Root-stress in Gitksan: Modeling the path to lexical accent*

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1 Introduction

This paper discusses the pattern of stress assignment in Gitksan, a Tsimshianic language spoken in the northwest Interior region of British Columbia.[1] As previous work by Rigsby (1986) and Tarpent (1994) shows, word stress in this language is assigned largely on the basis of the position of the lexical root. Though these works argue that stress is assigned to the final syllable in the root, a substantial number of initial-stressed forms are attested in the language as well. Rigsby (1986) and Tarpent (1994) derive these forms with a set of epenthesis rules; I present an alternative metrical analysis in which root-internal stress is sensitive to weight. Under this analysis, syllables with long vowels attract stress leftward. I formalize this system in a generative metrical framework, following Idsardi (1992).

Further, I discuss the broader potential for diachronic change in stress systems dependent on morphological knowledge. Because these systems are affected by factors of both phonological and morphological opacity arising over time, I suggest that this may be a place where lexical accent systems emerge. Gitksan, being a language with a relatively small number of polysyllabic root forms and a somewhat substantial number of exceptions, is an interesting case to examine.

In Section 2, I present the basic stress patterns found in Eastern Gitksan polysyllabic roots and how they have been accounted for in Rigsby's (1986) analysis of stress. I present an alternative to his root-internal fixed-stress system: a root-internal weight-sensitive system. In Section 3 I discuss sets of exceptions to both analyses, and compare how each analysis accounts for them. Finally, in Section 4 I consider how such morphologically dependent metrical systems might change over time, proposing that the rise of exceptions to possible generalizations might result in learners positing lexically-specified accentual systems. There is a greater possibility of such development when the lexicon of relevant forms is small.

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[1] I focus mainly on the eastern dialects due to the larger body of established vocabulary work done on them. My materials include words sourced from Hindle and Rigsby's (1973) word list, Rigsby's (1986) grammar, and Brown (2008), all based on the Hazelton/Kispiox dialect (Gitxsanimx̲), as well as the cross-dialectal fieldwork of myself and the UBC Gitksan Research Lab. Eastern dialect forms are presented here.
Abbreviations: 3 = third person, ANTI = antipassive, DSTR = distributive, EPIS = epistemic modal, II = series II suffixal person marking, INTR = intransitive, NMZ = nominalizer, PL = plural, SG = singular, TR = transitive, VAL = valency adjuster. Morpheme breaks are hyphens (-) for affixes and equals signs (=) for clitics. Reduplication is marked by tildes (∼).

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2 Root-internal stress patterns

No targeted phonetic study has been done on the phonetic correlates of Gitksan syllable stress; impressionistically, its major markers are increases in intensity and pitch.[2] The position of stress in Gitksan is dependent on the position of the morphological root, rather than on the boundaries of the prosodic word. This can be demonstrated by examining the forms in (1), where the root is positioned differently in each four-syllable word. In each example, the stress falls on the monosyllabic root.

(1)	a.	[ʔan.ˈ**siː.pʔ**ɪnsxʷ.diːt]	NMZ-**like**-TR-ANTI-3PL.II	'their friend'
	b.	[ɬa.ɢa.ˈ**tsuː**.diːt]	NMZ-DSTR-**other**-3PL.II	'the others'
	c.	[ha.ʔni.ɢan.ˈ**ʔwɪn**]	NMZ-on-empty-**teeth**	'gums'

It would be ideal to additionally show a form in which stress falls on the initial syllable of four; unfortunately, I have not been able to find or construct a chain of suffixes more than two syllables long. The forms below demonstrate that there is nothing barring initial stress (2a–b), and that the number of posttonic syllables may be extended by the addition of a clitic after the root (2c).[3]

(2)	a.	[ˈ**he.d**ɪn.diːt]	**stand**-TR-3PL.II	'stand (them) up'
	b.	[ˈ**baː.sɢ**an.diːt]	**split**-TR-3PL.II	'separate (them)'
	c.	[nɪ.ˈ**niː.nixs**.xʷdiː.dɪ.ma]	PL∼**marry.PL**-VAL-3PL.II=EPIS	'maybe they married'

Stress occurs on the morphological root in almost all cases; exceptions to this robust generalization will be discussed in Subsection 3.2. In alternate terms, this is an interface system, dependent largely on morphological factors (Revithiadou 1999). A substantial majority of Gitksan roots are monosyllabic: the preferential root shape in this language is CVC (Tarpent 1987). As a consequence, morphological information alone is often enough to determine the position of stress.

