d] is determined by position within a grammatical or phonological domain. In Basaá [BAS.1], for example, where there is no underlying contrast between /t/ and /d/, /tu/ is realized [t] stem-initially, but is voiced to [d] elsewhere (~ [r] intervocalically): /bâ-tâ/ [batâ] ‘fathers’, /bâTâ/ [bâdâ] ~ [bârâ] ‘gather’, /ti-nûnî/ [di-nûnî] ‘birds’, where /ti-/ is the noun class 13 prefix.

(iii) Allophonic. In this case the difference between [t] and [d] is determined by phonetic context. An example is Korean, where /t/ is realized [d] intervocalically, e.g /su/ ‘water’ + /to/ ‘way’ → [sudo] ‘waterway, waterworks’.

While the usual distinction drawn is between contrastive vs. non-contrastive, or phonemic vs. non-phonemic (allophonic), we see in the examples in (i) and (ii) that the term contrastive is ambiguous: It can refer to underlying or surface representations. The choice must therefore be made whether phonological typology should be based on underlying (morphophonemic) or surface (phonemic) contrasts. The decision made in producing the UPSID database of segmental inventories was to typologize by surface contrasts, hence, roughly the output of the lexical phonology (Maddieson 1984, Maddieson & Precoda 1990). Thus, continuing the example of a voicing contrast on obstruents, UPSID presents the consonant system of Kpelle [XPE.1] as in (1.27).

\[
\begin{array}{cccccc}
p & t & k & k^w & kp \\
b & d & g & g^w & gb \\
f & s \\
v & z \\
6 & l & r & y & Y \\
m & n & ñ \\
\end{array}
\]

However, in the on-line UPSID database Maddieson is well-aware that “voiced plosives and fricatives can be morphophonemically derived in initial position following a low-toned nasal, which deletes”) (http://web.phonetik.uni-frankfurt.de/L/L4103.html). What this means is that there are contrasts such as in (1.28a) (Welmers 1962:XX), where [.] = nasalization:

\[
\begin{array}{ll}
\text{stem} & \text{‘my’} & \text{‘his/her’} \\
a. & \text{pólu} & \text{‘bólù} & \text{‘back’} \\
& \text{tíé} & \text{‘díùé} & \text{‘front’} \\
& \text{kɔ́} & \text{‘gáó} & \text{‘foot, leg’} \\
& \text{kpiŋ̊} & \text{‘gbiŋ̊} & \text{‘self’} \\
& \text{fií} & \text{‘víi} & \text{‘hard breathing’} \\
& \text{súá} & \text{‘zúá} & \text{‘nose’} \\
\end{array}
\]
As seen in the ‘my’ forms, /p,t,k, kp, f, s/ become voiced after an underlying H tone nasal /N-/. They also become voiced with an initial pitch lowering in the ‘his/her’ forms. That a L tone nasal /N-/ is involved can be seen in (1.28b), where /b, l, w, y/ become the corresponding nasal consonant with a H tone in the ‘my’ forms and with a L tone in the ‘his/her’ forms. Because the L tone nasal drops out in the ‘his/her’ forms in (1.28a), Kpelle is entered with a voiced obstruent contrast in UPSID—ignoring the fact that pólu ‘back’ and bólu ‘are, strictly speaking, not a minimal pair because of the initial L tone of the latter. It is interesting to note that Welmers phonemicizes the ‘his/her’ forms as /`pôlu/, /`tú/, and so forth (cf. (1.42) below for his analysis of Kpelle tone).

With its morphophonemic orientation, generative phonology has of course traditionally revelled in data such as in (1.28). But what about phonological typology? Should typology “classify” by morphophonemic contrasts or by what contrasts on the surface? Specifically, should one consider Kpelle among the languages which have a voicing contrast in obstruents, or among those which don’t? As we shall see, the same problem arises in tone system typology. To some extent we have already seen this in the two interpretations of Somali which were considered in §1.2 In the strictly tonal analysis in (1.18) Somali would qualify as having a /H/ vs. Ø contrast throughout its phonology (although the /H/ tones are largely assigned by the grammar). In an accentual analysis such as in (1.20), the underlying contrast would be one of (contrastive) accent, while the surface contrast might still be tone. In this case it was argued that the so-called accents were equivalent to tones. Thus, under either analysis Somali would be included among languages of the world having a tone system. However, its culminative /H/ tone would figure prominently in an internal typology and differentiation of tone systems. That is, the goal of typology is not simply to place a label on different “types”, e.g. languages with or without a tonal or obstruent voicing contrast, rather to appreciate how these systems are the same vs. different.

