Tone and syllable structure in Karuk (Hokan, California)*

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Word-level prosody in Karuk incorporates both tone and stress, and the placement of prominence is sensitive to complex interactions of lexical, phonological, and morphological factors. This system has traditionally been analyzed as an accent system. In this paper, the placement of prominence in stems is shown not to be lexically conditioned by an arbitrary accentual class of the stem, but rather as being predictable and phonologically conditioned by the requirements of tone. Preliminary results of a quantitative analysis of prominence in Karuk roots are reported, which show that syllable structure is an important factor in determining placement of tone. A constraint against high tone on short closed syllables, *CV́C, is proposed to capture this effect. The same parameter affecting the static distributions of tones is also shown to be active in derived contexts; contributing to the degree of stability of tone under affixation and triggering a vowel lengthening process seen with certain affixes. *CV́C thus unifies and motivates seemingly arbitrary phonological rules, and results in the Karuk system being far more predictable than has previously been thought.

1 Introduction

1.1 Karuk accent as a mixed tone/stress system

Languages that do not fall neatly into the categories of prototypical tone or stress languages pose theoretical and descriptive challenges. Some of these languages, such as Karuk, have been described as having accent or pitch accent, but accent is a vague term which may be used to describe prosodic systems that are quite different from one another (Hyman 2006, 2009; Hualde 2012). Some have been characterized as simplified tone or stress systems, but this fails to capture the complexity of languages such as Karuk, a Hokan language of Northern California, where both stress and tone are present and interact in intricate ways. In this paper, a tone-driven phonological explanation is proposed which unifies several accentual patterns in Karuk that have previously required arbitrary, morpheme-specific rules.

Tone and stress are both present in Karuk, and normally coincide, making it difficult to determine which is basic. The only time they do not coincide is when a final high tone is deleted before a pause, in which case stress falls on a low-toned syllable. This phenomenon is discussed further in §5.3 below. For clarity, high tone (H) is marked with an acute accent mark, high-low falling tone (HL) with acute and grave accent marks, and except in examples demonstrating tone only, stressed syllables are underlined.

Stress is culminative and obligatory, with one stress per word, which can fall on almost any syllable of a root or affix. Examples (1a)–(1d) show that stress can fall on the first, second, third, or fourth syllable of a word.[1] Stress can also fall on the final syllable of a word, as shown in (1e). Alternations between high tone and no high tone in this word represent intonational phrase-medial vs. intonational phrase-final pronunciations.

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[1]The practical Karuk orthography is used throughout, except for transcription of accent. /ʔ/ is transcribed as <'>, /θ/ as <th>, /ʃ/ as <sh>, /tʃ/ as <ch>, and long vowels as a doubled vowel. Following Crowhurst and Macaulay (2007), tone is transcribed on both orthographic vowels of a long vowel for clarity (*á* and *áá* for H, on short and long vowels, respectively, and *áà* for HL).

(1) a. *thúkinkunish* ‘blue, green, yellow’
b. *yupsítanach* ‘baby’
c. *suvaxráxar* ‘drying rack’
d. *kuyrakinívkih* ‘eight’
e. *kunpíip* ∼ *kunpiip* ‘they say’

High (H) and high-low falling (HL) tones contrast on long vowels in stressed syllables. Word pairs showing examples of surface H and HL contrasts on non-final syllables are given in (2)–(3). Example (4) shows the contrast between what I assume here are underlying H and HL tones in words with final prominence. The level high in the word for ‘rat’ in (4a) is deleted at the right edge of an intonational phrase, but the falling high for the word for ‘oak bark’ in (4b) is not deleted.

(2) a. *púúfich* ‘deer’
b. *púùvish* ‘bag’

(3) a. *áápunma* ‘know’
b. *ááànaxus* ‘weasel’

(4) a. *achnáát* ∼ *achnaat* ‘rat’
b. *ahtúùn* ‘oak bark’

Stem accentuation is affected in non-uniform ways by various affixal morphology, resulting in extraordinarily complex derivations of surface tone placement. Examples of tones shifting are given in (5)–(6).

(5) a. *imnísh* ‘to cook’
b. → *imníísh-tih* ‘to be cooking’
c. → *ú-mniish-tih* ‘he is cooking’

(6) a. *imnísh* ‘to cook’
b. → *imníísh-tih* ‘to be cooking’
c. → *imniish-tíh-at* ‘was cooking’
d. → *u-mniish-tíh-at* ‘he was cooking’

Examples (5)–(6) show a relatively simple example of how stem accentuation is affected in non-uniform ways by both prefixes and suffixes. Following Bright’s (1957) derivations for words containing these morphemes, example (5b) and (6b) show vowel lengthening and a H tone realized on the final stem syllable before the durative suffix *-tih*. Example (5c) shows the H tone shifting one syllable to the left with the addition of the third person singular agreement prefix *u-*. Example (6c) shows that with the addition of the past tense suffix *-at*, H tone shifts one syllable to the right to the final stem syllable before the suffix *-at*. However, when the third person singular prefix *u-* is added to this stem, in (6d), there is no leftward shift of H tone.

Verbs and verbal suffixes are focused on here, and an overview of numbers of roots and affixes is provided in Table 1 to give the reader a sense of the complexity of the system.

Table 1: Overview of Karuk verbal system

Verb Roots	1-σ	85
	2-σ	379
	3-σ+	312
Affix Positions	Suffixes	Approx. 12
	Prefixes	2 plus proclitics
Affixes	Suffixes	over 80
	Prefixes	21

1.2 Previous analyses

Karuk's prosodic system was meticulously described by Bright (1957) in accentual terms, and was more recently characterized in terms of tone and stress (Macaulay 1990; Crowhurst and Macaulay 2007), but it has so far defied a comprehensive analysis. Under Bright's system, an extensive list of seemingly arbitrary rules is required to define the environments where different processes are active. The current work builds on Crowhurst and Macaulay (2007), which breaks accent down into tone and stress, and seeks to find generalizations that make the system more predictable. Crowhurst and Macaulay (2007) did not address the role of coda consonants, which are found to be key in the current analysis.

1.3 Proposal

This paper makes two points of relevance to the study of mixed tone and stress prosodic systems. On one hand, it is shown that an extraordinarily complex system of affixes with a myriad of prosodic effects, such as that of Karuk, can be reanalyzed in typologically familiar terms from the study of accent (i.e., 'strong' and 'weak' affix classes). On the other hand, it is shown that the variable effects of an affix on different stems in this system are best analyzed *not* as lexically conditioned by an arbitrary accentual class of the stem, but rather as being predictable and phonologically conditioned by the requirements of tone. This second point makes this analysis quite different from classical analyses of 'accent systems'.

I claim that tone in Karuk is partially predictable based on syllable structure.[2] A constraint against H tone on closed syllables with a short vowel is proposed: *(C)V́C. This constraint accounts for a number of seemingly disparate patterns, including skewed tone distributions in roots, stability of tone under affixation, and affix-triggered vowel lengthening. It is shown that this constraint is active in different domains (roots, derivational morphology), and provides coherent phonological motivations for some of the patterns which have previously required diacritics. Interactions with several other factors make the *(C)V́C constraint rarely surface-apparent. These include the fact that this structure is found in roots, the constraint's interaction with preferred tone-foot alignment, and opacity created by surface gemination.[3] It is further claimed that a bimoraic foot with an associated H-L melody is important in Karuk, a new foot type not

[2]Syllabification of words here assumes Bright's characterization of the Karuk syllable: "Any consonant plus an immediately following vowel, plus any immediately following consonant that is *not* immediately followed by a vowel, constitute a syllable. In other words, Karok speech may be divided into units of the pattern CV(C)" (Bright 1957:11). Bright notes that syllables of the form CCV(C) also occur, in the context of initial vowel deletion, and that there are some loan words with unusual syllable structures, but that these are not treated any differently by the grammar than more typical syllables. V(C) syllables are also clearly possible word-initially in Karuk, but do not otherwise occur. Therefore, whenever there is a VCV sequence, I assume it is syllabified V.CV, and whenever there is a VCCV sequence, I assume it is syllabified VC.CV. The sequence V.V is never found.