In the next subsections I address the question of how stress is assigned within polysyllabic roots, with generalizations deriving from a database of Gitksan roots (compiled from Hindle and Rigsby 1973; Rigsby 1986; Brown 2008; as well as primary fieldwork). I focus on bisyllabic forms, as I have found few root forms with three or more syllables.[4]

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[2] Some current work is being done on aspects of syllabification and prominence in Gitksan. One study suggests that some fricatives may be perceived by speakers as nucleic; minimal pairs such as the following were both reported by participants as having two "beats", despite one being monovocalic (Schwan and Anghelescu 2013).

(i) a. [mɪtxʷ] 'fill.INTR'
b. [mɪdɪn] 'fill.TR'

Such findings are relevant for an investigation of syllable structure and prominence. However, I assume for the purposes of this work that only vocalic peaks are potential targets for stress.

[3] Under some analyses clitics are adjoined to the prosodic word, and thus would not be expected to contribute to syllable counts for stress assignment purposes (see e.g. the analysis of some functional morphemes in European Portuguese by Vigário 1997). Still, I include these examples for the sake of illustration, and because the theoretical prosodic nature of clitics as opposed to other morphology in Gitksan is not yet determined.

[4] Note that I assume that subsequent forms in this paper are synchronically "atomic". That is, while some may be further historically decompositional, I have not noted productive morphological alternations within these forms and thus consider them to have "root" status. In an effort to remain conservative about my estimates of the difference between synchronic and historical roots, I have largely followed Rigsby's (1986) claims

I begin with consideration of final-stressed forms, and review the analysis of Interior Tsimshianic stress given by Rigsby (1986) and Tarpent (1994), in which stress is root-final. Many roots in Gitksan exhibit stress on the initial syllable, however. I consider these forms in Subsection 2.2 and discuss factors of syllable weight that may be at play in Subsection 2.3.

2.1 Root-final stress

Rigsby (1986) and Tarpent (1994) argue for a system of root-final stress placement (the former for Gitksan, and the latter for all the modern Tsimshianic languages). Forms such as those in (3) demonstrate this.

(3) a. [gɪ.ˈba] ‘wait.for’
b. [gʷɪ.ˈla] ‘blanket’
c. [laχ.ˈʔni] ‘hear’
d. [bɪs.ˈdaʔj] ‘grouse’
e. [sdɪ.ˈkʔeːkʷ] ‘sister’

Bisyllabic roots would thus be described metrically as iambs. This would be simple to formally model: below in Table 1, a boundary is placed on the rightmost edge of the initial metrical plane (Line 0); a boundary on the left would suffice equally well at this point. The only crucial parameter is the one which locates the head of the Line 0 constituent to the right, allowing only the final syllable to be projected onto Line 1 as the root’s main stress.

Table 1: A final-stressed root

	x	Line 1
x	x)	Line 0
gʷɪ	la	‘blanket’

(4) *Head Location Parameter (Line 0):*
Project the rightmost element of a constituent on Line 0 onto Line 1.

Final-stressed forms make up the majority of bisyllabic roots (about 70% of the approximately 180 forms I have collected). However, this still leaves significant number of initial-stressed forms that must be accounted for. The next section discusses an analysis for these forms.

2.2 Initial stress

There are a number of other disyllabic forms which do not have surface final stress, as in (5).

about root status, and have excluded forms with potential frozen affixes from consideration as “atomic”. Investigating the synchronic status of such forms in the minds of speakers will be the subject of future work.

