

# Cumulativity and ganging in the tonology of Awa suffixes

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## 1 Introduction

Awa (ISO 639-3: awb) is a Papuan language in the Kainantu group spoken in the Eastern Highlands region of Papua New Guinea by about 2000 people. It is a tonal language with a fairly high functional load in both lexical and grammatical distinctions. This paper revisits the tonology of noun suffixes, as described by Loving (1973). The author treats most suffixes as underlyingly toneless and divides them into six classes depending on the observed tonal alternations when suffixed onto noun roots. Here I reanalyze the suffixes as indeed having underlying tone, arguing that this view greatly simplifies the analysis while at the same time abiding by common constraints on tone motivated by typological data.

The analysis brings up two main theoretical points of interest. First, Awa avoids HLH sequences, a common avoidance crosslinguistically due to the large amount of pitch excursion required in a short period of time. However, in Awa, this sequence is avoided in just one particular configuration: when the two H tones are separated by a single L association line, as in H.LH, HL.H, or H.L.H (where the period indicates a syllable boundary). Interestingly, HL.LH is acceptable. This suggests that the avoidance configuration is abstract, since phonetically, it would seem that an entire L-toned syllable between two Hs would allow more time for the L tone than two halves of contour tones.

Second, as the title indicates, the analysis of Awa relies crucially on constraint ganging. This means that no strict ranking of constraints can be found to derive the data patterns (without constraint conjunction, Smolensky 1993, 2006). In this paper, I couch the analysis in Harmonic Grammar (Legendre et al. 1990, Smolensky and Legendre 2006), using

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weighted constraints to capture effects of counting and ganging-up cumulativity (Jäger and Rosenbach 2006).

A final aim of this paper is to bring descriptive data from fifty years ago back into the spotlight by applying current analytic techniques. Many beautiful data sets lie buried in the pages of old grammars, and the generalizations in these data may help shed light on current questions of theory and typology. It is my hope that the preliminary analysis provided in this paper can serve as a starting point for future work on Awa, particularly since data from Papaun languages have received relatively little attention in the development of theories of tone.

## 2 Awa tone

### 2.1 Tonal inventory

Awa is described as having four tones, high (H), falling (HL), rising (LH) and low (L). Though Loving lists these as equal tonemes, I will show in this analysis that HL and LH are best seen as the combination of L and H rather than as tonal primitives in their own right. The tones are linked to syllables, and each syllable can carry up to two tones. Examples of the tonemic contrast include:<sup>2</sup>

- (1) náh ‘breast’  
nàh ‘house’  
nâh ‘taro’  
pǎh ‘fish’

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<sup>2</sup>In this paper, I use the standard orthography developed for Awa with all tones marked. The orthography deviates from IPA in the following ways: <q> stands for glottal stop, <ah> stands for [ɔ] and <eh> stands for [æ]. High tone is indicated with an acute accent /´/, low tone with grave /`/, falling with a circumflex /^/, and rising with a hacek /~/ . Abbreviations used here are: SG ‘singular’, PL ‘plural’, SP ‘specific’, NSP ‘non-specific’.

## 2.2 Tonotactics

The distribution of contour tones is fairly restricted in Awa. First, rising tones are only found on word-final syllables. Loving writes, “Of the sixteen possible patterns [on disyllabic words], note that four of the six which do not occur are those in which the initial toneme is rising” (p. 13). In fact, this tonotactic restriction is so strong that even word-final rising tones are simplified in phrase-medial position. When a rising tone finds itself in the middle of a phrase, the H portion delinks from its original syllable. If a L-initial word follows, the H relinks to that syllable creating a falling tone; otherwise, the H is deleted:<sup>3</sup>

(2) *Rise simplification across word boundaries*

a. pĕh    tâhnú    →    pĕh    tâhnú  
       ^    | |        |    ^ |  
       L H   L H     L   H L H  
       ‘just’ ‘flea’    ‘just a flea’

b. pĕh    nâh    →    pĕh    nâh  
       ^    ^        |    ^  
       L H   H L     L H H L  
       ‘just’ ‘taro’    ‘just taro’

In other words, rising tones are only allowed phrase-finally.

The other two unattested patterns are H.HL and HL.H. Loving notes that both of these patterns are possible on the last two syllables of trisyllabic words, citing:

(3) a. wĕnâwĕh ‘his sister’s husband’

b. âwĕhwâh ‘sister’s husband’

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<sup>3</sup>Alternatively, as the following analysis suggests, the delinked H merges with the following H.

Nevertheless, these two words are clearly morphologically related, suggesting that they are complex forms rather than roots. Though the exact morphological composition is not given, description of the possessive system elsewhere (McKaughan and Loving 1973:32-34) suggest the following structure:

- (4) a. wèná-wêh  
 3SGSP-sister.in.law  
 ‘his sister-in-law’
- b. á-wêh-wáh  
 3SGNSP-sister.in.law-older.brother  
 ‘someone’s sister-in-law (of their older brother)’

The exact decomposition of (4b) is tentative. But the point remains that these words are morphologically complex. It seems a likely possibility that the sequence H.HL and HL.H are never found on Awa roots, though we may find such sequences in compound nouns and other higher level combinations; as the remainder of this paper shows, these sequences are avoided in root-suffix combinations as well.

Second, the author notes that he has observed no more than two falling tones in a row. In fact, it seems plausible that even two falling tones in a row is an anomaly, since the only example given that shows this sequence is bi-morphemic (*nâh-pô* ‘is it a taro?’, literally taro-Q).

The fact is that we simply do not have enough data to determine stem tonotactics with any certainty. Nonetheless, the observations given in Loving are typologically natural:

1. Falling tones can occur in any position in the word, but rising tones are restricted to the last syllable.
2. Sequences of falling tones are dispreferred.

With regards to generalization 1, we can capture the lack the final rising tones with a constraint \*NONFINALRISE (\*NFR). Zhang (2004), among others, found that cross-

linguistically, there is an implicational hierarchy wherein if a language has word-medial rising tones, it must also carry rising tones on final syllables, but not vice versa. He argues that this is due to the fact that contour tone distribution is sensitive to phonetic duration, and that final syllables tend to be longer than word-medial syllables. Relatedly, the fact that falling tones can occur word-medially but not rising tones is due to the fact that phonetically speaking, falling tones require less duration than rising tones. Thus, the distribution of Awa’s contour tones is phonetically and typologically natural.

Generalization 2 also makes reference to a crosslinguistically uncommon sequence. Many languages avoid the general tonal sequence HLH, which can be captured by a constraint like \*HLH (Cahill 2007, Hyman 2010, cf. Yip 2002 \*TROUGH). A sequence HL.HL requires wide pitch excursion in a short period of time, with four tonal targets shared between just two syllables, arguably even worse than a sequence like HL.H. As we will see for the suffixes, though, even tri-tone HL.H sequences are penalized. As noted in the introduction, this avoidance seems to adhere to abstract autosegmental principles, since a sequence with two L association lines separating the H tones, as in HL.LH, is allowed.