[3]Consonants (other than the non-geminable consonants /h, ', v, r, y/) are automatically geminated medially in most roots, and in certain morpheme-initial configurations (see Bright 1957:9–10, 17–18, and 51 for more details). Gemination is not written in the practical orthography.

previously proposed for this language.

1.4 Outline of paper

Sources of data for the current analysis are given in §2. A brief overview of Karuk prosodic phonology is given in §3. The tonal constraint *(C)V́C is discussed in §4. In §5, evidence from non-derived contexts for the proposed constraint is provided, in particular, it is claimed that a skewed distribution of tone in verb roots can be attributed to avoidance of H on initial (C)VCs. Section §6 provides evidence from two derived contexts for the proposed constraint. It is claimed that *(C)V́C interacts with tone-foot alignment constraints to determine which stems react to tone-moving processes, and that vowel lengthening is a repair for a stem-final derived H on (C)VC syllables. Conclusions are given in §7.

2 Data sources and methods

The current work combines phonological analysis based on Bright's descriptions of accentuation and accentual shifts with a distributional analysis of a database of Karuk words. The quantitative data come from a 3368 lexical item database created by the author, drawn from the xml source file of the online Karuk dictionary,[4] representing the electronic version of the Karuk Dictionary (Bright and Gehr 2005). Karuk words included in the online dictionary from sources other than Bright's (1957) grammar were not included in the current version of the database. Descriptions of phenomena analyzed here are all based on those in Bright (1957).

The reasons for basing the current analysis on the previous phonetic descriptions are threefold. Bright was able to work with a greater number of speakers and more fluent speakers than is possible today, and it seems probable that present-day speakers have had some level of change in the accent system in their speech, either due to attrition, English interference, or both. It is essential in the context of language attrition to describe the prosodic system in its fullest possible version. Secondly, it is clear from Bright's descriptions that he was not, in fact, conflating intonation, pitch, stress, and/or vowel length, a common source of inaccuracies in transcriptions of prosody. Finally, there are few useful recordings from Bright's time. Nonetheless, additional phonetic analysis of recorded material will certainly prove useful in future work.

Where possible, Bright's descriptions of tone and stress in Karuk have been confirmed with analysis of modern phonetic data. Modern data comes from the Karuk Dictionary and Texts project at UC Berkeley and are also available on the online Karuk Dictionary and Texts website.

3 Representation of tone and stress

3.1 Overview of Karuk tone and stress

Tone and stress have an impoverished distribution in Karuk. Each word follows the pattern of a span of H tone followed by a span of L tone, as shown in the simplified schema in (7), although the entire pattern is not always realized on very short words.

(7) 

The drop represents either a HL tone or a H tone followed by a L on the next syllable. HL is only possible on long vowels,[5] while H occurs on both short and long vowels. The placement of this tone is generally unpredictable overall, but I will show that it is actually predictable in a number of contexts.

[4] Karuk Dictionary and Texts, http://linguistics.berkeley.edu/~karuk/

[5] There are two exceptions, both English loan words: *fîsh* 'fish' and *prâms* 'plums'.

Each word bears exactly one stress, which coincides with the syllable containing the tone-bearing mora (at the right edge of the H span), when present. Thus stress marks the surface contrastive tone in the word.

3.2 Representation of tone

Every Karuk word has a single underlying H tone. By default, a L tone is supplied immediately following every H, when possible. I follow Macaulay (1990) in representing both H and HL surface tones with an underlying H tone linked to a single mora underlyingly. Macaulay's schema is reproduced here in (8), with the current tone terminology.

(8)

a. HL	b. H (UR)		c. H (surface)	
long vowel	long vowel	short vowel	long vowel	short vowel
H	H	H	H	H
|	|	|	∧	|
μ μ	μ μ	μ	μ μ	μ
∨	∨	|	∨	|
V	V	V	V	V

A HL long vowel has a H tone linked to its first mora, and the L on the second mora is supplied by rule. A H long vowel has a H tone linked to its second mora, and the H spreads leftward by rule, creating a level H over the entire syllable. The leftward H tone spreading rule is needed independently in Karuk to account for H tones on syllables to the left of a stressed H in longer words. Underlyingly toneless, short vowels in word-initial syllables surface as L due to a word-level boundary L tone. Long vowels in word-initial syllables are not affected. Syllables following the syllable containing the H tone receive L tone by default.[6]

I diverge from previous researchers in analyzing a final prominence that surfaces as alternating H∼L as a final H tone. Before pause, a right edge phrasal boundary L tone can cause a word-final H to delete. Only a very few words with final prominence display a non-alternating final H; I consider these to be lexical exceptions. The vast majority of words with final prominence show the alternation. Issues in representing tone in words with final prominence is beyond the scope of this paper.

3.3 Representation of stress

Because H and HL constrast on stressed syllables, tone must be lexically specified, and because stress predictably coincides with tone, there is no need for it to be lexically specified. Stress coincides with any syllable containing a realized lexical H tone (including a HL syllable). Assignment of stress is assumed not to occur until the post-lexical level, because when a final H is deleted due to a phrasal boundary L, default stress assignment occurs. According to Bright (1957:13), if no surface H is present, stress falls on a long vowel, when present,[7] otherwise on the rightmost syllable. This raises the interesting question of whether stress or tone is basic, however, this question is left to future research.

[6] See Bright (1957:11–13, 52–55) for details of phonetic realizations of pitch on stressed and unstressed syllables.
[7] No words with more than one long vowel are found without H tone.

4 Tonal constraints

While a *(C)V́C constraint in particular has not been seen before, some precedence for avoidance of tone on a closed syllable exists. Gordon (1999) makes a distinction between a type of syllable weight that attracts stress, based on total energy, and a type of syllable weight that attracts tone, that crucually depends on sonorant energy. This distinction could account for a CV syllable being a better target for tone than a CVC syllable. In a typological study of contour tones, Zhang (2001) finds that in some Chinese dialects CV syllables can bear more tonal contrasts than CVC syllables.

In Karuk, the categorical restriction limiting surface contour tones to syllables with long vowels is readily explained by a representation in which long vowels have two moras, either of which can have a H tone linked to it. However, a more gradient representation of syllable weight than that of moras is also needed in Karuk. A gradient restriction causes high tones to be attracted to rimes which are relatively longer than others, though at a sub-moraic level. It is gradient because there is a hierachy of rime length, as shown in (9), which interacts with other constraints on tone placement. In this hierarchy, a CV syllable is a better tone bearing unit than a CVC syllable, and because it has the greatest sonorant energy, a CVV syllable is the best tone bearing unit.

(9) (C)VV(C) $\succ$ (C)V $\succ$ (C)VC

The harmonic scale in (9) gives us a corresponding constraint ranking in (10), of which only the highest ranked constraint is active in the phenomena discussed here.

(10) *(C)V́C $\gg$ *(C)V́ $\gg$ *(C)V́V́(C)

A general constraint for avoidance of a high tone on a closed short syllable is given in (11a). This constraint can be seen to be active, though not extremely highly ranked, throughout the grammar. A more specific ban on H on (C)VC syllables is also needed, given in (11b), for word-initial syllables. It is apparent that this constraint is active in roots.

(11)a. *(C)V́C
A (C)VC syllable cannot bear H tone.

b. *#(C)V́C
A word-initial (C)VC syllable cannot bear H tone.