(5) a. [ˈnaː.sɪkˀ] ‘raspberry’
b. [ˈlaː.ʁal] ‘examine’
c. [ˈʔoː.tsˀɪn] ‘soul’
d. [ˈhoː.bix] ‘spoon’
e. [ˈʁoj.pˀaχ] ‘bright’
f. [ˈnam.qˀap] ‘bank of stream’

Assuming that these forms are synchronically atomic, examples such as these must be accounted for via some other phonological phenomenon. Rigsby (1986) does this by calling on two processes of epenthesis which follow stress-assignment (R represents a sonorant).

(6) a. ∅ → ə / ...V́ːC_C
b. ∅ → ə / ...V́(R)Cˀ_C (Rigsby 1986: 220–1)

The first rule epenthesizes a vowel in coda consonant clusters following a long vowel, while the second epenthesizes a vowel in coda clusters where the initial consonant is glottalized.[5] Note that both processes are necessarily root-internal; in clusters where segments are separated by morpheme boundaries, epenthesis does not occur. This is demonstrated in the following words with the pronominal suffix [-t] ‘3SG’ added after the root, creating a cluster:

(7) a. [sdɪ.ˈkˀeːkʷt] ‘his/her sister’
b. [hoːxʲt] ‘he/she wore/used ...’
c. [ɬɔˀqt] ‘he/she swallowed’

Assuming the root-internal epenthesis rules in (6), the underlying forms of the initial-stressed roots in (5) may be considered monosyllabic, as shown below:[6]

(8) a. [ˈnaː.sɪkˀ] /naːskˀ/ ‘raspberry’
b. [ˈlaː.ʁal] /laːql/ ‘examine’
c. [ˈʔoː.tsˀɪn] /ʔoːtsˀn/ ‘soul’
d. [ˈhoː.bix] /hoːpx/ ‘spoon’
e. [ˈʁoj.pˀaχ] /ʁojpˀχ/ ‘bright’
f. [ˈnam.qˀap] /namqˀp/ ‘bank of stream’

This requires no additions to the stress assignment process discussed in the previous section, but relies on a greater degree of underlying abstraction in speakers’ mental representations of root forms, and several active epenthesis processes for which there is no obvious evidence from alternations.

It is important to note that on the surface, there is little that differentiates epenthesized unstressed vowels from inherent unstressed vowels. The quality of the unstressed/epenthetic vowels in (8) is predictably determined by the place of neighboring consonants: lowering processes apply beside

[5] Rigsby’s (1986) original rule for (6b) specified that the second member of the cluster be either a stop or [χ] (and in the latter case, be optionally followed by another consonant), but I have seen no compelling evidence for a more specific rule as opposed to a more general one. I thus present the more generalized formulation here.

[6] Voiced obstruents in the phonetic representation correspond to underlying voiceless obstruents; there is a robust process of prevocalic voicing in the Tsimshianic languages (Rigsby 1986; Tarpent 1987).

uvulars and laryngeals, and rounding processes apply beside labiovelars (see Rigsby 1986). The default vowel is [ɪ]. The quality of unstressed vowels with a corresponding segment in the underlying representation is subject to the same processes. This is demonstrated by alternation in the vowel quality of the plural prefix /lə-/ below:

(9) a. [lɪtseːxʲ] 'PL-be.full'
b. [laʔaks] 'PL-drink'
c. [luxʷdaxʲ] 'PL-be.hungry'

We may therefore consider the possibility that both of the vowels in consistently bisyllabic, initial-stressed forms are underlying. With such underlying forms as those in (5), another immediately apparent method of deriving initial stress is via sensitivity to syllable weight.

2.3 Weight sensitivity

Under a weight-sensitive analysis of stress, we may exchange Rigsby's (1986) epenthesis rule applying after long vowels for, instead, an additional mechanism in the stress assignment process. Such a mechanism would equally well account for the generalization that stress always falls on a long vowel, if one is present in a root.

This mechanism comes in the form of a syllable-boundary parameter. Such a parameter places constituent boundaries on the edges of heavy syllables, defined here as long vowels:

(10) *Syllable Boundary Parameter (Line 0):*
Project a right-parenthesis on the right side of a syllable containing a long vowel.