Returning to the Kpelle problem, we don’t want simply to throw together all languages that contrast voicing on obstruents at any level. That would seem to be missing an important difference between Kpelle and, say, English. As seen in (1.29), consonant systems fall into four different obstruent voicing “types”, depending on the level of representation at which the voiced obstruents first contrast in the phonology (marked by “x”):

<table>
<thead>
<tr>
<th>Type</th>
<th>morphophonemic</th>
<th>phonemic</th>
<th>allophonic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Type 2</td>
<td>-</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Type 3</td>
<td>-</td>
<td>-</td>
<td>x</td>
</tr>
<tr>
<td>Type 4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

While obstruent voicing may originate at any of the three indicated levels of representation, it can also be totally lacking (Type 4). Once voicing is present at one level, it must be carried through to the lower level(s). An analysis in which /b, d, g/ occur morphophonemically and/or
phonemically, but not allophonically (i.e. phonetically), would probably be too abstract to be useful for typological purposes. Finally, we have to decide what to do about an extremely rare language such as Yidiny, whose only stops are pronounced [b, d, j, g] (Dixon 1977: 31). If analyzed as /b, d, j, g/, Yidiny falls into Type 1. If analyzed as /p, t, c, k/, with redundant voicing Yidiny becomes Type 3. However, in reality it is unlike either: Unlike Type 1, /b, d, j, g/ does not contrast with /p, t, c, k/. Unlike type 3, there are no voiceless allophones (or only marginal devoicing) alternating with [b, d, j, g]. We could of course trivially assign Yidiny to a Type 5. In any case, the typology should be based not only on what is contrastive, but also on what occurs—even if redundantly—and at what level of representation. The question is whether the one stop series [b, d, j, g] should be encoded as underlyingly voiced, voiceless, or perhaps even “underspecified” /P, T, C, K/, i.e. [o voice].

This last possibility returns us to another issue mentioned in §1.2, namely, the need to “normalize” the analyses of different languages so that their properties can be compared as independently from different theoretical interpretations as possible. This is what Maddieson (1984) and Maddieson & Precoda (1990) had to do in setting up the UPSID database. Maddieson (1991: 196) recognizes the problem of having to rephonemicize a number of the systems in UPSID. He describes the methodology as follows:

“Segments are positively specified for those attributes possessed by the most basic allophone of the segment in question. In most cases this is the most frequent allophone, but sometimes there are reasons for thinking that another phonetic form is more basic, particularly when the more common form seems like a relaxed variant of the other.”

An interesting case comes from Rotokas, which is well-known for its small consonant system, generally phonemicized with the voiceless stops /p, t, k/ and the voiced consonants /β, r, g/ (Firchow & Firchow 1969). The voiced series is however subject to the following allophonic variations, where I have substituted the IPA symbols [β], [r] and [γ] for [b], [r] and [g]:

“The allophones of /β/ are [β], [b], and [m], which fluctuate freely in all positions....”

“The allophones of /r/ are [r], [n], [l] and [d], which fluctuate freely in all positions....”

“The allophones of /g/ are [g], [γ], [ŋ], which fluctuate freely in all positions. The allophone [γ] is predominantly heard word medially....” (Firchow & Firchow 1969: 274)

Maddieson maintains Firchow & Firchow’s phonemic /β, r, g/ in UPSID, whereas his above methodology would presumably allow a /b, d, g/ interpretation. Either representation would classify Rotokas as devoid of nasal consonants in its underlying inventory. A third possibility, /β, r, γ/ would place Rotokas among the languages lacking phonemic voiced stops.

All of the above problems—levels, (non-)contrastiveness, interpretation—arise in the analysis of tone systems. A rather example occurs in Ik [IKX.1], about which Heine (1993: 18) writes:

“A low tone is realized as mid if followed by a high tone in the same word. The mid tone is retained even when the high tone is deleted due to word-final devoicing.”

As seen in the examples in (1.30), Ik contrasts /H/ and /L/ on both syllables of a bisyllabic word. When the final vowel is devoiced and deleted, the results are as indicated:
When the two tones are identical, as in (1.30a,b), a single H or L results. When the tones are different, \( /H-L/ \) is realized as a HL falling tone, while \( /L-H/ \) is realized \([M]\). What this means is that although Ik has an underlying two-height tone system \( /H, L/ \), it contrasts three tone heights, \( H, L \) and \( M \), on the surface. Should Ik be typologized as a two-height or three-height tone system?