5 Evidence from non-derived contexts

As shown in (1) above, placement of prominence in Karuk roots can contrast. Crowhurst and Macaulay (2007) demonstrate some systematicity in placement of tone in roots, but require lexical tone in many cases. This section focuses on one additional salient generalization that can be made regarding the placement of tone in roots, and provides a constraint-based analysis of the pattern.

5.1 Skewed distributions of tone

Two facts are particularly striking about the distribution of prominence in Karuk roots. First, in disyllabic roots, final prominence is more common than initial prominence, while in longer roots there is a marked avoidance of final prominence. Final prominence is rare in roots of three syllables with all short vowels, and never occurs in longer roots (i.e., never in roots of four moras or more).[8] Second, in disyllables with two short vowels, whether the first syllable is open or closed is important in determining where

[8]Generalizations are based on my analysis of a database created from the online Karuk dictionary.

prominence falls. Both of these distributional anomalies are accounted for by the constraint against H tone on closed syllables with short vowels introduced above, in conjunction with other common constraints.

Disyllabic verb roots with short vowels are focused on here because these are very numerous and show the greatest skewing.[9] In Table 2, the distributions of tone in disyllabic words are broken down by syllable structure.

Table 2: Distribution of tone in disyllabic verb roots with short vowels

Shape of 1st syllable	Syllable with tone	
	1st	2nd
Open	94	17
Closed	0	187

When verbs are sorted by syllable structure as in Table 2, a pattern becomes apparent: the placement of prominence in these verbs is highly dependent on whether the first syllable is open or closed. If the first syllable is open, high tone is more likely to fall on the first syllable, as in example (12a), than on the second, as in example (12b). If the first syllable is closed, as in example (13), high tone never falls on the first syllable. Closed syllables are quite common in Karuk, and many more words included in the counts in Table 2 have a closed final syllable than an open one. The presence or absence of this final consonant, however, does not seem to affect placement of tone.

(12)a. *cháfich* 'gnaw meat from'
b. *chifích* 'defeat'

(13) *tathríp* 'strain out (soaked acorns)'

Overall, the skewing is too great to be due to chance. In this section, an optimality theoretic account is proposed which accounts for this skewed distribution of prominence, assuming three possible tonal inputs (disyllables may be underlyingly toneless or have a H tone linked to any one mora), and an interaction between a ban on H on initial (C)VCs, a ban on H on final moras, and tone faithfulness.

5.2 Avoidance of initial H tone

As shown in Table 2, initial prominence on a (C)VC syllable is avoided categorically. For the reasons discussed in §4, it is better to analyze this avoidance as a constraint against H tone, rather than stress, on this syllable type. There is more motivation for tone than stress to be preferentially attracted to a (C)V syllable over a (C)VC syllable, and there is no metrical or syllable-weight based explanation for stress to be avoided on syllables of this shape.

Based on disyllabic roots only, it is impossible to tell whether this is due to a ban on H tone on (C)VC syllables in general, from which word-final syllables are exempt for some reason, or whether it is due to a ban on word-initial (C)VC syllables specifically. Longer roots provide evidence that H tone is avoided on word-initial (C)VCs in particular. Word-initial H on (C)VC syllables is vanishingly rare in Karuk. Not including disyllables, out of 313 roots beginning with (C)VC, only 9 have initial H tone (listed exhaustively in 14). Many of these are proper nouns which might be more likely to have atypical prosody. This indicates that H on initial (C)VC syllables is generally avoided in Karuk.

[9]There are comparatively few disyllabic roots containing long vowels (less than 100), which show some tendency for tone and stress to fall on the long vowel, but not categorically so. In these roots and in longer roots, the avoidance of high tone on CVC syllables is less pronounced than in disyllables, but this could be due to many apparent roots actually being morphologically complex but lexicalized to some degree.

(14)a. *ásneepirax* ‘woman’s name’
b. *chánhaayfur* ‘exclamation of Coyote’
c. *ímpaha* ‘to decide’
d. *tánmaha* ‘to owe’
e. *tínxuumnipaa* ‘placename’
f. *tháthriinaa* ‘(two filled containers) to sit’
g. *xútnahich* ‘thin (as of fabric)’
h. *yúxtuuyruk* ‘placename’
i. *yúxtuuyrup* ‘placename’

H on word-medial (C)VC syllables is much more common than H on initial (C)VCs, although not as common as H on open syllables. For comparison, several examples (not exhuastive) of H on word-medial (C)VC syllables are given in (15). This shows that the avoidance of H on initial (C)VC syllables, specifically, is behind the pattern in disyllables, even if, as I show in §6, a more general avoidance of H on (C)VC syllables is active in Karuk phonology. If the avoidance were not limited to the initial syllable, it would also be necessary to explain why a H tone on a final closed syllable is possible while a H tone on an initial closed syllable is not.

(15)a. *furáthfip* ‘to be nervous, cranky, fretful’
b. *patánvish* ‘to ask a question (of someone)’
c. *pathúvriin* ‘to measure strings of dentalia’
d. *pithvúyram* ‘to meet, assemble’
e. *suváxrah* ‘to spread out to dry’
f. *tarúprav* ‘to lace’
g. *thapáxrah* ‘to be very thirsty’
h. *tharámpuk* ‘to cook acorn soup’
i. *thaxústay* ‘to suspect’

5.3 Avoidance of final H tone

In addition to the avoidance of initial prominence in specific syllable structures, there is also avoidance of final prominence in Karuk. This avoidance is more general, and not limited to any particular syllable structure. Note that in the words with open first syllables in Table 2, 97 have prominence on the first syllable, and only 17 have prominence on the second syllable. This asymmetry cannot be attributed to the shape of the second syllable in these roots; most are closed in both groups. As mentioned above, final H is extremely rare in roots greater than two syllables. Furthermore, from a close inspection of Bright’s description of accentual effects of derivative suffixes (see Appendix A), it is clear that final H never occurs in derived stems.

In principle, the static pattern of avoidance of final prominence in root forms could be either stress-driven or tone-driven. Evidence that it should be considered tone-driven comes from the default stress pattern in Karuk. A word with a final H tone, such as *umáh* in (16a) and *u’úúm* in (17a), surfaces without that H tone at the end of an intonational phrase. When this happens, stress defaults either to the final syllable of the word, as in (16b), or to a long vowel, when present, as in (17b) and *uumi* in (17c) (**?**)f.][12–13, 57]Bright:1957.

(16)a. kári xás káán **umáh** akvaat ...
then then there 3s(>3)-see raccoon
'And there he saw raccoons...' (source: WB_KL-05)

b. kári xás **umah**
then then 3s(>3)-see
'And he saw her.' (source: WB_KL-62)

(17)a. xás pakáán **u'úúm** yánava vúra áhtaay má'ninay ...
then NOMZ-there 3s(>3)-arrive EVID INTS fire-much high.mountain.country
'And when he got there, he saw lots of fire in the mountains...' (source: WB_KL-10)

b. xás **u'uum**.
then 3s(>3)-arrive
'She arrived.' (source: JPH_PHM-24-343a)

c. ...îkam kúúk **uumi**!
outdoors to.there arrive-IMPER
'... go outdoors!' (source: WB_KL-61)

The position of stress in toneless words with all short vowels indicates that the default position for stress is rightmost, not penultimate. The position of stress in toneless words containing a long vowel shows that stress is weight sensitive. If the default position for stress is rightmost, then the avoidance of this position must be driven by requirements of tone. Further support for avoidance of final prominence being tone-driven comes from the fact that stress is predictable based on tone in Karuk (stress always coincides with the tone-bearing syllable), but tone is not predictable based on stress in (a stressed long vowel can have either surface HL or H tone). Additionally, in words longer than two syllables, HL tone is found on final long vowels while H tone is not, meaning that it is not prominence on the final syllable *per se* that is problematic, but rather a H tone linked to the final mora of a word.