The addition of a second boundary on Line 0, situated on the right side of the initial heavy syllable, allows for the formation of two metrical constituents, and thus the projection of two metrical units to Line 1. On Line 1, it is therefore necessary that the *leftmost* element project to Line 2, to become the main stress of the word. It is again ambiguous whether Line 1's edge boundary should be assigned to the left or right; I have placed it on the left in Table 2 below to correspond with the leftward-oriented projection parameter.

Table 2: An initial-stressed root

x		Line 2
(x	x	Line 1
x)	x)	Line 0
hiː	ɬuxʷ	'morning'

(11) *Head Location Parameter (Line 1):*
Project the leftmost element of a constituent on Line 1 onto Line 2.

It may be beneficial to exchange the epenthesis rule for this more complex stress assignment process when considering the fact that a small number of roots do not apparently undergo epenthesis after a long vowel:

(12) a. [baːsxʲ] ‘be afraid’
b. [ɢaːqɬ] ‘rat’
c. [nuːɬχ] ‘be wet (of person)’

The next question in a discussion of quantity-sensitivity is whether codas contribute to weight. The following examples demonstrate that coda obstruents and sonorants are both apparently invisible to stress assignment, as stress is never pulled to the initial syllable when a coda is present there.[7]

(13) a. [ʔix.ˈsda] ‘tasty/sweet’
b. [laχ.ˈʔni] ‘hear’
c. [gɪm.ˈxdi] ‘sibling (different gender)’
d. [hɪn.ˈda] ‘where’

Of the several remaining initial-stressed forms which are unaccounted for, most have a glottalized onset in the second syllable. This could be accounted for with Rigsby’s (1986) other epenthesis rule, which applies to underlying glottalized consonant clusters.

(14) a. [ˈɢo.ʔmɪl] ‘blink’
b. [ˈnam.qʔap] ‘bank of stream’
c. [ˈɢoj.pʔaχ] ‘bright’

Unlike the previous epenthesis rule, which applied after long vowels, there is no clear way to reincorporate this epenthesis rule as a feature of a quantity-sensitive system. I thus follow Rigsby in suggesting that it could be incorporated as a phonological process that follows stress assignment. A sample derivation is provided in Table 3: stress assignment applies to the unmodified underlying form.

Table 3: Stress assignment with root-internal epenthesis

x		Line 1
x)		Line 0
/ qoj	pʔχ /	
[ɢoj	pʔaχ]	‘bright’

In conclusion, stress assignment in Gitksan may be analyzed as a quantity-sensitive process. Under a weight-based analysis, stress defaults to the final syllable, but may be pulled forward if the initial syllable is heavy. Heavy syllables are those containing long vowels (CV:) but not those

[7] There are some forms where having a coda sonorant in the initial syllable results in initial stress, but these may largely be identified as historically complex. Some examples are presented below with a potential related or root form, where one is identifiable.

(i)

	Word		*Root*	
a.	[ˈsɪl.gʷɪns]	‘middle finger’	[sɪlkʷ]	‘middle, waist’
b.	[ˈgɪl.bɪl]	‘two’	[gʲalp]	‘testicles’
c.	[ˈsgɪm.sɪm]	‘eagle species’	?	

with codas. This allows for more transparent underlying representations of words with long vowels, but root-internal epenthesis is still a necessary process to explain initial stress near glottalized consonants in a small number of forms.

3 Exceptions

In this section I discuss some exceptions to the analyses of stress presented above in Section 2. These include both phonological and morphological exceptions. In the former category, I discuss some initial-stressed forms which are accounted for neither under a fixed root-final nor a quantity-sensitive stress assignment analysis, and propose an epenthesis rule to account for them supported by patterns of speaker variation. In the latter category, I discuss some exceptional stress which falls on affixes, as well as irregular stress on plural forms. Finally, I briefly consider the role of loanwords in the Gitksan system and how loanword stress differs from and impacts native stress.

3.1 Phonological exceptions

Forms which end in the dorsal fricatives [xʲxʷχ] disproportionately display initial stress, often in a pattern that is not motivated by either of the analyses presented so far. Further investigation shows variation in many of these forms, both in their pronunciation by speakers and in their documented spelling (Hindle and Rigsby 1973).