The following sections show that the first tonotactic constraint is inviolable, even with the addition of suffixes, but that the grammar does allow occasional sequences of HLH when alternative output candidates are less optimal or harmonic.

### **2.3 Floating tones: evidence from phrasal tonal allomorphs**

Before turning to the main point of this paper, Awa noun suffixes, we must briefly address the issue of what Loving calls “tonally differentiated allomorphs” of nouns, which I argue provide evidence for word-final floating tones. The system is basically replacive (Welmers 1973, McPherson 2014): certain modifiers trigger grammatically-conditioned tonal melodies on following words that completely overwrite those words’ lexical tone. Loving divides modifiers into three classes. Class I words cause the following word to take a LH tonal melody, as in:

- (5) a. kàwèq ‘good’ + nàh ‘house’ → kàwèq nǎq ‘good house’
- b. ànòqtâh ‘big’ + kàpàtà ‘bird’ → ànòqtâh kàpátá ‘big bird’

All words that end in L (be it a level L or the L portion of HL) are part of Class I, along with some rising- or H-final words.

Class II words cause the following word to take a H melody. For example, *kàpàntéh* ‘sick’ followed by *kàpàtà* ‘bird’ becomes *kàpàntéh kápátá*. Class II consists of both H- and rising-final words, but no L- or falling-final words. Finally, Class III words do not cause any perturbation of the following words. The words in this class are semantically different than the others, containing such words as *ítè* ‘not’, *mòqkě* ‘all’, *pěh* ‘just’, and possessives.

When taken together with data from the suffixes, this phrasal allomorph pattern suggests that the initial L triggered by Class I words arises either from a floating L tone (in the case of H-final words) or from spreading the final L of L-final words. We could also assume that all Class I words carry a floating L tone, but this begs the question: why are all L-final words followed by a floating L tone? Richness of the Base (Prince and Smolensky 1993) predicts the existence of L-final words without a floating tone, yet never do we find a pure {H} overlay following L-final words. Instead, I assume that L-final words that would take a floating L tone are ruled out by an OCP constraint at the root level against adjacent L tones. The L on the following word is then due to spreading. It is not entirely clear what motivates this spreading. Hyman (2007b) notes that it is typologically rare for a language to display L spreading without H spreading, yet this appears to be the case in Awa. Neither of the two constraints proposed by Hyman (2007a) to account for L spread are applicable in Awa. The first, LAG-IO(L), states that an input L should extend onto the following syllable, while the second, \*JUMP(UP), states that a L to H pitch jump should not happen across a syllable boundary. Both constraints would predict that underlying /L.H/ words would surface as [L.LH], but plenty of [L.H]

words are attested (e.g. *tàhnú* ‘flea’). In Awa, only word-final L tones spread across a morpheme boundary (i.e. it is a derived-environment rule). For the purpose of analysis, I propose a constraint SHARE(L), which is penalized when a word-final L tone is not shared across a morpheme boundary.

Under this analysis, the morphotonological effects of Class I and II are unified: both condition a replacive {H} melody on the following noun, but this {H} overlay surfaces as {LH} after Class I words due to spreading or docking of the floating tone. In a longer phrase, the initial modifier imposes its overlay on all following words. All words after the initial modified word take H, which is natural if we assume that their whole tone pattern (including potential floating Ls) is overwritten with the grammatically-controlled {H}. For example:

- (6) a. *ítòqkě* + *sèhìö* + *pàtòsă* + *wèhùqkè*  
       ‘no good’ (I) ‘foolish’ (I) ‘blind’ (II) ‘people’ (II)  
 b. *ítòqkè sèhíó pátósá wéhúqké*  
       ‘bad, foolish, deaf people’

We will see more evidence for this floating L from Class I words in the next section.

### 3 Awa noun suffixes

Noun stems can take a wide variety of suffixes, with meanings ranging from canonical categories like plural to adjective-like meanings such as ‘elongated’ (*-kaqta*) or ‘similar’ (*-tahnsa*). Loving makes an initial division between suffixes with underlying tone and suffixes without, with the latter split into six classes. I argue that the data strongly suggest underlying tone for all suffixes, which eliminates the need for dividing affixes into semantically arbitrary classes, each with idiosyncratic phonology. In this paper, I will focus only on the supposedly toneless suffixes; for a description of suffixes Loving deems to have underlying tone, see Loving (1973).

Loving outlines six suffix classes according to their tonal behavior. In what follows, I will present his description for each suffix followed by my specified reanalysis. I will introduce the constraints necessary to account for the surface forms in the discussion of the data and offer preliminary descriptive rankings. As we will see, strict ranking breaks down, motivating the Harmonic Grammar analysis offered in §4.

### 3.1 Class 1

Class 1 consists of the following three monosyllabic suffixes:

(7) Class 1 suffixes

-miq *predicative*

-me *identificational*

-teh *conjunctive*

As Loving describes, these suffixes surface as H after H-final nouns and LH after L-final nouns:

(8) a. póétáhq-mé  
pig-ID  
'the pig'

b. ànôwǎ-téh [ànôwà-téh]  
his.mother-CONJ  
'his mother and others'

c. àyàtâ-mě  
hair-ID  
'the hair'

d. àhtè-mǐq  
woman-PRED  
'it is a woman'

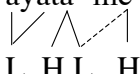
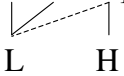
In (8b), the word-final rising tone on *ànôwǎ* ‘his mother’ is simplified to L before the following H tone, obeying the ban on non-final rises.

I analyze Class 1 as being underlyingly H-toned. Though Loving makes no reference to stem class (I or II) in his description, the surface forms [H] and [LH] are obtainable even after Class I nouns with a floating L tone, due to the ban on HLH sequences. That is, the floating L is unable to dock on the H-toned suffix, since this would create a H.LH sequence. Interestingly, as we see in (8c), HL.LH is allowed. This supports the following formulation for the constraint \*HLH for Awa:

- (9) \*HLH: Assign a violation whenever two H tones are separated by only a single L association line.

First, let us consider how the surface forms are derived following Class I L-final nouns:

(10) *Class 1 suffixes on Class I L-final nouns*

- a. *ayata -me*      [àyàtámě]    ‘the hair’  
  
L H L H
- b. *ahte -miq*      [àhtèmǐq]    ‘it is a woman’  
  
L      H

The final L spreads to the suffix, creating a rising tone. Just as we saw in §2.3 with tonally differentiated allomorphs, this L spreading is motivated by the constraint SHARE(L): a final L tone should bridge a morpheme boundary.