I analyze the avoidance of final prominence in Karuk as tone-driven non-finality. It would also be possible to refer to footing here (for instance, to require H tone to associate with the head of a trochaic foot), but it is not necessary.

5.4 Evidence for lexical H tone

There are three logical possibilities for underlying representations for words with two short vowels: a lexical H tone could be linked to either syllable, or a default tone could be assigned. I assume that two lexical H tones would be impossible, due to the Obligatory Contour Principle.

Words with identical syllable structures, such as those seen in example (12), can have two different tonal patterns, H-L and L-H. Since it is only possible for one of these patterns to be a default, at least one of them must be the result of a lexical tone. I assume that words which follow the minority pattern L-H, as in (12b), have lexical tone associated with the second syllable, while those receiving default tone follow the majority pattern, H-L.

5.5 Constraints

Ban on H on initial (C)VC syllables To account for the avoidance of initial prominence in disyllabic roots, a specific *#(C)ÝC constraint is used. The constraint from (11b) above is repeated here in (18). This constraint must be highly ranked because there is an absolute ban on initial CVC syllables in disyllabic roots.

(18) *#(C)ÝC
A word-initial (C)VC syllable cannot bear H tone.

Ban on Final H In disyllabic roots which do *not* have an initial CVC syllable, there is a tendency to avoid final prominence. Therefore, a constraint against final prominence is required to counterbalance the constraint against initial prominence. To account for avoidance of final prominence, a NON-FINALITY(TONE) constraint (abbreviated as NON-FIN(T)), given in (19), is employed. NON-FIN(T) must be ranked below *#(C)V́C, as it is violated in all disyllabic roots with a closed initial syllable.

(19) NON-FIN(T, μ, ω)
A tone T must not fall on the final mora of a prosodic word (after Hyde 2007).

NON-FIN(T) in effect requires a H to be followed by a L, because a L is supplied by default following a H tone.

Preserve Lexical H The tendency against final prominence in words with an open initial syllable is strong but not absolute. Therefore, there must be another constraint ranked above NON-FIN(T), which allows for final prominence in some of the words with an open initial syllable. I analyze the words with an open initial syllable and final prominence as having a lexically associated tone on their final mora. The identity constraint in (20) outranks NON-FIN(T) and ensures that a lexically associated tone is preserved in the output.

(20) IDENT-ASSOC(T)
If there is an association between x and tone T in the input, then there is an association between x' and T' in the output, where x' and T' are the correspondents of x and T respectively (de Lacy 2002).

Assuming Richness of the Base, initial H on CVC is avoided even for an input with a lexically associated tone on the first mora. Therefore, the faithfulness constraint in (20) must be ranked below *#(C)V́C.

One Prominence Per Word Every word bears stress and one high tone (assuming that the process switching words with final H to L when they occur before pause is a late one). Stress always falls on the rightmost syllable linked to a high tone. I will assume therefore that there are highly ranked constraints requiring each grammatical word to be a prosodic word, and aligning the prosodic head with a (rightmost) H.

5.6 Constraint ranking

Tableaux are given in (21)–(22) that illustrate the interactions of the constraints given in (18)–(20) using representative Karuk words of each shape. Not shown are undominated constraints requiring one H tone and one stress per word, and stress alignment constraints that ensure stress aligns with H tone.

For a disyllabic word with an open first syllable, two outcomes are seen in the data, initial H tone and final H tone. There are two possible inputs that would result in a surface form with initial H tone, such as *cháfich*. The tableau in (21a) shows that a H tone associated with the first syllable in the input must be retained in the output. The tableau in (21b) shows that an input with no lexically associated tones would also result in an initial H, since a final H would violate NON-FIN(T). Only one possible input would result in final H tone in a word with this shape, such as *chifích*. The tableau in (21c) shows that a H tone associated with the final syllable in the input must be retained in the output, violating NON-FIN(T).

(21) Sample Tableaux for CV.CVC Word

a.

/chafich/ | H	*#(C)V́C	IDENT-ASSOC(T)	NON-FIN(T)
a. ☞ cháfich			
b. chafích		*!	*

b.

/chafich/	*#(C)V́C	IDENT-ASSOC(T)	NON-FIN(T)
a. ☞ cháfich			
b. chafích			*!

c.

/chifich/ | H	*#(C)V́C	IDENT-ASSOC(T)	NON-FIN(T)
a. chífich		*!	
b. ☞ chifích			*

This provides the partial ranking IDENT-ASSOC(T) ≫ NON-FIN(T), because if NON-FIN(T) were ranked above IDENT-ASSOC(T), final H tone would never surface in a word of this form, and *chifích* would come out as **chífich*.

For a disyllabic word with a closed first syllable, there should be only one possible outcome, final H tone. The tableaux in (22) show that with this constraint ranking, all three possible inputs would result in a surface form with final H tone, such as *tathríp*. The tableau in (22a) shows that a H tone associated with the first syllable in the input is not retained in the output because it violates *#(C)V́C. The tableau in (22b) shows that a H tone associated with the second syllable in the input is retained. The tableau in (22c) shows that an input with no lexically associated tones would also result in a final H, since an initial H would violate *#(C)V́C.

(22) Sample Tableaux for CVC.CVC Word

a.

/tathrip/ | H	*#(C)V́C	IDENT-ASSOC(T)	NON-FIN(T)
a. táthrip	*!		
b. ☞ tathríp		*	*

b.

/tathrip/ | H	*#(C)V́C	IDENT-ASSOC(T)	NON-FIN(T)
a. táthrip	*!	*	
b. ☞ tathríp			*

c.

/tathrip/	*#(C)V́C	IDENT-ASSOC(T)	NON-FIN(T)
a. <u>táth</u>rip	*!		
b. ☞ tathr<u>íp</u>			*

*#(C)V́C must outrank IDENT-ASSOC(T), because if *#(C)V́C were ranked below IDENT-ASSOC(T), an input with a lexical tone on the first syllable would come out as **táthrip*. *#(C)V́C (and a constraint requiring each word bear a H tone) must outrank NON-FIN(T), otherwise final H tone would never surface. The full constraint ranking is given in (23). This ranking reflects a situation in which an initial H tone is worse than faithfulness to a lexical tone, and while a final tone is also dispreferred, it is better to be faithful to a lexical tone than to avoid a final tone.

(23) *#(C)V́C ≫ IDENT-ASSOC(T) ≫ NON-FIN(T)

5.7 Summary

The chart in (24) summarizes the outputs of this constraint ranking for each of the three possible inputs for a word with two moras: lexical high tone associated with the first mora, lexical high tone associated with the second mora, and no lexical tones.

(24)

Underlying Tone	(C)V.CV(C)	(C)VC.CV(C)
a. [μ μ]$_W$ | H	<u>H</u>-L	L-<u>H</u>
b. [μ μ]$_W$ | H	L-<u>H</u>	L-<u>H</u>
c. [μ μ]$_W$	<u>H</u>-L	L-<u>H</u>

For a (C)V.CV(C) word, there are two ways to get the H-L pattern (a lexical H on the first syllable and the default), and one way to get the L-H pattern (a lexical H on the second syllable). For a (C)VC.CV(C) word, only the L-H pattern is possible with either lexical H or the default. Assuming some number each of words with lexical tone associations to the first and second syllables, and a default class where tone is assigned to the most harmonic position, the constraint ranking in (23) correctly predicts one possible outcome for (C)VC.CV(C) roots, and two for (C)V.CV(C) roots, with one being more likely than the other. The distributions seen in Table 2 are not only possible, but quite numerically plausible under this analysis.