(15) a. [tˀɪlxʲ ~ ˈtˀɪ.lixʲ] ‘(oolichen) grease’
b. [dɪlχ ~ ˈdɪ.laχ] ‘tongue’
c. [lanxʲ ~ ˈla.nixʲ] ‘throat’
d. [lɪmxʲ ~ ˈlɪ.mixʲ] ‘song’

Such variation is not limited to root-internal position, as demonstrated most obviously by variation seen in of the name of the language itself, in the derivational suffix /-əmχ/ ‘language’.

(16) [gɪt.ˈxsa.nɪmχ ~ gɪt.ˈxsa.nɪ.maχ] ‘Gitksan language’

I propose that this process, which sees variation both across and within speakers, as well as between lexical items, is the result of epenthesis between a preceding sonorant and an immediately following dorsal fricative, as formalized in (17).

(17) ∅ → ə / ...VR_X

Application of this epenthesis rule would, like epenthesis in glottalized clusters, apply after the assignment of stress. Unlike that epenthesis process, which holds only within the domain of the root, the domain of this rule is the whole word. An example is shown in Table 4.

The final total of necessary epenthesis rules thus stands at three for a quantity-insensitive analysis (one word-internal, and two root-internal), and two for a quantity-sensitive analysis (one word-internal, and one root-internal). With this variation accounted for, both analyses accurately predict the stress patterns found in Gitksan roots, but differ in the posited underlying representations of some forms.

Table 4: Stress assignment with late-stage epenthesis

x		Line 1
x)		Line 0
/ la	nx^{j} /	
[la	nix^{j}]	‘throat’

3.2 Morphological exceptions

Though to this point I have considered stress assignment a purely root-internal phenomenon, there are a small number of morphological exceptions to this generalization. These come in two categories: suffixal stress, and irregular plural stress.

I have so far identified three suffixes which take stress instead of the roots to which they attach. These are /-ul/, the human classifier which appears on numbers (18a–b), and the unidentified derivational suffixes /-eːʔ/ (18c) and /-əs(t)/ (18d).

(18)

	Root		*Derived*	
a.	[tχalpχ]	‘four’	[tχalpχ.ˈdul]	‘four (people)’
b.	[x^{w}sdɪns]	‘five’	[x^{w}sdɪn.ˈsul]	‘five (people)’
c.	[baɬ]	‘spread’	[bɪ.ˈɬeːʔ^{e}]	‘curtains’
d.	[tʔam]	‘mark’	[tʔɪ.ˈmɪs]	‘write’

Notably, of all of these suffixes, none seem to be currently productive. The human counter is found, predictably, only on the ten number words, and combines in a phonologically transparent fashion with only six of them (Hindle and Rigsby 1973; and see Tarpent 1983a for a thorough review of the development of Tsimshianic counting words). The /-eːʔ/ suffix is not used productively in speech; it is found on a limited set of nouns including [ʔi.ɬeːʔ^{e}] ‘blood’, which has no bare root form. Similarly, Rigsby (1986: 216) identifies the /-əs(t)/ suffix in only two words. It could perhaps be identified in the following final-stressed words as well, based purely on phonological resemblance:

(19)

a.	[bɪl.ˈʔust]	‘star’	PL: [bɪx.bɪl.ˈʔust]		(Hindle and Rigsby 1973)
b.	[sɢa.ˈʔnɪst]	‘mountain’	PL: [sɪx.sɢa.ˈʔnɪst]		
c.	[sgɪ.ˈnɪst]	‘jackpine’			

The above forms in (19) can be clearly identified as polysyllabic roots in speakers’ vocabulary by examining reduplicated plural forms, where available. Reduplication targets the root, and in these forms targets the unstressed first syllables rather than the syllable under stress (Tarpent 1983b). This indicates that the unstressed syllables cannot be interpreted as prefixes; they must be part of the root.[8]

[8]Regular plural-formation processes serve as a useful diagnostic in Gitksan for the position of the root, in fact, since these morphemes (whether reduplicative or simply prefixal) always appear immediately neighboring the root, separating away other prefixes. This diagnostic cannot always be utilized, however, as Gitksan plural forms are frequently irregular or suppletive, and many nouns—which comprise a large proportion of polysyllabic forms—have no distinct plural at all.