With Class I H-final nouns, which all carry a floating L tone, we find that the floating tone is deleted in order to avoid creating a H.LH sequence:

(11) *Class 1 suffixes on Class I H-final nouns*

a. tahnu    -me    [tahnúmé]    ‘the flea’  
       |    |    |  
       L H L    H

b. apokeh    -me    [ápòkèhmé]    ‘the treetop’  
       |    / \    |  
       HL H L    H

In (11a), the floating L is deleted, yielding the surface form *tahnú-mé*. In (11b), the derivation is a bit more complicated. The floating tone is likewise deleted, but the underlying rise on *ápòkèh* is also simplified by delinking the H from the final syllable of the noun and relinking it to the suffix. I argue that the two H tones are then merged into a single H, which violates UNIFORMITY (McCarthy and Prince 1995) while satisfying \*TWIN, a constraint penalizing two identical tones linked to the same syllable (cf. Twin Sister Convention, Clements and Keyser 1983). As we will see when we consider the grammar as a whole, H tones are rarely deleted due to powerful MAX(H), supporting a merger analysis rather than deletion; powerful MAX(H) also explains why the floating L is deleted rather than the H of the suffix. Finally, these forms show us that \*HLH must outrank MAX(L)—it is better to delete a L tone than to create a H.LH sequence.

We might wonder why the floating L couldn’t link to both the suffix and the final syllable of the noun, creating a HL.LH sequence. I argue that this is due to a ban on leftward spreading in the language. This is unsurprising from a typological perspective, where (preservatory) rightward spreading is far more common than (anticipatory) leftward spreading (Hyman and Schuh 1974). I capture this effect using a constraint SPREAD-R:

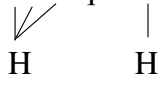

(12) SPREAD-R: Assign a violation for every leftward spreading association line.

This constraint encompasses the effects of a couple of tonal constraints proposed in the literature. For associated (non-floating) tones, the constraint ANCHOR-L (Myers 1997, from McCarthy and Prince 1995) could be used instead, which assigns a violation whenever the left edge of a tonal domain in the input is not shared in the output. However, for floating tones, the input has no domain of syllables for that tone. The fact that floating tones associate rightwards rather than leftwards could be seen as the effect of NOTAUTOMORPHICDOCKING (Wolf 2007), which assigns a violation whenever a floating tone docks to the morpheme that introduced it (in the case of Awa, the noun root). Though these two constraints penalize the configurations we wish to penalize, ANCHOR-L would also penalize output forms in which a tone has shifted to the right, since the left edge of the domain would not be shared between the input and the output, yet this shifting is amply attested in Awa and does not appear to be penalized. For this reason, I adopt the constraint SPREAD-R, which is sensitive only to the direction in which association lines are inserted.

Notice also that the noun *ápòkěh* in (12b) gives us further evidence that \*HLH bans sequences with a single L association line while allowing HL.LH sequences.

Class 1 suffixes after Class II nouns (H-final with no floating tone) are straightforward: if the final syllable is H, then the form surfaces faithfully, but if it is rising, then the H of the LH sequence is shifted onto the suffix, where it merges with the suffixal H tone. These results are illustrated in (13):

(13) *Class 1 suffixes on Class II nouns*

- a. poetahq -me      [póétáhqmé] ‘the pig’  

- b. anowa -teh      [ànôwàtéh] ‘his mother and others’  


Taking stock, this section motivates the following constraint ranking:

- (14) \*HLH, SPREAD-R, MAX(H), \*TWIN, \*NFR  $\gg$  MAX(L), UNIFORMITY

### 3.2 Class 2

Class 2 is populated by two monosyllabic suffixes:

- (15) Class 2 suffixes

-po *question marker*

-seq *personal dual*

These suffixes surface as L following all H-final stems (both Class I and II) and otherwise have a falling tone:

- (16) a. póétáhq-pò  
pig-Q  
'is it a pig?'
- b. ànôwǎ-sèq [ànôwà-sêq]  
his.mother-PERS.DUAL  
'and his mother'
- c. nâh-pô  
taro-Q  
'is it a taro?'
- d. àhtè-pô  
woman-Q  
'is it a woman?'

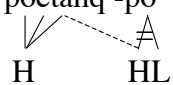
I argue that these realizations are best explained if the suffix is underlyingly /HL/. As we can see, HL then simplifies to L when following a H tone. This is a case of so-called

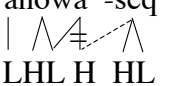
“regressive tonal absorption”, which occurs when a contour tone is preceded by a like tone. Hyman (2007a) reports that this is typologically less common than progressive tonal absorption (one of the original “universals of tone rules”, Hyman and Schuh 1974), but is still attested in languages like Luba (Bantu, Democratic Republic of Congo) or Kuki-Thaadow (Tibeto-Burman, India and Burma). I capture this effect with the neighborhood constraint \*H.HL.

The last section showed that H deletion is penalized by the constraint MAX(H). Interestingly, the constraint-based grammar provides the best match to the data when the simplification of H.HL to H.L is quite literally a case of tonal absorption, with the H of the contour tone merging on the surface with the preceding H tone, violating both UNIFORMITY as well as SPREAD-R.

The following examples schematize Class 2 suffixes after Class II (H-final) nouns:

(17) *Class 2 suffixes after Class II nouns*

a. poetahq -po    [póétáhqpò] ‘is it a pig?’  


b. anowa -seq    [ànôwàsêq] ‘and his mother’  


In (17a), we see leftward tonal absorption from the suffix to the stem. In (17b), however, this leftward absorption would leave a non-final rise on the surface. Instead, the H.HL sequence is resolved by delinking the stem-final H and merging it with the H of the suffix (the same result seen in (11) above).

If these suffixes are added to Class I H-final nouns with a floating L, the floating L is deleted and the output mirrors that of Class II nouns:

- (18) *Class 2 suffix on Class I H-final noun*
- |       |     |           |                 |
|-------|-----|-----------|-----------------|
| tahnu | -po | [tahnúpò] | ‘is it a flea?’ |
|       |     |           |                 |
| L     | HL  | HL        |                 |

The floating L tone cannot be linked to the suffix without creating a three-tone LHL sequence, so it is deleted. This leaves a H.HL sequence, resolved as above by merging the suffixal H with the stem-final H.