If we adapt the approach of (1.29) to the question of tone height, a partial typology of tone height might look as follows:

(1.31)

<table>
<thead>
<tr>
<th>morphophonemic phonemic allophonic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1  2  2  2</td>
</tr>
<tr>
<td>Type 2  2  2  3</td>
</tr>
<tr>
<td>Type 3  2  3  3</td>
</tr>
<tr>
<td>Type 4  3  3  3</td>
</tr>
</tbody>
</table>

As seen, a language can have two tone heights, \( H \) and \( L \), at all levels, as in Falam, which contrasts \( H \) and \( L \), as well as a HL falling and LH rising contour on monosyllabic words (from my personal notes):

(1.32)  
\[ /H/ \quad \text{páa} \quad \text{‘mushroom’} \quad \text{lám} \quad \text{‘road’} \]  
\[ /L/ \quad \text{kèe} \quad \text{‘leg’} \quad \text{sèer} \quad \text{‘lemon’} \]  
\[ /HL/ \quad \text{sâa} \quad \text{‘animal’} \quad \text{thlûak} \quad \text{‘brain’} \]  
\[ /LH/ \quad \text{zâu} \quad \text{‘bear’} \quad \text{tłâañ} \quad \text{‘mountain’} \]

Similarly, a language can have three tone heights \( H, M, L \) contrasting at all levels, as in San Marcos Tlalcoyalco Popoloca (Stark & Machin 1977; 73) As seen in the following examples (where I have replaced the numerical marking of tone height with accents), all nine combinations of the three tone heights occur on bisyllabic words (p.74):

(1.33)  
\[ /H-H/ \quad \text{îch:á} \quad \text{‘more’} \]  
\[ /H-M/ \quad \text{şóth:á} \quad \text{‘grinding stone for metate’} \]  
\[ /H-L/ \quad \text{hác:è} \quad \text{‘red’} \]  
\[ /M-H/ \quad \text{çûnt:á} \quad \text{‘snow’} \]  
\[ /M-M/ \quad \text{kâtê} \quad \text{‘sandal’} \]  
\[ /M-L/ \quad \text{sák:ò} \quad \text{‘pineapple’} \]  
\[ /L-H/ \quad \text{tòs:á} \quad \text{‘orange (sour fruit)’} \]  
\[ /L-M/ \quad \text{kâc:ò} \quad \text{‘maguey’} \]  
\[ /L-L/ \quad \text{kân:tà} \quad \text{‘nopal’} \]

On the other hand, a language may have fewer underlying or phonemic tone heights than on the surface. Jenison & Jenison (1991:XX) analyze Obokuitai with underlying \(/H/ \) and \(/M/\)
tone, which they designate as pitch levels [1] and [2]. The following distributions are found in mono-, bi- and trisyllabic words:

(1.34)  

<table>
<thead>
<tr>
<th></th>
<th>monosyllabic</th>
<th>bisyllabic</th>
<th>trisyllabic</th>
</tr>
</thead>
<tbody>
<tr>
<td>HM</td>
<td>H-M</td>
<td>H-H-M</td>
<td>M-H-M</td>
</tr>
<tr>
<td>M</td>
<td>HM-H</td>
<td>H-M-H</td>
<td>M-M-H</td>
</tr>
<tr>
<td></td>
<td>HM-M</td>
<td>H-M-M</td>
<td>M-M-M</td>
</tr>
<tr>
<td></td>
<td>M-H</td>
<td>HM-H-H</td>
<td>M-M-HM</td>
</tr>
<tr>
<td></td>
<td>M-M</td>
<td>HM-M-M</td>
<td></td>
</tr>
</tbody>
</table>

As seen, except for M-M-HM, the HM contour is generally found on the first syllable. Jenison & Jenison (1991:XX) further point out that the three contrasting tones are subject to the following lowerings before pause:

(1.35)  

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>→</td>
<td>HM</td>
</tr>
<tr>
<td>HM</td>
<td>→</td>
<td>HL</td>
</tr>
<tr>
<td>M</td>
<td>→</td>
<td>L</td>
</tr>
</tbody>
</table>

Whereas a final /H/ becomes HM, both /HM/ and /M/ end L before pause. The difference between the M and L pitch levels is clearly allophonic, hence the Type 2 designation of Obokuitai in (1.31). Note that nothing would change if we instead interpreted Jenison and Jenison’s [1] and [2] as H vs. L, with [3] being a prepausal lowered L tone (L).