The above forms constitute evidence for two classes of affixes in Gitksan: the majority which do not impact stress, and these marked suffixes that apparently fall within the domain of stress assignment. There are two potential methods of accounting for such suffixes. First, these forms could simply have been analyzed by speakers as whole roots, though this seems unlikely for all cases. As roots, they would be subject to stress assignment as whole units, which would default to the right.

Alternatively, the stress assignment process may be cyclic, with a second round of stress assignment being triggered by only these marked suffixes. Following Halle and Vergnaud's (1987) notion of cyclic suffixes, implemented for cases such as Russian and Lithuanian dominant suffixes or English *-ity*, the addition of a cyclic suffix results in previous segmental material from Line 0 (that is, only the x marks) being copied into a new round of stress assignment on a distinct structural plane. This has the effect of erasing previous metrical constituents and allowing for a "fresh" round of stress assignment. Stress falls on the suffix, due to the rightward orientation of stress. Changes in the final vowel quality of the root may be due to reduction requirements for unstressed vowels. The process is exemplified in Table 5 below.

Table 5: Cycle A (root) and cycle B (suffix-triggered)

x		Line 1_A
x)		Line 0_A
/ tʔam /		'mark'
	x	Line 1_B
x	x)	Line 0_B
/ tʔam	-əs /	
[tʔɪ	mɪs]	'pencil'

The irregular plurals are another series of cases with irregular stress. These forms involve vowel lengthening, either within the reduplicant (20), or root-internally (21).[9]

(20)

	Sg	*Pl*	
a.	[noχ]	[ˈnoː.naχ]	'mother'
b.	[woq]	[ˈwoː.waχ]	'sleep'
c.	[naχ]	[ˈnaː.naχ]	'snowshoe'

(21)

	Sg	*Pl*	
a.	[gʷɪ.ˈla]	[gʷiː.ˈla]	'blanket'
b.	[gɪ.ˈʔnam]	[giː.ˈʔnam]	'give something'
c.	[gʷɪ.ˈneːqxʷ]	[gʷiː.ˈneːqxʷ]	'feel cold'

The stress patterns of these two types of irregular plural are split: in the forms where the reduplicant lengthens, stress shifts off the root to the newly-lengthened reduplicant vowel. Conversely, in

[9]Though the targets of these irregular plural formation mechanisms constitute very clear phonological classes, this does not mean that the processes are regular. Normal reduplication of the type in (20), for example, outputs singular/plural pairs such as [ʤoq] / [ʤaχ-ʤoq] *'dwell'*, or [maɢaj] / [maχ-maɢaj] *'rainbow'*.

the vowel-lengthening type shown in (21), stress is retained on the final syllable, rather than shifting it to the newly-lengthened first syllable.

The lengthened-reduplicant types in (20) could feasibly be analyzed as suppletive-like forms which are input whole into the initial root-level stress assignment process. In a weight-sensitive system, stress would be attracted leftward onto the heavy reduplicant. Alternately, these irregular reduplicants could have the same marked, cyclic status as the affixes discussed above, with a reduced stem form.

Table 6: An irregular plural with long reduplicant

x		Line 2
(x	x	Line 1
x)	x)	Line 0
wo:	waχ	'sleep.PL'

Under a root-final stress analysis, the root vowel in the forms in (20) must instead be input later in the course of the derivation via epenthesis (Rigsby 1986; Tarpent 1983b).

The vowel-lengthening types cannot be so analyzed; here, where length is a result of internal change, there appears to be no effect on stress. The assignment of stress on these forms is unproblematic for a root-final stress system regardless of what time in the course of the derivation vowel length is introduced, but in a weight-based system requires a special rule marked for these particular types of irregular plurals. Vowel lengthening must be the consequence of a morphological rule which follows the assignment of stress.