If we turn to Class 2 suffixes after Class I L-final nouns, we see that the language avoids **creating** rising tones, suggesting a more general constraint \*RISE:

- (19) *Class 2 suffixes on Class I L-final nouns*
- |   |     |         |                 |
|---|-----|---------|-----------------|
| a. nah  | -po | [nâhpô] | ‘is it a taro?’ |
| ^   | ^   |         |                 |
| HL  | HL  |         |                 |
| b. ahte -po      [àhtèpô]      ‘is it a woman?’ |     |         |                 |
| /   | ^   |         |                 |
| L   | HL  |         |                 |

Example (19b) violates SHARE(L) but is otherwise well formed. The form in (19a), on the other hand, is more surprising, since it is the first and only case found in the data of a HL.H sequence. One could easily imagine another output: spreading the L from the stem and deleting the final L of the suffix; in doing so, this would satisfy both SHARE(L) as well as \*HLH, at the small expense of MAX(L), violated in so many other output forms. I argue that this result is due to the fact that the other hypothetical output form, HL.LH, creates a rising tone, penalized by \*RISE. Rising tones occur in the language, so the constraint cannot be too powerful on its own, but the creation of rising sequences in conjunction with other constraint violations (such as MAX(L)) is enough to rule these candidates out. This result could potentially be obtained by constraint conjunction, with a conjoined constraint such as \*RISE&MAX(L) outranking \*HLH (in the case of *nâh-*

$p\hat{o}$ ) and SHARE(L) (in the case of  $\grave{a}ht\grave{e}p\hat{o}$ ). In §4, I will show how the use of weighted constraints makes such ganging possible.

Taking stock, the new constraints motivated with Class 2 suffixes are \*RISE and \*H.HL. The ranking in light of the additional data is as follows:<sup>4</sup>

- (20) \*RISE&MAX(L), \*H.HL, MAX(H), \*TWIN, \*NFR  $\gg$  \*HLH, SPREAD-R  $\gg$  MAX(L),  
 UNIFORMITY  $\gg$  \*RISE

### 3.3 Class 3 suffixes

Class 3 suffixes are shown in (21):

- (21) Class 3 suffixes

- pa ‘to, at’ (animate)
- ne *possessive*
- ka *actor marker*
- taq ‘at, on’
- sahq *purposive collective*

The tonal behavior of these suffixes appears to be more complicated, since it depends not only on the final tone of the noun but also on whether or not it carries a floating L (i.e. it is Class I).

With Class I nouns, Loving describes the suffixes as taking the form LH after L, falling, or rising-final nouns and L after H-final nouns:

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<sup>4</sup>We know \*RISE on its own must be at the bottom of the grammar, outranked by MAX(L), since rising tones are attested (i.e. L does not delete to create a simple H tone). However, see §4 for an interesting reversal in strength in Harmonic Grammar.

- (22) a. àhtè-ně  
 woman-POSS  
 ‘the woman’s’
- b. nâh-sáhq  
 taro-PURP.COLL  
 ‘taro collecting’
- c. (no example given with rising-final Class I noun)
- d. tahnú-kà  
 flea-ACT  
 ‘the flea did it’

Following Class II nouns, whether H- or rising-final, the suffix always surfaces as H:

- (23) a. òyétá-táq  
 egg-LOC  
 ‘on the egg’
- b. pãh-sáhq            [pàh-sáhq]  
 fish-PURP.COLL  
 ‘fish collecting’

As in other examples, the stem-final rise in (23b) is simplified to L when a suffix is added.

I analyze these suffixes as carrying underlying /LH/ tone. After L-final nouns in Class I, the surface form is fully faithful; even high-ranked SHARE(L) is violated, since spreading the stem-final L would violate \*TWIN:

(24) *Class 3 suffixes on Class I L-final nouns*

a. ahte -ne      [àhtèně]      ‘the woman’s’  
     |    |      ^  
     L    L H

b. nah -sahq      [nâhsâhq]      ‘taro collecting’  
     ^    ^  
     H L L H

No deletions or spreading occur in these forms.

After a H-final Class I noun with a floating L tone, we find our first case of H deletion:

(25) *Class 3 suffixes on Class I H-final nouns*

tahnu -ka      [tàhnúkà]      ‘the flea did it’  
   |    |    ^  
   L   H L L H

In this example, the floating L links to the suffix while the H tone deletes. (The two L tones are assumed to merge on the surface, in violation of UNIFORMITY.) In the ranking above, MAX(H) was shown to outrank MAX(L), yet this example shows the opposite. I argue that this is the result of **counting cumulativity** in constraint evaluation, a form of constraint ganging (Jäger and Rosenbach 2006). The H is unable to remain, since it would lead to a H.LH sequence. Since leftward linking of the floating L is blocked by SPREAD-R, the only way to maintain the H is to delete both L tones. As this example shows, violating MAX(H) once is better than violating MAX(L) twice. Section 4 will demonstrate how this result is obtained in a Harmonic Grammar model with weighted constraints.

Finally, after Class II nouns (all of which are H-final with no floating L tone), the L of the suffix is simply deleted in order to avoid an illicit H.LH sequence:

(26) *Class 3 suffixes after Class II nouns*

a. oyeta -taq      [òyétátáq]    ‘on the egg’  
     | √ ~~∧~~  
     L H   ~~L~~ H

b. pah -sahq      [pàhsáhq]    ‘fish collecting’  
     ~~∧~~ ~~∧~~  
     L H   ~~L~~ H

The form in (26b) also shows rise simplification, with the final H of the noun delinking and reassociating with the suffix, where it merges with the suffixal H.

In summary, Class 3 further supports the constraints introduced with the previous suffixes but provides evidence for counting cumulativity in the analysis. For illustration, this can be represented in strict ranking by making MAX(L)x2 dominate MAX(H).

(27)    MAX(L)x2, \*RISE&MAX(L), \*H.HL, \*TWIN, \*NFR ≫ \*HLH, SPREAD-R, SHARE(L)  
           ≫ MAX(H) ≫ MAX(L), UNIFORMITY ≫ \*RISE

In §4, I will show that this result is more elegantly captured using weighted constraints.

### 3.4 Class 4 suffixes

Class 4 suffixes are all disyllabic, as the following inventory shows:

(28) Class 4 suffixes

-sape	<i>causational/referential</i>
-tate	<i>dual</i>
-tato	<i>trial</i>
-mati	<i>plural</i>
-kaqta	‘elongated’
-kaqkaq	<i>conjunctive</i>
-taqte	<i>instrumental</i>
-piqpeq	‘in’
-tapa	‘over, across’

The suffixes are realized as L.H after Class I L-final nouns and as L.LH after Class I H-final nouns:

- (29) a. nâh-màtí  
taro-PL  
‘many taros’
- b. kàpàtâ-màtí  
bird-PL  
‘many birds’
- c. tàhnú-tàtě  
flea-DUAL  
‘two fleas’
- d. ápòkěh-kàqkăq [ápòkèh-kâqkăq]  
tree.top-CONJ  
‘and a tree top’

After Class II nouns, the suffixes surface as H.H:

- (30) a. òyétá-táté  
egg-DUAL  
'two eggs'
- b. pàh-mátí [pàh-mátí]  
fish-PL  
'many fish'

I analyze the suffixes as being underlying /H/, like Class 1; the difference in surface forms stems from the mono- vs. disyllabic distinction. The L.H output following Class I L-final nouns is attributed to SHARE(L) and \*NFR:

(31) *Class 4 suffixes after Class I L-final nouns*


a. nah -mati [nâhmàtí] 'many taros'

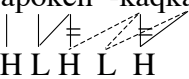
b. kapata -mati [kàpàtàmàtí] 'many birds'

Because the L is already linked to the noun in (31a), spreading it to the H suffix does not create a violation of \*HLH (since two association lines separate the H on the noun from the H on the suffix). However, the H must shift onto the final syllable to resolve a derived non-final rise.