The skewed patterns of tone distribution in disyllabic words with short vowels, then, can be seen as a manifestation of a more general ban on word-initial CVC syllables active in Karuk (*#CV́C). The constraint ranking in this section can also be extended to explain why final prominence is so common in disyllables and so rare in longer words. Final prominence occurs in disyllabic words only to avoid initial prominence. In longer words, final prominence can be avoided without violating *#CV́C by having prominence fall on some other medial syllable.

6 Evidence from derived contexts

6.1 Focus of analysis

In this section, further evidence for avoidance of H on (C)VC syllables is demonstrated by the mobility of stem tone under affixation and a vowel lengthening process sometimes triggered by affixation.

I group Karuk suffixes into three classes based on the possible types of effect they have on the tone of the stem they attach to:

1. *Tone-neutral*: No effect on input tone in any stem
2. *Strong*: Impose tone, erasing any previous tone on input
3. *Weak*: Interact with input tone[10]

There is no obvious correlation between these classes of affix and morpheme order. There are few tone-neutral suffixes, but they include both inner and outer suffixes. No strong suffixes are found among the outermost suffixes. Weak suffixes are the most common and occur in all positions in the verb stem.

Tone-neutral suffixes have no effect on the tone of any stem they attach to, as shown in example (25).

(25)a. *chúúpha* 'to talk' + *-naa* PLURAL → *chúúphinaa* '(plural) to talk'
b. *ihéèra* 'to smoke' + *-naa* PLURAL → *ihéèranaa* '(plural) to smoke'
(source: Bright 1957, p. 112)

Strong suffixes affect input stems with any tone and shape the same way. For verbal suffixes, they assign a H tone to the (first syllable of the) suffix, or to the syllable preceding the suffix. An example of a strong suffix which always receives H tone on its first syllable is given in (26). Note that it will even erase a HL tone which, as will be seen below, is normally a very stable tone.

(26)a. *ikyáv* 'to make' + *-tánmah* 'for nothing, for no reason' →
ikyaatánmah 'to make for nothing'
b. *éèh* 'to give' + *-tánmah* 'for nothing, for no reason' →
eehtánmah 'to give for nothing, gratis'
(source: Bright 1957, p. 110)

Weak suffixes normally shift stem tone rightward within the stem they attach to (if tone is already on the rightmost stem syllable, it will not shift further right onto the suffix triggering the shift). Examples are shown in (27).

(27)a. *ikrívkiri* 'to sit on' + *-tih* DURATIVE → *ikrivkíritih* 'to be sitting on'
(source: Bright 1957, p. 48)
b. *chúúpha* 'to talk' + *-tih* DURATIVE → *chuuphítih* 'to be talking'
(source: LA-VS-01, CT-01)

[10] My tone-neutral class includes Bright's Zero accentuation class as well as the suffixes he describes as having no effect on accentuation. My strong class includes Bright's Suffixal, Presuffixal, and Pre-presuffixal accentuation classes. My weak class includes Bright's Progressive, Modified Progressive, and Special Progressive classes. The terms 'strong' and 'weak' are not intended to align exactly with traditional notions of accent categories of strong/weak and dominant/recessive (e.g. Czaykowska-Higgins 1993; Kiparsky 1973). I do not use the term 'recessive' to avoid confusion with Bright's category 'Recessive accentuation' which contrasts with 'Progressive accentuation', and refers to processes that typically move tone leftward. See Appendix A for a list of suffixes by class.

However, weak suffixes display irregularities in their effects, depending on the stem they are affixed to. When a suffix of this class is attached to certain stems, a vowel lengthening process is triggered in addition to the tone shift, as can be seen in the final stem syllable before the suffix in the examples in (28).

(28)a. *ikrívruh* 'to roll' + *-rupu* 'downriver' → *ikrivrúúhrupu* 'to roll downriver'
(source: Bright 1957, p. 37)

b. *fikríp* 'to pick out, sort' + *-tih* DURATIVE → *fikrííptih* 'to be sorting'
(source: GD-MD-VSu-01)

When a suffix of this class is attached to certain other stems, however, no tone shift or vowel lengthening takes place, as in the examples in (29).

(29)a. *ítap* 'to know' + *-tih* DURATIVE → *ítaptih* 'to be knowing'
(source: GD-MD-VSu-01, VS-10)

b. *ihéèra* 'to smoke' + *-tih* DURATIVE → *ihéèratih* 'to be smoking'
(source: Harrington 1932, p. 46 , VS-11)

The current analysis focuses on these irregularities, which are discussed in turn in the following section. Both are shown to be fully or partly explained by the *(C)V́C constraint.

6.2 Role of coda consonant in stems that resist tone shift

6.2.1 Which tones are exempt from moving?

A number of different weak tone-moving prefixes and suffixes normally cause a tone shift, as seen above, in (27). Some stems, such as those shown in (29), are exempt from these shifts. I call stems that are affected by and exempt from these processes 'moveable tone' and 'fixed tone' stems, respectively. Whether a stem has moveable or fixed tone is not arbitrary. Rather, it is determined by the syllable structure of the tone-bearing syllable and (sometimes) the syllable immediately following the tone-bearing syllable. This is true of derived and underived stems, and includes both nouns and verbs.

The descriptive generalization is as follows. Stems that have 'fixed' tone with respect to these weak tone-moving processes are stems in which a HL sequence is realized on a single syllable (i.e., a long vowel bearing HL tone), and those in which a H-L sequence realized on two short vowels, the first of which is in an open syllable. Any other configuration is 'moveable'.[11] Structures that are and are not sensitive to these processes are given schematically in (30).

(30)

	Fixed	Movable
a.	(C)V́V̀(C)	(C)V́V́(C)
b.	(C)V́.CV(C)	(C)V́C.CV(C)
c.		(C)V́(C).CVV(C)
d.		(C)V́(C)#

[11] Bright (1957:45) defines 'fixed accent' stems as those with circumflex accent and those containing a V̋CV̆ sequence, and 'moving accent' stems as all others. There are exceptions, of two types. (1) Tone in some words that fit the fixed criteria are not fixed; Bright calls this 'unstable accent' (these are almost all attributable to derived tonal patterns caused by four affixes, found in Table 4 in Appendix A, with a few lexicalized roots.) (2) When the two syllables of the second fixed pattern lie on either side of a morpheme boundary, whether the tone is fixed or not depends on which side of the morpheme boundary the consonant falls on and whether it is geminable or de-geminated. Some sets of affixes only affect a subset of 'moving accent' stems

Thus, (30a) shows that any HL tone is fixed, and any H tone on a long vowel is moveable, regardless of other syllables in the word. The structures in (30b) show that a H tone on a short open syllable followed by any short syllable is fixed, while a H tone on a short closed syllable followed by any short syllable is moveable. A H tone on a short syllable followed by a long syllable (30c)[12] and a H tone on a word-final short syllable (30d) are both moveable.

It is important to note that these patterns hold for both underived roots and morphologically complex stems, and that a H tone can 'move into' a fixed position. That is, moveable or fixed accent is not an inherent, diacritic property of roots. For example, the two roots in (31) each contain one of the moveable structures above. When one of these roots has a weak tone-shifting suffix added to it, the H tone moves rightward to the final syllable of the root. In (31a), the H tone lands on a short open syllable followed by a CV(C) syllable. The tone is now fixed and will not more again when another tone-moving suffix is added. By contrast, if the tone lands on a closed syllable, as in (31b), or on a long vowel, the tone will move again if another tone-moving suffix is added. This means that in the context of suffixes that trigger these changes, the underlying tone of a stem is unimportant.