Unlike Obokuitai, where the third tone height is allophonic, we saw in (1.30) that the contrast between M and L is phonemic in Ik. There are two reasons why the third height is considered to be “phonemic”: First, the /H/ trigger of the L → M raising rule is not present on the surface (vs. the pause in Obokuitai). Second, since the raising rule applies only within the word (as quoted from Heine above), phonetic [M-H] and [L-H] will contrast within utterances, the latter necessarily occurring across a word boundary.

The above represents only a partial view of the possible distinctions which arise in languages with the same vs. different number of tone heights at the different levels of phonological representation. As will be seen in Chapter XX, underlying /H, L/ and /H, M, L/ systems are also capable of contrasting four, even five, tone heights on the surface. Encoding these differences as in (1.31) seems to be a more revealing way of encoding the typological properties rather than choosing an arbitrary level at which to encode the number of tone heights. In other words, a truly phonological typology is not one which “flattens” input-output relationships to a single level, rather one which both embraces and sorts out the underlying and surface complexities as I have only briefly done above. We will have to do this not only for tone height, but for other properties of tonal representation as well, for example, concerning the status of contour tones, floating tones, positional or cooccurrence restrictions on the various tones, and so forth. When all of the significant properties of tone are considered at once, we will of course be interested in seeing which ones tend to correlate with each other and with properties outside of tone. However, as discussed in Chapter XX, it is unlikely that there will be discrete “types” of tone systems, rather clusters of properties which can vary independently and, hence, may tend, but are not required to cooccur.
This brings us back to the question of what the goal of (phonological) typology is or should be. According to Bickel (2007: 239), the goal of typology is to ask, “What’s where why?” What is found? Where is it found? Why? Conceptualized in this broad way, typology is involved not only in determining Hagège’s “most significant properties which distinguish one [language] from another”, but also the distribution of these properties in the world’s languages and the explanation of the distribution. To do this one must consider “universal tendencies”, genetic inheritance, areal factors vs. chance. For example, if it is true that Chinese and nearby tone systems have certain properties that are different from those found, say, in Africa, as has sometimes been suggested (Pike 1948, Ratliff 1992a,b), we need to understand the properties of the relevant systems (= what), establish if there really is such a geographic skewing (= where), and, if so, account for why this is the case (= why).

As pointed out earlier in this section, phonology has always been concerned with such questions. Thus, while there has been a de facto split between formal syntax and (morpho-) syntactic typology, phonological theory has always been inherently cross-linguistic and typological. The goal of traditional generative phonologists has been to understand what is possible in a phonological system. I share this concern in the sense that tone systems have certain properties which are not found elsewhere in phonology (§XX). While some practitioners have taken this goal as an invitation to construct abstract formal models, the vast majority of work on tone has been concerned with substance: What is found vs. not found in the tone systems of the world, and how can we account for it? In the following chapters there will not be a huge difference between doing “phonology” and doing “phonological typology”. Whichever it is, the emphasis will be on a PROPERTY-DRIVEN typology, i.e. on analyzing and understanding the properties of diverse tone systems.

1.4. Description

It is often said that there is no description without theory, and tone is no exception. I will therefore treat description and theory together. As seen in §1.3, one theoretical position that we have already taken concerns representations: While various schools of thought have taken different positions, phonology has long recognized three distinct levels of representation:

(1.36) a. the morphophonemic level
    b. the phonemic level
    c. the (systematic) phonetic level

These three levels can be defined roughly as follows: First, the morphophonemic (or underlying) level is what one obtains by following the principle “One morpheme, one representation”. The procedure here is to factor out allomorphy which can be predicted on the basis of the phonological environment. Since this includes the position of a morpheme within a prosodic domain, grammatical information may also be invoked, although perhaps indirectly. In this sense, the morphophonemic level is obtained by a top-down operation, which pays attention especially to the phonological alternations which input morphemes undergo. Let us return to Falam [FLM.2], whose tones were briefly presented in (1.32). As seen in (1.37a) a /LH/ rising tone is realized without change when followed by a L tone:
(1.37)  
\begin{align*}
a. ~/tlaaŋ/ + ~/sëer/ & \rightarrow tlaaŋ sëer \quad \text{‘mountain lemon’} \\
b. ~/tlaaŋ/ + ~/läm/ & \rightarrow tlaaŋ läm \quad \text{‘mountain road’} \\
c. ~/tlaaŋ/ + ~/sâa/ & \rightarrow tlaaŋ sâa \quad \text{‘mountain animal’} \\
d. ~/tlaaŋ/ + ~/zuû/ & \rightarrow tlaaŋ zuû \quad \text{‘mountain bear’}
\end{align*}