After Class I H-final nouns, the floating L must spread to both syllables of the suffix in order to avoid a violation of \*HLH:

(32) *Class 4 suffixes after Class I H-final nouns*

a. tahnu -tate [tahnútàtě] ‘two fleas’  


b. apokeh -kaqkaq [ápòkèhkàqkăq] ‘and a tree top’  


The doubly spreading L pushes the H of the suffix off of the first syllable. In (32b), the derivation is more complicated, due to the resolution of a non-final rise on the noun stem. The final H of the noun delinks and reassociates to the initial syllable of the suffix, which it shares with one association line of the floating L tone. The L equally associates to the final syllable of the suffix, creating a HL.LH sequence and avoiding a violation of \*HLH.

In the interest of space, I do not illustrate disyllabic H suffixes after Class II nouns, since the outputs are fully faithful (with the exception of non-final rise simplification in forms like *păh-mátí* → *pàh-mátí* ‘many fish’).

The ranking given in the last subsection remains unchanged.

### 3.5 Class 5

Loving gives a single suffix in Class 5, disyllabic *-tahnsa* ‘similar’. After L-final nouns, it surfaces as L.H; after H-final nouns, it surfaces as L.LH, unless the noun’s final H is part of a rise, in which case it shifts onto the suffix, creating HL.LH:

(33) a. nàh-tàhnsá  
 house-SIM  
 ‘like a house’

b. (no example given with a falling-final stem)

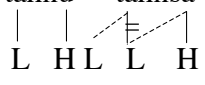
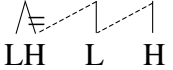
- c. tahnú-tàhnsă  
 flea-SIM  
 ‘like a flea’
- d. päh-tàhnsă [pàh-tâhnsă]  
 fish-SIM  
 ‘like a fish’

I analyze the suffix as underling /L.H/. When the suffix is added to a L-final word, the output is completely faithful:

- (34) *Class 5 suffix after Class I L-final noun*
- |     |         |             |                |
|-----|---------|-------------|----------------|
| nah | -tahnsa | [nàhtàhnsá] | ‘like a house’ |
|     |         |             |                |
| L   | L       | H           |                |

This form violates SHARE(L), since the final L of the noun does not spread to the suffix. Doing so would either create a violation of \*TWIN (if the L of the suffix remained on the first syllable) or would create a rising tone in violation of \*RISE (if the L of the suffix shifted to the second syllable).

If the noun is H-final, either Class I or Class II, a rising tone must be created. While derived rising tones are dispreferred, failure to spread the L to the final syllable of the suffix would result in a HLH sequence with just a single L association line separating the two H tones:

- (35) *Class 5 suffix after H-final nouns*
- a. tahnu -tahnsa [tahnútàhnsǎ] ‘like a flea’  

- b. pah -tahnsa [pàhtàhnsǎ] ‘like a fish’  


In (35a), *tahnú* ‘flea’ is a Class I noun with a floating L. This L links to the first syllable of the suffix, and the original L on that syllable shifts to the final syllable of the suffix, creating a rising tone. Two association lines separate the H tones and the output is licit. In (35b), the rising tone on the noun cannot be maintained due to \*NFR. The H thus shifts onto the suffix, and the L must spread to both syllables of the suffix in order for two association lines to intervene between the H tones.

Once again, this suffix shows us that HLH sequences are avoided, so long as no tones are deleted to do so. Derived rising tones are also avoided if the constraint driving their creation is weak (SHARE(L)) but not if it is stronger (\*HLH). This effect is not easily captured using ranked constraints, but falls out naturally using weighted constraints if the combined violations from creating a rising tone (\*RISE plus faithfulness violations) outweigh SHARE(L) but not \*HLH. See §4 for more on Harmonic Grammar and the online supplemental materials for tableaux illustrating these forms.

### 3.6 Class 6

The final class of suffixes, Class 6, consists of two suffixes with similar meanings:

- (36) Class 6 suffixes

-pomo *dubitative*  
 -poqpoq *dubitative conjunctive*

It is possible that both are related to the question marker *-po* from Class 2, though Loving does not draw this conclusion. After L-final words, these suffixes surface as L.HL, while after H-final words (with no regard for Class I or II) they surface as H.L:

- (37) a. nâh-pòmô  
taro-DUB  
'a taro?'
- b. nâh-pòqpôq  
house-DUB.CONJ  
'and a house?'
- c. tâhnú-pómò  
flea-DUB  
'a flea?'
- d. pãh-póqpòq [pãh-póqpòq]  
fish-DUB.CONJ  
'and a fish?'

I argue that these suffixes are underlying /H.L/. After L-final nouns, the L spreads (satisfying SHARE(L)), and the H shifts to the final syllable to resolve the non-final rise:

- (38) *Class 6 suffixes after Class I L-final nouns*
- a. nah -pomo [nâhpòmô] 'a taro?'
- 
- b. nah -poqpoq [nâhpòqpôq] 'and a house?'
-

Following H-final nouns, the suffix retains its underlying H.L tone. If the noun carries a floating L (i.e. it is Class I), this floating L deletes, since there is no way to link it without either violating \*HLH or creating triple branching (assuming it spreads to both syllables of the suffix to create two L association lines):

- (39) *Class 6 suffixes after H-final nouns*
- a. tahnu -pomo [tahnúpómò] ‘a flea?’  
 | | | |  
 L H L H L
- b. pah -poqpoq [pàhpóqpòq] ‘and a fish?’  
 / \ | |  
 LH H L

In (39b), the H on the noun shifts to the right and merges with the suffixal H to alleviate the violation of \*NFR. The constraints and rankings given in earlier sections account for these data patterns.

### 3.7 Local summary

Loving’s original analysis relied entirely on arbitrary tone classes: Nouns belonged to one of two classes, suffixes belonged to one of six. Thus far I have shown that what appear to be classes arise naturally from underlying tonal specification. Different surface tone patterns within each class result from the interaction between noun tone and suffix tone, with tones spreading, shifting, or deleting to satisfy the tonotactic demands of the language.