(31)a. *Moveable position to fixed position*

mááhva	'to visit'
→ *mahvú-tih*	'to be visiting'
→ *mahvú-tih-an*	'the one who is visiting' (source: constructed, after Bright 1957 p. 67)

b. *Moveable position to moveable position*

tímnih	'to love'
→ *iimníh-tih*	'to be loving'
→ *iimnih-tíh-an*	'the one who is loving' (source: constructed, after Bright 1957 p. 48)

6.2.2 Why some stems are exempt from tone shift

Which stems do and do not participate in tone shift can be explained by a combination of two factors: tone-foot alignment, and the avoidance of H tone on (C)VC. I propose here that fixed stems are those with the ideal foot for tone in Karuk, in which a HL sequence is realized over exactly two moras, forming a moraic trochee.

Assuming a moraic representation of syllable weight in which short vowels have one mora and long vowels have two, what unifies the two fixed tone structures in (30) above is that they both contain a H-L sequence realized over exactly two moras, without an intervening coda consonant. This can be represented as a moraic trochee in which the head is associated with a high tone and the non-head associated with a low tone at a moraic level, despite the fact that stress must be associated with the entire syllable in a bimoraic foot consisting of a single long vowel, as shown in (32).

(32)

H	L	H L
|	|	| |
μ	μ	μ μ
(C)V.	CV(C)	(C)VV(C)
(x	.)	(x)

Because this is the 'ideal' foot from the point of view of tone placement in Karuk, this structure is unaffected by tone-moving processes, while tone in other, less optimal, feet is affected. Moveable stems, then, are those with a non-ideal foot structure. This representation accounts for three of the four types of moveable stems in (30) above. Regardless of how it is footed, any long vowel with H tone (30a)

[12] Based on Bright's description, the tone in a (C)V́.CVV(C) sequence is predicted to be moveable, but not enough examples of words including this structure have been found to confirm that this is definitively the case. For now, I will assume that they are moveable.

must be dispreferred. A (μ́μ́) foot is bimoraic, but a HL contour is not realized, violating the requirement for the moraic foot to align with a HL sequence. A (μ́μ́.μ̀) foot meets the requirement for the HL tone association, but is not strictly bimoraic. A (μ̀.μ́.μ́) foot would, of course, violate both criteria. Likewise, a (μ́.μ̀μ̀) foot, as in (30c), meets the requirement for the HL tone association, but is not strictly bimoraic, and were the syllables reversed, it would violate both criteria. Finally, a high tone which falls on a short vowel in the final syllable of a word, as in (30d), is problematic because it cannot meet the HL contour requirement.

This representation alone cannot account for why a disyllabic foot with an open first syllable should have fixed tone while one with a closed first syllable, as in (30b), should not. H must avoid (C)VC independently of syllable weight. If a coda consonant were moraic, one would expect stress to be attracted to closed syllables over open ones. For instance, given the word /axaska/, one would expect *axáska, but the actual form is *áxaska* 'to be thin, lose weight', with stress on an open syllable. Given /thanfirip/, one would expect *thánfirip or *thanfiríp, but the actual form is *thanfírip* 'to miss, fail to hit', again with stress on the open syllable. Based on many words like these where stress falls on an open syllable, codas cannot be moraic. If a coda consonant is not moraic, (C)VC.CV(C) and (C)V.CV(C) feet have the same moraic structure. The factor differentiating these two feet, then, is simply the syllable structure of the tone-bearing syllable. Therefore, a H tone on a (C)VC syllable must have some inherent instability, which is captured by the *CV́C constraint.

It is clear that the dispreference for H tone on a (C)VC is not strong enough to prevent a H tone from *landing* on a (C)VC syllable, it only means that a tone in this structure is available to move. This tone moving process, as well as one repair for the creation of the dispreferred CV́C structure due to it, is explored in greater detail in the following section.

6.3 Role of coda consonant in output of affixation

In this section, another irregularity, this time in the output of tone-moving affixation processes, is also shown to be due to the *CV́C constraint. When the dispreferred structure is a result of derivation, a new repair strategy is found, namely, vowel lengthening. To illustrate this process, the directional suffixes are focused on here. The directional suffixes represent the largest set of weak tone-moving affixes[13], and they also have quite regular effects on tone, as a group. All the directional suffixes cause rightward tone movement. Some also trigger vowel lengthening in some stems, which will be shown to be accounted for by *CV́C.

As expected for weak tone-moving affixes, the directional suffixes have no effect on fixed stem tone. The examples in (33–34) demonstrate directional suffixes being attached to the two structures with fixed tone, (C)V́.CV(C) and a long vowel with HL tone, with no effect.

(33) *ikvírip* 'to run' + *-faku* 'from uphill' →
ikvírip-faku 'to run down from uphill' (source: Bright 1957 p. 96)

(34) *kúùntaku* 'to sit on' + *-ish(rih)*[14] 'down' →
kúùntak-ish(rih) 'to sit down on' (source: Bright 1957 p. 97)

Also as expected, these suffixes cause moveable tone to shift one syllable to the right, as in the examples in (35–37). In (35–36), the tone is moveable because H falls on a long vowel. The example in (37) demonstrates another moveable tone structure, (C)V́C.CV(C). In all three cases, the addition of a weak tone-moving suffix shifts the tone one syllable rightward. Note that in these examples, a consonant-initial suffix is added to a vowel-final stem, or a vowel-initial suffix is added to a consonant-final stem.

[13]The directional suffixes are comprised of 30 consonant-initial and 8 vowel-initial suffixes. A complete list of verbal suffixes and their tonal effects is given in Table 5 in Appendix A.

[14]Parentheses indicate an alternate longer form of a suffix.

(35) *ííthva* ‘to pack’ + *-faku* ‘from uphill’ →
iithvá-faku ‘to pack down from uphill’ (source: Bright 1957 p. 96)

(36) *ííthri* ‘container to sit’ + *-kirih* ‘into fire’ →
ithrí-kirih ‘to set a container on fire (causative)’ (source: Bright 1957 p. 98)

(37) *ikrívruh* ‘to roll’ + *-unih* ‘down’ →
ikrivrúh-unih ‘to roll downhillward’ (source: Bright 1957 p. 104)

Examples (38–39) show stems with the moveable tone structure, (C)V́C.CV(C), and example (40) shows a stem with the moveable tone structure of H on a long vowel. As in the previous set of examples, the addition of a weak tone-moving suffix shifts the tone one syllable rightward. However, when consonant-initial suffixes are added to consonant-final stems, as in these examples, a short vowel in the final syllable of the stem is lengthened.

(38) *ishpát* ‘to break (intr.)’ + *-rav* ‘in’ →
ishpáát-rav ‘to break (sth) into two (tr.)’ (source: Bright 1957 p. 100)

(39) *ikrívruh* ‘to roll’ + *rupu* ‘downriver’ →
ikrivrúúh-rupu ‘to roll downriver’ (source: Bright 1957 p. 37)

(40) *ikréémyah* ‘to blow’ + *-varak* ‘from upriver’ →
ikreemyááh-varak ‘to blow down from upriver, north wind to blow’ (source: Bright 1957 p. 104)

This vowel lengthening process cannot be attributed to vowel lengthening in stressed syllables, because no lengthening takes place when the result is a stressed H on a CV syllable, e.g. when a consonant-initial suffix is added to a vowel-final root, as in (35–36), or when a vowel-initial suffix is added to a consonant-final root, as in (37). Bright describes ‘progressive accentuation’ as moving H one syllable to the right, while the vowel lengthening process is described as stem-final. However, no evidence is given for *this* set of affixes moving accent to anywhere but the final syllable of the stem.[15] I propose that it is not a coincidence that the syllable which is lengthened by the addition of these suffixes is also the syllable bearing tone in the output, rather that the vowel lengthening occurs as a repair whenever a H tone ends up on a closed short syllable.