However, by a rule of “tonal absorption” (§XX) originally described by Osburne (1975: 132), /LH/ is simplified to [L] when followed by /H/ or /HL/, as in (1.37b,c). Also quite regularly, a /LH/ + /LH/ sequence is realized [L-H], as in (1.37d). Osburne proposes that /LH/ + /LH/ first becomes LH + H, and then the tonal absorption rule needed for (1.37b,c) converts this to L-H. The result of these alternations is that one cannot tell from the surface if a L + H sequence is from /LH/ + /H/, /LH + LH/, or /L/ + /H/ (cf. /sëer/ + /läm/ → sëer lâm ‘lemon road’). The morphophonemic level sorts all of this out on the basis of how each of the above morphemes is pronounced in isolation, and in contexts where there are no tone changes.

While the morphophonemic level is established by comparing allomorphs of the same morpheme, the phonemic level is obtained by comparing allophones which can be predicted on the basis of the phonetic environment. The phonemic level is thus obtained by a “bottom-up” operation largely involving the factoring out of redundancies. Contrastive vs. allophonic distributions have usually been established within the word domain, i.e. ignoring any phones which become contrastive only when words are combined. Consider the examples we discussed in §1.3 concerning predictable variation between M and L pitches. In Obokuitai, where the non-H tone is realized L before pause and M everywhere else, the variation is allophonic. However, the situation is different in Ik, where /L/ is raised to M before a /H/ occurring in the same word. Because this /H/ can be deleted, as in (1.30), the resulting L vs. M allophones cannot be predicted from the surface—and hence would be treated as a phonemic contrast in many frameworks. In a related process, a strictly allophonic third [M] is found in Kubeo [CUB.6], where /L/ is predictably realized M before a H tone CV syllable (Salser 1971:XX). In the Cibecue, San Carlos and White Mountain dialects of Western Apache [APW.4], which contrast /L/ vs. Ø (no tone),

“... there are three phonetic tones, mid, high and low, where mid and high are realizations of the non-low tone in complementary distribution. The mid tone occurs on long vowels, and the high tone occurs on short vowels.” (de Reuse 2005: 209)

In Mulwi [MUG.1], the non-H tone will be realized [L] after one of the “depressor consonants” /b, v, ñ, z, g/, otherwise [M] (Tourneux 1978: 52). As these examples clearly show, tonal allophony can be conditioned by segmental information (cf. §XX).

The third level, termed “systematic phonetic”, consists of the output phones of the phonology, which are considered to be discrete, categorical, and not fully specified in phonetic detail. This level is said to correspond to a broad phonetic transcription and is thus distinct both from a narrow transcription and the actual physical phonetic record. There are of course problems determining where to draw the line, i.e. where phonology leaves off and phonetics begins. Many researchers in fact do not consider it possible to separate phonetics and phonology, and some might not accept the above characterization of three distinct levels.

In this study it will generally suffice to mark underlying forms with the traditional slash notation, e.g. Ik /cèkí/ ‘woman’, with intermediate or output forms being presented either
without indication of the level of representation, e.g. cēkī, 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

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<td>3</td>
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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) \[ \begin{array}{c}
H \\
p \ a \\
\end{array} \begin{array}{c}
L \\
p \ a
\end{array} \]

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

(1.41) a. \[ \begin{array}{c}
H \\
C \ V \\
p \ a
\end{array} \begin{array}{c}
L \\
C \ V \\
p \ a
\end{array} \]

b. \[ \begin{array}{c}
H \\
\mu
\end{array} \begin{array}{c}
L \\
\mu
\end{array} \]

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) root node: \[ o \]

laryngeal node: \[ \begin{array}{c}
-\text{voice}
\end{array} \begin{array}{c}
-\text{cont}
\end{array} \begin{array}{c}
-\text{nasal}
\end{array} \]

place node: \[ o \]

Labial
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).

![Contour Tone](image1.png)  
(1.43) a. σ σ b. σ σ σ σ

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).