Before going on to the analysis, I would like to briefly address the question of whether all suffixes belong to the same morphological level or whether Awa presents evidence of a level-ordered system (as in *Lexical Phonology and Morphology*, Kiparsky 1982). Loving appears to suggest a division of suffixes into two levels based on their behavior following “perturbed nouns”. He asserts that Classes 2, 5, and 6 retain their regular tonal behavior

following perturbed nouns while Classes 1, 3, and 4 surface as all H (suggesting that they have been subsumed into the {H} grammatical overlay). At first glance, this supports the idea that Classes 1, 3, and 4 make up “inner” Level 1 morphology while Classes 2, 5, and 6 are “outer” Level 2 suffixes, outside the influence of grammatical overlays. However, Classes 1, 3, and 4 **always** surface as H following H-toned words; this surface form is not the result of the grammatical overlay but rather follows simply from the principles of tonal realization laid out in the preceding sections.

Thus, I adopt an analysis in which all suffixes are subject to the same grammar (i.e. one level with a single set of constraints).

## 4 Analysis

With the data patterns in place, we are now ready to flesh out the analysis. The framework I will be using is Harmonic Grammar (Legendre et al. 1990, Smolensky and Legendre 2006), a constraint-based framework like Optimality Theory (Prince and Smolensky 1993/2004) but employing **weighted** rather than **ranked** constraints. Constraints are assigned real number weights; the more powerful the constraint, the larger the weight. For every candidate, the number of violations of a constraint is translated into a negative integer which is multiplied by the constraint’s weight. These numbers are summed across the constraint set, and the resulting number is known as a candidate’s **Harmony**.

To take a simple example, let us construct a simple grammar consisting of two constraints, \*CODA and MAX(C). Assuming a language with only open syllables, we know that \*CODA must be a more powerful constraint than MAX(C). This effect is captured by assigning \*CODA a larger weight than MAX(C), say 3 vs. 2 (the exact integers are not important, simply the relative weights of constraints).

(40)

/kat/	*CODA	MAX(C)	Harmony
	3	2	
a. kat	-1	0	-3
b. ka	0	-1	-2

Candidate (a) violates \*CODA once; its weight of 3 is multiplied by -1 for the single violation, resulting in a harmony of -3 (no other constraints are violated). Candidate (b) violates MAX(C) once; its weight of 2 is multiplied by -1 for the single violation, resulting in a harmony of -2. The winning candidate is the one with the greatest harmony, in this case candidate (b) (-2 > -3).

As the reader may imagine from this set up, the use of weighted constraints opens up the possibility of **cumulativity** in the model, where multiple violations of weaker constraints combine to overpower a more powerful constraint, an effect which cannot be captured in OT without special pleading (using, for example, conjoined constraints). Jäger and Rosenbach (2006) identify two types of cumulativity, **counting** cumulativity and **ganging-up** cumulativity. In the former, two or more violations of a single weaker constraint overpower a single violation of a more powerful constraint. In the toy grammar above, the candidate [ka] for the underlying form /kast/ would incur two violations of MAX(C), resulting in a harmony of -4. Depending on how violations of assessed for \*CODA (i.e. one violation per coda consonant or one violation per coda as a whole), this candidate might be ruled out in favor of [kast] or [kas].

In the latter, violations of two or more weaker constraints conspire to overpower a single more powerful constraint. Let us imagine a more specific constraint in the hypothetical grammar, MAX(CORONAL), with a weight of 2. Candidate (b) in the tableau above would then have a harmony of -4, less harmonic than candidate (a), meaning that *kat* will map to *kat*, while *kap* will map to *ka*.

Both types of cumulativity are attested in the analysis of Awa, lending support to the framework of Harmonic Grammar.

## 4.1 The constraint set

The analysis of Awa relies on the following constraints, each of whose demands are informally summarized in the following table:

(41)	<u>Markedness</u>	
	*H.HL	“Penalize falling tones after H tones.”
	*FLOAT	“Penalize floating tones in the output.”
	*HLH	“Penalize two H tones separated by a single L association line.”
	*TWIN	“Penalize two identical tones on the same TBU.”
	SHARE(L)	“Penalize a stem-final L tone not spread across the morpheme boundary.”
	*RISE	“Penalize rising tones.”
	*NONFINALRISE	“Penalize non-final rising tones.”
	<u>Faithfulness</u>	
	MAX(H)	“Penalize H tone deletion.”
	MAX(L)	“Penalize L tone deletion.”
	DEP(A)	“Penalize association line insertion.”
	MAX(A)	“Penalize association line deletion.”
	UNIFORMITY	“Penalize two underlying tones merging on the surface.”
	SPREAD-R	“Penalize leftward spreading.”

All of the markedness constraints penalize surface configurations of tone: falling tones after H tones, HLH sequences with just a single association line for L, rising tones in non-final positions, etc. Of these markedness constraints, only SHARE(L) (to my knowledge) lacks crosslinguistic support. While details of formulation may differ (e.g. in the case of \*HLH), all other markedness constraints are typologically natural.

The inventory of faithfulness constraints is likewise straightforward: tone deletion is penalized (MAX(H), MAX(L)), as is the insertion and deletion of autosegmental associa-

tion lines (which control the spreading or shifting of the underlying tones). UNIFORMITY penalizes cases where two underlying tones merge to just a single tone on the surface. The last faithfulness constraint, SPREAD-R, evaluates the mapping between the underlying form and the surface form, penalizing both leftward spread of underlyingly linked tones and leftward association of floating tones.

To derive constraint weights, tableaux indicating violations and winners were fed into OT Help (Staub et al. 2010). The results are given in (42), with the constraints reordered from strongest to weakest:

(42)	<u>Constraint</u>	<u>Weight</u>
	MAX(H)	12
	*H.HL	12
	*FLOAT	12
	MAX(L)	11
	SPREAD-R	9
	*HLH	9
	*TWIN	8
	SHARE(L)	7
	*RISE	5
	*NFR	3
	DEP(A)	1
	MAX(A)	1
	UNIFORMITY	1

The reasoning behind the weights will become clear in the next section, where I illustrate the analysis with tableaux. Here, however, I briefly comment on two aspects of the weights. First, two of the highest-weighted constraints are undominated in the OT sense (\*H.HL and \*FLOAT); no winning candidate ever violates these constraints. The third, MAX(H), is not, as can be seen in (43). The difference lies in ganging. Violations

of weaker markedness constraints can gang up and overcome MAX(H), but the repairs for \*FLOAT and \*H.HL (MAX(L) or DEP(A) in the first case, perhaps MAX(A) or UNIFORMITY in the second) never overpower these constraints. Second, it can be seen that \*NONFINALRISE has a smaller weight than \*RISE, despite the fact that the former is never violated by a winning candidate while the latter is; in the OT ranking in, e.g., (27), \*NFR outranks \*RISE, yet in Harmonic Grammar, \*RISE is more powerful. These weights are due to the fact that every violation of \*NONFINALRISE entails a violation of \*RISE, but not vice versa. Thus, a form with a non-final rise will have a harmony of at most -8, while a form with a final rise will have a harmony score of at most -5; it is always worse to have a non-final rise.