In all the most common verb root shapes, the weak tone-shifting affixes either have no effect due to fixed tone, as in examples (33–34), or they move H tone to the final syllable of root, as in examples (35–40). In each of the root shapes that have moveable tone, a H ends up on the last syllable before the suffix under affixation. When a H lands on an open CV syllable, as in the words in (35–36), shown here in (41–42), no vowel lengthening occurs. This is because the ideal tonal feet (vá.fà)$_{\mu\mu}$ and (rí.kì)$_{\mu\mu}$ are created, whereas a H on a CVV syllable would be less optimal.

(41) ííth.va + -faku → iith.**vá.fa**.ku (*iith.**váá**.fa.ku) ‘to pack down from uphill’

(42) ííth.ri + -kirih → ith.**rí.ki**.rih (*ith.**ríí**.ki.rih) ‘to set a container on fire (causative)’

When a H would land on a closed CVC syllable, as in the words in examples (38–40), shown here in (43–45), vowel-lengthening is triggered, indicating that a H on a CVV syllable is preferable to a H on a CVC syllable.

[15] In any case, the number of roots that would accommodate rightward movement of tone without it landing on the final syllable is very small. For other affixes that attach further from the root, the continuing rightward pattern may be seen. These patterns are left to further research.

(43) ish.pát + -rav → ish.**páát**.rav (*ish.**pát**.rav) ‘to break (sth) into two (tr.)’

(44) ik.rív.ruh + -rupu → ik.riv.**rúúh**.ru.pu (*ik.riv.**rúh**.ru.pu) ‘to roll downriver’

(45) ik.réém.yah + -varak → ik.reem.**yááh**.va.rak (*ik.reem.**yáh**.va.rak) ‘to blow down from upriver’

However, when the final consonant of the root can syllabify with a following vowel across the morpheme boundary, as in the word in (37), shown here in (46), no lengthening occurs. This is because, again, an ideal tonal foot (rú.hù)$_{\mu\mu}$ is created.

(46) ik.rív.ruh + -unih → ik.riv.**rú.hu**.nih (*ik.riv.**rúu**.hu.nih) ‘to roll downhillward’

These patterns show that it is better to lengthen a short vowel than to have a H on a short closed syllable in the output, but that lengthening a short vowel is *not* better than having a H on a short open syllable in the output. It is also clear that a highly ranked faithfulness constraint makes the deletion of coda consonants an unacceptable repair to violations of H on (C)VC, even though this would create an more optimal output (a ($\acute{\mu}.\grave{\mu}$) foot) than does the vowel lengthening. The directional suffixes thus provide more evidence for avoidance of H on (C)VC syllable, because vowel lengthening only occurs when a H tone would otherwise fall on a (C)VC syllable.

6.4 Summary

In this section, evidence for the avoidance of H on (C)VC syllables in Karuk from two different parts of verb derivation has been provided. This constraint has been shown to be partly responsible in determining which stem tones will move under affixation, and also accounts for vowel lengthening in some outputs of tone-moving affixation.

I have also shown that a bimoraic HL trochee represents the most preferred tone-foot alignment in Karuk, as evidenced by the fixed nature of tone whenever it falls into this structure. This phenomenon indicates that tone assignment is sensitive to metrical structure even when it is not dependent on stress.

7 Conclusions

To sum up, the phenomenon of avoidance of a H tone on a short closed syllable unifies and explains several different phonological patterns in Karuk. This avoidance is reflected in different ways at different levels of the grammar, namely: static distributions of tone in roots, mobility of tone in stems, and vowel lengthening under affixation. The fact that avoidance of H on (C)VC is limited to initial (C)VC syllables in roots, whereas it is a more general constraint in derived forms, is not surprising given that roots often allow structures that derived forms avoid, and that the initial syllable is a prominent position where marked structures might be less well tolerated.

In conclusion, while Karuk affixes can be understood in terms of strong, weak, and neutral classes typical of traditional accent analyses, the accentual behavior of stems is best attributed not to arbitrary accentual categories, but to tone-driven phonological constraints. These findings reinforce the idea that tone is active in the Karuk system, as Crowhurst and Macaulay (2007) propose. However, the findings indicate that tone interacts with a metrical system in a more involved and complicated way than has previously been observed (e.g Bright 1957; Macaulay 1990; Crowhurst and Macaulay 2007). By introducing coda consonants as a factor in the placement of tone by way of the constraint *(C)V́C, this analysis makes the Karuk system more predictable, both in terms of static tone distributions and in terms of morphological effects on word prosody. While more work remains to be done, in particular, modeling the mechanisms by which tones are moved and understanding more complex morphological interactions, the generalizations made here represent a step towards better understanding this system and an important data point in the space of ‘pitch-accent’ languages.

Appendix

A Verb suffixes

Tables 3–5 list Karuk verbal suffixes. Verbal prefixes and nominal prefixes and suffixes function similarly, and are fewer in number. Eight deverbal derivational suffixes also have not been included in these tables. Also excluded are *-sap* ('closing up', derivational class 2(?), PS or PA)[16], and *-iruv* 'too much', derivational class 4(?), PS or PA), due to insufficient description of accentual effects.

Verbal derivational suffix position classes follow Bright (1957), incorporating more recent work by Macaulay (1990), but note that Bright's classes are partially semantically determined and not wholly reflective of combinatoric restrictions. I have tentatively collapsed Bright's four inflectional position classes into three, based on his description of combinatoric possibilities, taking prosodic effects into consideration, and incorporating Macaulay's (1989) reanalysis of Bright's 'syntactic postfixes' as suffixes. However, more work remains to be done to determine the correct analysis of these suffixes.

Table 3: Tone-neutral Verbal Suffixes

Affix	Gloss	Type	
-0vrik	'in response to motion'	Derivational Class 4	
-naa, -vunaa	PLURAL	Derivational Class 6	(SA*)
-ach	DIMINUTIVE	Derivational Class 8	
-N	IMPERATIVE	Inflectional Class 1	

[16] SA: 'Suffixal Accentuation' – H or HL on first syllable of suffix, as indicated
PS: 'Presuffixal Accentuation' – H on syllable preceding suffix
UPS: 'Unstable Presuffixal Accentuation' – 'Unstable' H on syllable preceding suffix
UPPS: 'Unstable Pre-presuffixal Accentuation' –'Unstable' H two syllables preceding suffix
PA: 'Progressive Accentuation' – generally speaking, rightward moving tone
SP: 'Special Progressive Accentuation' – PA that only operates on a limited set of stem shapes
MP: 'Modified Progressive Accentuation' – PA that only operates on stems Bright labels 'unaccented'
PL: 'Potential Lengthening' – Vowel lengthening (where applicable in consonant-final stems)
VS: Vowel shortening (where applicable)
( ) indicates under certain conditions
* indicates different accentuation in combination with monosyllabic stems
** indicates an irregular allomorph or accentuation in combination with particular morphemes

Table 4: Strong Tone Verbal Suffixes

Affix	Gloss	Type	Effect
-chak	'closing up'	Derivational Class 2	PS
-fip	'completely'	Derivational Class 4	PS
-kiri	(motion)	Derivational Class 4	PS
-sar	'along with'	Derivational Class 4	PS
-kiri	INSTRUMENTAL	Derivational Class 4	PS, VS
-koo	'to'	Derivational Class 4	PS, VS
-tárar	(unknown)	Derivational Class 2	SA
-tánmah	'for nothing, for no reason'	Derivational Class 4	SA
-úùr	'for a long time'	Derivational Class 4	SA
-iichva	'in pretense'	Derivational Class 4	UPS
-oo	HABITUAL	Derivational Class 4	UPS, VS
-vaana	'oneself'	Derivational Class 4	UPS
-va	PLURAL ACTION	Derivational Class 6[17]	UPPS, (VS, PL)**