![Falam Simplification](image2.png)  
(1.44) a. σ 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 $[^3]$, $[^13]$, $[^*]$ and $[^*]$. 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’
   láá ‘lie down’
   bóá ‘knife’
   píli ‘jump’
   b. Low throughout
   kpòò ‘padlock’
   tòò ‘chisel’
   kpáki ‘loom’
   tóloj ‘dove’
   c. High followed by low (low begins on the next vowel if there is one)
   ye ‘for you’
   kpôŋ ‘door’
   tôa ‘pygmy antelope’
   kâli ‘hoe’
   d. Mid throughout
   kpɔŋ ‘help’
   see ‘sit down’
   sua ‘animal’
   kâli ‘snake’
   e. Mid with first vowel, then high followed by low
   te ‘black duiker’
   konâ ‘mortar’
   yuñ ‘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:

$$
\begin{array}{c}
\mu \\
\mu \\
\downarrow \\
L \ H \\
\downarrow \\
M
\end{array}
$$

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).

$$
\text{pili} \quad \text{tọọ} \quad \text{kali} \quad \text{kali} \quad \text{kona} \\
\vee \quad \vee \quad | \quad | \quad | \quad | \quad \wedge \\
H \quad L \quad H \ L \quad L \ H \quad L \ H \ H \\
(\rightarrow \text{M-M}) \quad (\rightarrow \text{M-HL})
$$

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).

$$
\text{a. } \sigma \quad \sigma \\
H \quad H \\
\text{b. } \sigma \quad \sigma \\
H \quad H
$$

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, CVVCV, CVVCV and CVVCVCV—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:

$$
\text{a. } \text{medially} \quad \text{b. } \text{before pause} \\
(mà-) bá \quad (mà-) bá \quad \text{‘oil palms’} \\
(mà-) báá \quad (mà-) báá \quad \text{‘cheeks’} \\
(mà-) bágá \quad (mà-) bágá \quad \text{‘show knives’} \\
(lì-) báámá \quad (lì-) báámá \quad \text{‘liana’} \\
(lì-) bálágá \quad (lì-) bálágá \quad \text{‘fence’}
$$
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. millennia

\[
\begin{array}{cccc}
\text{má-bá} & \text{wátá} \\
\text{H} & \text{H} & \text{\underline{M}} & \text{\underline{M}}
\end{array}
\]

b. before pause

\[
\begin{array}{cccc}
\text{má-bá} & \text{wátá} \\
\text{H} & \text{\underline{M}} & \text{\underline{M}}
\end{array}
\]

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. ainge-ja → angé-įjá ‘he should have cooked’
\[ \begin{array}{c}
\text{H} \\
\text{H}
\end{array} \]
b. ku-chi-shunth-a → ku-chí-shúnth-a ‘to wash it’ (cf. ku-shunth-a ‘to wash’)
\[ \begin{array}{c}
\text{H} \\
\downarrow
\end{array} \]

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’  
\[ \begin{array}{c}
\downarrow
\text{H}
\end{array} \]
b. ngo↓tó ‘sheep’  
\[ \begin{array}{c}
\text{H} \\
\text{H}
\end{array} \]
c. ngo↓tó
\[ \begin{array}{c}
\text{H} \\
\text{L} \\
\text{H}
\end{array} \]

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  
\[ \begin{array}{c}
\text{H} \\
\text{H}
\end{array} \]
b. σ
\[ \begin{array}{c}
\text{H} \\
\text{H}
\end{array} \]

The OCP(TT) clearly prohibits 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↓H contour syllable in the following Shambala example (David Odden, pers.comm. Nov. 13, 2010):

(1.56) u-a-kaang-a → wá↓á↓káanga ‘you sg. killed’ (remote past)
\[ \begin{array}{c}
\text{H} \\
\text{H} \\
\text{H}
\end{array} \]
As Odden points out, however, one could equally well maintain that mora is the TBU in Shambala, as in (1.56):

(1.57) \[
\begin{array}{c}
\sigma \\
\mu \\
\mu \\
\H \\
\H
\end{array}
\]

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. \[
\begin{array}{c}
\sigma \\
\H \\
\H
\end{array}
\]

b. \[
\begin{array}{c}
\sigma \\
\H \\
\H
\end{array}
\]

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 tautomorphic, 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 possibility, 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. \[
\begin{array}{c}
\sigma \\
\sigma \\
\sigma \\
\H \\
\L \\
\H
\end{array}
\]

b. \[
\begin{array}{c}
\sigma \\
\sigma \\
\sigma \\
\H \\
\H \\
\H
\end{array}
\]

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) \[
\begin{array}{c}
bá-ka-bón-a \\
\H \\
\H \\
\H \\
\H \\
\H
\end{array}
\]

‘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-pénemène ‘plant (sp.)’ | li-káasiya ‘oar’ | n-xúwaákhi ‘tree (sp.)’

\[\begin{array}{c|c|c}
\text{H} & \text{H} & \text{H} \\
\end{array}\]