Examples of cumulativity like these will be explicitly pointed out and illustrated in the following subsection.

## 4.2 Illustrative tableaux

This section illustrates the analysis with a few of the more difficult cases, showing how the Harmonic Grammar approach is able to capture the data patterns. The full set of tableaux is available in the online supplemental materials.

The first tableau is for the form *tàhnú-kà* ‘the flea did it’, from (25). This form involves a Class 3 /LH/ suffix after a Class I H-final noun with a floating L tone. The following tableau illustrates the cumulativity effects that allow a H tone to be deleted, despite MAX(H)’s large weight; here and elsewhere, unviolated constraints are omitted in the interest of space.

(43) *Tableau for tahnú-kà ‘the flea did it’*

Weights	12	12	11	9	9	8	5	1	1	1	
<i>Input:</i> tahnú ka     ^ L HL LH	MAX(H)	*FLOAT	MAX(L)	SPREAD-R	*HLH	*TWIN	*RISE	DEP(A)	MAX(A)	UNIFORM	
<del>a.</del> a. tahnú ka       L H L <sub>1,2</sub>	-1	0	0	0	0	0	0	0	-1	-1	-14
b. tahnú ka   ^ ^ L HL LH	0	0	0	-1	0	0	-1	-1	0	0	-15
c. tahnú ka     ^ L H L <sub>1,2</sub> H	0	0	0	0	-1	0	-1	0	0	-1	-15
d. tahnú ka     ^ L H L L	-1	0	0	0	0	-1	0	-1	-1	0	-22
e. tahnú ka       L H H	0	0	-2	0	0	0	0	0	-1	0	-23
f. tahnú ka     ^ L HL LH	0	-1	0	0	-1	0	-1	0	0	0	-26

Let us begin with the fully faithful candidate, candidate (f), which has the lowest harmony of any candidate. This is due to the presence of a floating tone (-12 from \*FLOAT); the linked tones HLH violates \*HLH (-9), since only a single L association line separates the two Hs, and the rising tone on the suffix incurs -5 by \*RISE. The other candidates represent varying repair strategies. Candidate (b) links the floating L to the left, which violates SPREAD-R (-9), but the other violations (\*RISE and DEP(A)) result in relatively little penalty. Nevertheless, the combined penalty score of -15 is worse than that of winning candidate (a), even though this candidate resolves the tonotactic problems of the faithful form by deleting a H tone (-12 from MAX(H)). Thus, this is a case of ganging-up cumulativity. The only other constraints violated by this form are MAX(A) (for deleting the H tone’s association line) and UNIFORMITY (for merging the floating L with

the L of the suffix), but the overall harmony is -14. If the H were not deleted (as in candidate (c)), combined violations of \*HLH and \*RISE overpower violations of MAX(H) and MAX(A). Deleting the H but not merging the two Ls incurs a violation of \*TWIN. Finally, in candidate (e) we see that even though MAX(L) is less powerful than MAX(H), deleting two L tones incurs greater penalty than deleting a single H, a case of counting cumulativity. If MAX(H) outranked MAX(L), as in OT, it would not matter how many L tones were deleted—deletion of H would always be worse.

When possible, inconveniently-placed H tones are merged with other H tones rather than deleted. This is the case in *póétáhq-pò* ‘is it a pig?’, where the H of the underlyingly /HL/ suffix is absorbed into the preceding H tone to satisfy \*H-HL:

(44) *Tableau for póétáhq-pò ‘is it a pig?’*

Weights	12	12	11	9	1	1	1	
<i>Input:</i> poetáhq po ↙      ↘ H      HL	MAX(H)	*H.HL	MAX(L)	SPREAD-R	DEP(A)	MAX(A)	UNIFORM	
✂ a. poetáhq po ↙      ↘ H <sub>1,2</sub> L	0	0	0	-1	0	-1	-1	-11
b. poetáhq po ↙      ↘ H      HL	0	-1	0	0	0	0	0	-12
c. poetáhq po ↙          H H    L	0	0	0	-1	-1	-2	0	-12
d. poetáhq po ↙        H      H	0	0	-1	0	0	-1	0	-12
e. poetáhq po ↙        H      L	-1	0	0	0	0	-1	0	-13

As this tableau indicates, the winning candidate is quite literally a case of tonal absorption, as envisaged by Hyman and Schuh (1974 and Hyman 2007a): the H of the suffix delinks (-1 from MAX(A)) and is absorbed into the H of the noun root (-1 from UNI-

FORMITY). The majority of the penalty this candidate incurs comes from SPREAD-R (-9), since the absorption proceeds leftwards. Candidates (b-d) are just slightly worse in terms of harmony. Faithful candidate (b) violates \*H.HL (-12); candidate (c) is similar to candidate (a), but the H from the suffix links independently to the final syllable of the noun root, requiring both deletion and insertion of association lines; candidate (d) deletes the L tone (-11 from MAX(L) and -1 from MAX(A)), which satisfies \*H.HL. Unlike in the case of *tàhnú-kà* above, deletion of the H tone is not warranted, as shown in candidate (e); the combined penalty of MAX(H) and MAX(A) rule out the candidate in favor of candidate (a).

The next case illustrates the interplay between \*HLH, \*NFR, and faithfulness. The form in question is *ápòkèh-kâqkãq* ‘and a tree top’, derived from the combination of *ápòkèh* (with a floating L) and *-káqkáq*.

(45) *Tableau for ápòkèh-kâqǎq ‘and a tree top’*

Weights	12	12	11	9	5	3	1	1	1	
<i>Input:</i> apokeh kaqkaq   /   / H L H L H	MAX(H)	*FLOAT	MAX(L)	*HLH	*RISE	*NFR	DEP(A)	MAX(A)	UNIFORM	
a. apokeh kaqkaq   /   / / H L HL H	0	0	0	0	-1	0	-3	-2	0	-10
b. apokeh kaqkaq   /   / H L H <sub>1,2</sub>	0	0	-1	0	0	0	0	-1	-1	-13
c. apokeh kaqkaq   /   / H L HL H	0	0	0	-1	0	0	-2	-2	0	-13
d. apokeh kaqkaq   /     H L H H	0	0	-1	0	0	0	-1	-2	0	-14
e. apokeh kaqkaq   /     H L L H	-1	0	0	0	0	0	-1	-2	0	-15
f. apokeh kaqkaq   /     H L H L H	0	0	0	-1	-1	-1	-1	-1	0	-19
g. apokeh kaqkaq   /   / H L HL H	0	-1	0	0	-1	-1	0	0	0	-20
h. apokeh kaqkaq   /   / / H L H LH	0	0	0	-1	-2	-2	-1	0	0	-26