Table 5: Weak Tone-Moving Verbal Suffixes

Affix	Gloss	Type	Effect
-va	PLURAL ACTION	Derivational Class 1	PA, (PL)
-riv	'at rest'	Derivational Class 2	PA, PL
-taku	'on or onto a horizontal surface'	Derivational Class 2	PA, PL
-kath	'hence across a body of water'	Derivational Class 3	PA, PL
-kiv	'out through a tubular space'	Derivational Class 3	PA, PL
-ku	'onto a vertical surface'	Derivational Class 3	PA**, PL
-mu, -vu	'thither, to, toward'	Derivational Class 3	PA, PL
-path	'around in a circle'	Derivational Class 3	PA, PL
-raa	'hither'	Derivational Class 3	PA, PL
-rav	'in, into'	Derivational Class 3	PA, PL
-rip	'off, out'	Derivational Class 3	PA, PL
-faku	'hither from uphill'	Derivational Class 3	PA, PL
-kara	'horizontally toward the center of a body of water'	Derivational Class 3	PA, PL
-rina	'hither across a body of water'	Derivational Class 3	PA, PL
-ruprin	'through'	Derivational Class 3	PA, PL
-rupu	'hence downriverward'	Derivational Class 3	PA, PL
-sip(riv)	'up (to the height of a man or less), to start to'	Derivational Class 3	PA, PL
-suru	'off, away'	Derivational Class 3	PA, PL
-tunva	'toward each other, together'	Derivational Class 3	PA, PL
-vara	'in through a tubular space'	Derivational Class 3	PA, PL
-furuk	'into an enclosed space'	Derivational Class 3	PA, PL, (PS*)

[17] Following Macaulay (1990), PLURAL ACTION *-va* is classified in position class 1 when directly attached to a root, but in class 6 when attached to a derived stem. Different accentual effects when attached to a root vs. a derived stem support this division.

Table 5: Weak Tone-Moving Verbal Suffixes

Affix	Gloss	Type	Effect
-kirih	'into or onto fire'	Derivational Class 3	PA, PL, (PS*)
-kurih	'into water'	Derivational Class 3	PA, PL, (PS*)
-ramnih	'in or into a container'	Derivational Class 3	PA, PL, (PS*)
-ripaa	'horizontally across a body of water	Derivational Class 3	PA, PL, (PS*)
-risuk	'out of a container'	Derivational Class 3	PA, PL, (PS*)
-roovu	'hence upriverward, around a basket'	Derivational Class 3	PA, PL, (PS*)
-rupaa	'out of one's mouth'	Derivational Class 3	PA, PL, (PS*)
-ruprav	'out through a solid'	Derivational Class 3	PA, PL, (PS*)
-ruprih	'in through a solid'	Derivational Class 3	PA, PL, (PS*)
-rupuk	'out of an enclosure'	Derivational Class 3	PA, PL, (PS*)
-varak	'hither from upriver'	Derivational Class 3	PA, PL, (PS*)
-varayva	'here and there within an enclosure'	Derivational Class 3	PA, PL, (PS*)
-ish(rih)	'down (from the height of a man or less)', RESULTATIVE	Derivational Class 3	PA, (SA**)
-0thuna	'here and there, in various places'	Derivational Class 3	PA
-unih	'down from a considerable height, hence downhillward'	Derivational Class 3	PA
-uraa	'up from a considerable height, hence uphillward'	Derivational Class 3	PA
-0vraa	'over'	Derivational Class 3	PA
-0vrath	'into a sweathouse, over'	Derivational Class 3	PA
-0vrin	'in opposite directions'	Derivational Class 3	PA
-0vruk	'down over the edge of something'	Derivational Class 3	PA
-ahiv	'on some occasion'	Derivational Class 4	PA
-ar	'to go in order to'	Derivational Class 4	PA
-ara	INSTRUMENTAL	Derivational Class 4	PA
-eep	'away from (a person)	Derivational Class 4	PA
-ihi	BENEFACTIVE	Derivational Class 4	PA, PL
-mara	'to finish Xing'	Derivational Class 4	PA, PL
-math, -vath	CAUSATIVE	Derivational Class 4	PA, PL
-rih	'up'	Derivational Class 4	PA, VS(?)
-uk	'hither'	Derivational Class 4	PA
-unis	'to, at, about'	Derivational Class 4	PA, (SA, VS**)
-ahi, -va	ESSIVE	Derivational Class 5	PA
-tih	DURATIVE	Derivational Class 7	SP, PL
-i	IMPERATIVE	Inflectional Class 1-3	PA, PL**
-at	PAST TENSE	Inflectional Class 1	PA, PL
-an, -han	PARTICIPIAL	Inflectional Class 2	PA
-ahak	'where'	Inflectional Class 2-3	PA**

Table 5: Weak Tone-Moving Verbal Suffixes

Affix	Gloss	Type	Effect
-irak	IRREALIS	Inflectional Class 2-3	PA
-aheen	ANTERIOR TENSE	Inflectional Class 2-3	SP**
-anik, -hanik	ANCIENT TENSE	Inflectional Class 2, 3	SP**
-avish	FUTURE TENSE	Inflectional Class 1	MP
-ara	NEGATIVE	Inflectional Class 2-3	MP, (SA*)
-ap	INVERSE	Inflectional Class 2	MP
-at, -hat	PAST TENSE	Inflectional Class 3	MP

References

Bright, W. (1957). *The Karok Language*, Volume 13 of *University of California Publications in Linguistics*. Berkeley and Los Angeles: University of California Press.

Bright, W. and S. Gehr (2005). *Karuk dictionary*. Happy Camp, CA: Karuk Tribe of California, Language Program.

Crowhurst, M. and M. Macaulay (2007). Stress and accent in Karuk. Unpublished ms., presented at SSILA Anaheim.

Czaykowska-Higgins, E. (1993). Cyclicity and stress in Moses-Columbia Salish (Nxa'amxcin). *Natural Language and Linguistic Theory 11*(2), 197–278.

de Lacy, P. (2002). The interaction of tone and stress in optimality theory. *Phonology 19*, 1–32.

Gordon, M. (1999). *Syllable weight: Phonetics, phonology, and typology*. Ph. D. thesis, UCLA.

Harrington, J. P. (1932). *Tobacco Among the Karuk Indians of California*. Smithsonian Institution Bureau of American Ethnology Bulletin 94. Washington, DC: United States Government Printing Office.

Hualde, J. I. (2012). Remarks on word-prosodic typology. In *Proceedings of the Thirty-Second Annual Meeting of the Berkeley Linguistics Society*, pp. 237–249.

Hyde, B. (2007). Non-finality and weight-sensitivity. *Phonology 24*, 287–334.

Hyman, L. (2006). Word-prosodic typology. *Phonology 23*(2), 225–257.

Hyman, L. (2009). How (not) to do phonological typology: the case of pitch-accent. *Language Sciences 3*(2-3), 213–238.

Kiparsky, P. (1973, Dec). The inflectional accent in Indo-European. *Language 49*(4), 794–849.

Macaulay, M. (1989). A suffixal analysis of the Karok 'endoclitic'. *Lingua 78*, 159–180.

Macaulay, M. (1990). A preliminary look at Karok pitch accent. In *Papers From the 1989 Hokan-Penutian Languages Workshop*, Volume 2 of *University of Oregon Papers in Linguistics*, pp. 41–61.

Zhang, Z. (2001). *The effects of duration and sonority on contour tone distribution - typological survey and formal analysis*. Ph. D. thesis, UCLA.

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