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’ ká: ‘in the mouth’

b. LH → LHL gǔ: ‘granary’ gǔ: ‘in the granary’

gũn ‘back (body)’ gũn: ‘behind’

c. L-H → L-HL bɔrɔ ‘bottom’ bɔrɔ: ‘at the bottom’

d. H-H → H-L úró ‘house’ úró ‘in the house, at home’

nũmɔ ‘hand’ nũmɔ ‘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) a. bɔrɔ Ø
\[\begin{array}{c|c|c}
\text{L} & \text{H} & \text{L} \\
\end{array}\]

b. nũmɔ
\[\begin{array}{c|c|c}
\text{H} & \text{L} & \text{H} \\
\end{array}\]

While pre-autosegmental approaches could represent such sequences as /bɔrɔ + '/' and /nũmɔ + '/', 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 /numó/ 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/ \(\rightarrow [\text{vér}]\) ‘warn’
\[\text{H}\]
b. /bara/ \(\rightarrow [\text{m[bàr]}]\) ‘love-charms’
\[\text{LH}\]
c. /yawi/ \(\rightarrow [\text{yàwà}]\) ‘pie’
\[\text{L}\]

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/ \(\rightarrow \text{àpò} [\text{àpɔ}^\prime]\) ‘to repair’
\[\text{LH}\]
b. /apo-bí\textsuperscript{N}/ \(\rightarrow \text{apo-bí}^N [\text{àpɔmì}]\) ‘he repairs’
\[\text{LH}\]

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) \(\emptyset\)-L
aa-kúy ‘head’
ma-khá ‘cough’
ka-shúy ‘be startled’
ŋa-níŋ ‘stand’

\(\emptyset\)-M
aa-kór ‘cover’
ma-cô ‘spit’
ka-sáy ‘be accustomed’
ŋa-réw ‘play’

\(\emptyset\)-H
aa-khòŋ ‘neck’
ma-nú ‘laugh’
ka-tsàa ‘be ill’
ŋa-níl ‘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 reminiscent 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) 
<table>
<thead>
<tr>
<th></th>
<th>H tone</th>
<th>L tone</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>σ mé ‘language’</td>
<td>mè ‘taro’</td>
</tr>
<tr>
<td>b.</td>
<td>σ−σ támo ‘down below’</td>
<td>támo ‘matches’</td>
</tr>
<tr>
<td></td>
<td>kiki ‘bone’</td>
<td>kiki ‘tree type’</td>
</tr>
<tr>
<td>c.</td>
<td>σ−σ−σ fèrepe ‘bushknife’</td>
<td>èresa ‘dark’</td>
</tr>
<tr>
<td></td>
<td>sakâre ‘arrow’</td>
<td>hiwâti ‘eyelash’</td>
</tr>
<tr>
<td></td>
<td>kenari ‘tree type’</td>
<td>kenari ‘bamboo type’</td>
</tr>
</tbody>
</table>

“Marginal” syllables are toneless and receive their pitch as follows:

“High nuclear syllables usually pull following contiguous marginal pitches 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-contrastive 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) 
|   | (H-M) râlôŋ ‘to come to agreement’ |
|   | M-M râlôŋ ‘to accompany’ |
|   | L-M râlôŋ ‘to become necessary’ |
| b. | Ø-M râlôŋ ‘to rise up’ |
| c. | H-Ø kágəp ‘to owe a debt’ |
The forms in (1.68a) have two phonological tones and exhibit a minimal 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) kpára + éngū → kpárá ngu ‘that man’
kíti + éngū → kíti ngū ‘that village’
wórēsē + éngū → wórēsē ngū ‘that woman’
wōdzādzī + éngū → wōdzādzī 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)
kpára engú → kpára ngu → kpára ngú
HM H M HM H M HM 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 /tuüzé/ ‘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. tuüz̥ lawo → tuüz̥ lawo → tuüz̥ láwo [tùuz̥ láwò] ‘a child’s horse’
   \[\begin{array}{c}
   H
   \end{array}\] \[\begin{array}{c}
   H
   \end{array}\] \[\begin{array}{c}
   H
   \end{array}\]

   b. yaara lawo → yaar lawo [yáar láwò] ‘a child’s arm’
   \[\begin{array}{c}
   H
   \end{array}\] \[\begin{array}{c}
   H
   \end{array}\]

   c. yaara lawo → yaar lawo → yár̥ láwo *[yáar láwò]
   \[\begin{array}{c}
   H
   \end{array}\] \[\begin{array}{c}
   H
   \end{array}\] \[\begin{array}{c}
   H
   \end{array}\] \[\begin{array}{c}
   H
   \end{array}\]