The underlying form violates several markedness constraints, including \*FLOAT, \*RISE, and \*NFR, as faithful candidate (g) shows. Candidate (h) repairs \*FLOAT by linking the floating L to the initial syllable of the suffix, but this form still violates \*RISE (5 x -2 = -10) and \*NFR (3 x -2 = -6) in addition to introducing a violation of \*HLH (-9) since the formerly floating L has only a single association line. Candidate (f) is slightly better in that linking the L to the suffix pushes the H over, thus avoiding a second non-final rise; however, this candidate likewise suffers from a violation of \*HLH. Repairing \*FLOAT by deleting the L tone, as in candidates (b) and (d), violates MAX(L),

the weight of which (11) is able to single-handedly rule out these forms in favor of the winning candidate (harmony of -10). Both of these candidates also repair the non-final rising tone by delinking the root-final H and shifting it to the suffix, either by merging it with the suffixal H (candidate (b)) or by linking it to the first syllable of the suffix and shifting the suffixal H over (candidate (d)). Both candidates (c) and (e) link the floating L to the suffix, resolving \*FLOAT. Candidate (c) also shifts the root-final H to the suffix to resolve the non-final rise, but since the L is linked only to the first syllable of the suffix, the form violates \*HLH. Candidate (e) resolves the non-final rise by deleting the root-final H, incurring a violation of MAX(H). Winning candidate (a) links the floating L to both syllables of the suffix to avoid a violation of \*HLH, which shifts the underlying suffixal H to the last syllable (creating a rising tone in violation of \*RISE). The underlying non-final rise is resolved by shifting the root-final H to the initial syllable of the suffix.

The last case I will illustrate in this paper is *nâh-pô* ‘is it a taro?’, the one reported data pattern that violates the otherwise strictly enforced ban on HLH sequences. The following tableau shows that no repair of the underlying form results in an improved harmony, and so the offending sequence is allowed to surface:

(46) *Tableau for nâh-pô ‘is it a taro?’*

Weights	12	12	11	9	7	5	1	1	
<i>Input:</i> nah po ^ ^ HL HL	MAX(H)	*H.HL	MAX(L)	*HLH	SHARE(L)	*RISE	DEP(A)	MAX(A)	
☞ a. nah po ^ ^ HL HL	0	0	0	-1	-1	0	0	0	-16
b. nah po ^ ^ HL H	0	0	-1	0	0	-1	-1	-1	-18
c. nah po   ^ L HL	-1	0	0	0	-1	0	0	-1	-20
d. nah po ^   HL L	-1	0	0	0	-1	0	0	-1	-20
e. nah po   ^ H HL	0	-1	-1	0	0	0	0	-1	-24

This form contains four tones and only two syllables, and since triple branching is not allowed, possibilities are limited. No changes in the association lines of the underlying tones will resolve the \*HLH violation—the only option is to delete one of the tones. Deleting the final L would do nothing to alleviate the violations of the winning candidate, and I do not consider it here. Deleting the first L, as in candidate (e), satisfies \*HLH but creates a violation of \*H.HL. Candidate (d) exchanges a violation of \*HLH for a violation of more heavily weighted MAX(H). Candidate (c) suffers the same problem as candidate (d). Candidate (b) deletes a L rather than a H, and spreads the initial L to the suffix to alleviate the HLH sequence. However, doing so creates a rising tone, and the combined penalties of \*RISE and MAX(L) equal the harmony of the faithful candidate, as suggested in the conjoined constraint in 3.2. Additional violations of weak faithfulness constraints rule out candidate (b).

For tableaux of all other forms presented in this paper, see the online supplemental

materials.

## 5 Conclusions

This paper has offered a reanalysis of the Awa tone facts first described in Loving (1973). First, I have shown that the distinction between Class I and Class II nouns can be reduced to tonal structure: Class I nouns either carry a floating L (after H final nouns) or end in L, while Class II nouns end in H with no floating tone. Second, I have shown that the six supposedly toneless classes of noun suffixes actually carry underlying tone; the classes simply represent differences in underlying tone and syllable count (i.e. monosyllabic H suffixes, Class 1, pattern differently from disyllabic H suffixes, Class 4). The varying surface forms of each “suffix class” are the result of tonal adjustments to satisfy the tonotactic demands of the language.

One interesting result of this work is that Loving’s meticulous documentation of the tone system leads directly to a specified analysis consistent with typologically natural tonal demands, a few of which are summarized in the following table:

(47)	<u>Tonotactic</u>	<u>Typological support</u>	<u>Constraint(s)</u>
	Tonal absorption	Hyman and Schuh (1974)	*H-HL
	Restrictions on rising tones	Zhang (2004)	*RISE, *NONFINALRISE
	HLH ban	Cahill (2007)	*HLH
	Ban on surface floating tone	Myers (2007)	*FLOAT
	Rightward spreading	Hyman and Schuh (1974)	SPREAD-R
	No identical tones on same TBU	Clements and Keyser (1983)	*TWIN

Nevertheless, some aspects of the analysis are specific to Awa. Perhaps most important is the exact definition of \*HLH. Though the original formulation of this constraint refers to any sequence of the three tones, Awa appears to be sensitive to **autosegmental** distance between the two H tones: a configuration with a single L association line separating the

two H tones is penalized, but two L association lines are acceptable. Surprisingly, this means that a H.L.H sequence is ruled out but a HL.LH sequence is allowed, despite the fact that the former most likely allots more milliseconds to the L-toned portion.<sup>5</sup> The other Awa-specific aspect of the constraint is the derived environment rule requiring that a stem-final L tone (but not a H tone) be shared across a morpheme boundary. This effect is encapsulated in the constraint SHARE(L). The alternative would be to posit a floating L following every stem-final L, which would achieve the same result, but I see no reason why such a condition should hold of L-final stems.

This paper has also demonstrated that while the constraint set required to account for Awa tonology is relatively natural from a typological standpoint, the constraint interactions that give rise to the surface patterns are far from simple. In fact, Optimality Theory with strict ranking will not work, due to the necessity of cumulativity and ganging in constraint evaluation. Harmonic Grammar, on the other hand, deftly captures the data patterns, since it allows both ganging up and counting cumulativity, seen in (43).

Finally, this paper aims to explore what we can learn when applying modern reanalysis to older descriptive work. Though the data set is small for Awa, Loving's careful description of the patterns leads to a principled analysis in which all morphemes carry underlying tone. Future work on the tonology of Awa will prove or disprove the account I have offered here; Awa promises to be interesting either way.

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<sup>5</sup>This is an empirical question that could be tested in Awa and other languages to see whether there is phonetic grounding for the autosegmental tonotactics.