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 /bi-/ in Abo [ABB.1] (personal notes):

(1.72) a. /bi-kék/ → bikék ‘things’
   /bi-tán/ → bitán ‘insects’

   b. /bi-át/ → byât ‘nails, claws’
   /bi-úŋ/ → byúŋ ‘skylarks’

In (1.72a), where the stem begins with a consonant /bi-/ 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):

\[(1.73) \quad /\text{èmì là wè bâsângi}/ \rightarrow [\text{èmâwâ:sângi}] \quad \text{‘it’s you and I who are related’}\]

In this example, when the [b] prefixal bâ- is deleted, the remaining â- fuses with the preceding pronoun wè ‘you’, producing the tonal complex syllable [wâ].

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:

\[(1.73) \quad \text{stable (remaining) deleted}\]
\[
a. \quad \text{tone} \quad \text{TBU, segment} \\
b. \quad \text{segment} \quad \text{tone, TBU} \\
c. \quad \text{TBU} \quad \text{tone, segment} \\
d. \quad \text{tone + segment} \quad \text{TBU} \\
e. \quad \text{tone + TBU} \quad \text{segment} \\
f. \quad \text{segment + TBU} \quad \text{tone}\]

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:

\[(1.74) \quad \text{location} \quad \text{example}\]
\[
1 \quad \text{Africa} \quad \text{MWM.1 Sar} \\
2 \quad \text{Asia} \quad \text{MNI.2 Meithei} \\
3 \quad \text{Pacific} \quad \text{AFZ.3 Obokuitai} \\
4 \quad \text{North America} \quad \text{HUR.4 Halkomelem} \\
5 \quad \text{Mexico} \quad \text{CTP.5 Chatino (Western Highland)} \\
6 \quad \text{South America} \quad \text{TUO.6 Tukano}\]
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:

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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

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  2.1. Goals of prosodic typology
  2.2. Definitions of prosodic systems
    2.2.1. Tone
    2.2.2. Stress
    2.2.3. Accent
2.3. Typology of prosodic systems
   2.3.1. Prototypical systems
   2.3.2 Mixed systems
   2.3.3. Intermediate systems

2.4. Typology of tone systems
   2.4.1. By tonal oppositions (underlying, surface)
   2.4.2. By tonal domains and interfaces
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   3.1.1. /H/ vs. Ø systems
   3.1.2. /L/ vs. Ø systems
   3.1.3. /HL/ vs. Ø systems
   3.1.4. /H/ vs. /HL/ systems
   3.1.5. Other

3.2. Equipollent systems
   3.2.1. /H/ vs. /L/ systems
   3.2.2. /HL/ vs. /LH/ systems
   3.2.3. Other

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Chapter 4. Multilevel tone systems I: Underlying
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   4.1.2. /H/ vs. /L/ vs. Ø systems
   4.1.3. Other

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5.2. Downstepped tone systems
   5.2.1. Downstepped H vs. M tone
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5.3. Upstep tone systems
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Chapter 9. Prosodic functions of tone

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9.3. Tone and intonation
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10.2. Tonal dissimilations
   10.2.1. target vs. trigger
   10.2.2. paradigmatic (horizontal) vs. syntagmatic (vertical)
   10.2.3. anticipatory vs. perseverative
   10.2.4. directionality
   10.2.5. comparison with tonal polarity

10.3. Additional factors in tonal assimilation and dissimilation
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11.1. Evidence for markedness hierarchy: *R >> *F >> H, L
   11.1.1. asymmetric occurrence of R vs. F in contour inventories
   11.1.2. asymmetric timing/effort requirements of R vs. F

11.2. Contour simplification based on the nature of the TBU
   11.2.1. underlying TBU is insufficient in terms of syllable weight, duration or sonorance
   11.2.2. derived TBU is insufficient in terms of syllable weight, duration or sonorance
   11.2.3. TBU is absent or deleted

11.3. Contour simplification based on position within a domain
   11.3.1. in the word (root vs. affix, initial vs. final etc.)
   11.3.2. in the phrase/utterance (distance from boundary; edge-adjacent decontouring)

11.4. Contour simplification based on tonal environment
   11.4.1. contour does not appear adjacent to preceding/following identical tone feature
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12.3. Tonoexodus
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12.4. Diachrony and tone system typology
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Appendix: Geographic and genetic identification of languages cited along with their tonal inventories
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