Table 7: Derivation for internal-change plurals

	x	Line 1
x	x)	Line 0
/ g^wi	la /	
g^wi:		V-lengthening
[g^wi:	la]	'blanket.PL'

In this subsection, I have reviewed two kinds of morphological exceptions to the previous generalization of root-internal stress. The first, suffixal stress, motivated the addition of cyclicity to the stress assignment mechanism, triggered by a small class of non-productive affixes. The second is of irregular plurals: weight seems to trigger the movement of stress from the root to the reduplicant, though in another class of irregular forms long vowels in the plural do not result in the movement of stress. For a weight-sensitive analysis, the difference in the latter two cases are accounted for largely as a matter of what stage in the derivation vowel length was introduced: as part of a semi-suppletive root or irregular cyclic prefix, or as a later rule of internal change.

3.3 The influence of loanwords

Remaining exceptions to the phonological generalizations put forth thus far are almost entirely loanwords from English, which retain the initial stress found in their source language despite being

otherwise phonologically nativized. Note that these forms were not necessarily borrowed by fluent bilinguals, as evidenced by the English plural *-s* frozen to the singular form in (22c).[10]

(22) a. [ˈbi.ja] ‘beer’
b. [ˈsu.gʷa] ‘sugar’
c. [ˈʤɪ.gɪnz] ‘chicken’

Related Coast Tsimshian also has a large number of English borrowings. Though initial stress is found there as well, stress is also frequently shifted to the final syllable, as in (23c–e) (Ts’msyen Sm’algya̲x Authority 2013).

(23) a. [ˈsweː.ta] ‘sweater’
b. [ˈpaw.da] ‘powder’
c. [su.ˈgʷa] ‘sugar’
d. [ka.ˈbɪts] ‘cabbage’
e. [ka.ˈpiː] ‘coffee’

The above forms demonstrate different nativization patterns in the different languages. While both languages demonstrate some non-native phonology in English loanwords (for example, prevocalic voiceless/aspirated stops, rather than voiced stops), only the Gitksan forms demonstrate consistently non-native stress as well. These differences could be attributed to different nativization strategies in the two languages (full nativization in Coast Tsimshian and only partial in Gitksan; see e.g. Itô and Meister 1995 and Pater 2005 for discussions on the organization of the lexicon in such situations). Alternately, or additionally, it might be attributed to differences in the languages’ stress systems, both of which are generally root-final (Tarpent 1994). It is possible that the productivity of the root-final stress assignment rule was stronger in Coast Tsimshian than in Gitksan at the time of loan adoption; the Gitksan system may have developed a higher degree of flexibility in incorporating initial-stressed forms without modification.

The role of non-Western loanwords in the Gitksan lexicon is also worthy of recognition. A significant body of loanwords come from the other Tsimshianic languages through contact and trade, and yet more come from neighboring Athabaskan languages and Tlingit, often in terms for animals. The distinctly different phonological shape of words from these languages (usually polysyllabic) versus those of Tsimshianic (usually monosyllabic) results in a large proportion of polysyllabic forms of foreign-language origin, potentially with foreign stress that must be nativized or accommodated.

If the properties of the stress assignment system are subject to the data available in a learner’s lexicon, then shifting proportions of root shapes and stress patterns during an influx of loanwords may have consequences for the next generation’s analysis. The existing system, no matter how simple, may not be maintained if it is not the best analysis for the new input.

4 Learnability, reanalysis, and lexical accent

Both analyses of the Gitksan stress system presented so far rely crucially on a learner’s ability to a) split the root from both productive and non-productive morphology, and b) systematically abstract

[10] I do not discuss names in this paper, but nativized English names are in frequent use in Gitksan, and all that I have heard also retain stress from English.

away from certain initial-stressed forms, creating monosyllabic underlying forms which undergo epenthesis. This section considers the problem of maintenance of such a system: how might root-internal stress systems be understood from the perspective of their learnability? I argue that these may be particular cases where lexically-specified accent systems emerge through reanalysis.

The learner's first step must be to determine that the stress system is root-based: this is presumably not too difficult a property to figure out, given a certain degree of morphological awareness: all that is needed is sufficient exposure to morphemes that neither receive stress nor shift the position of stress on the stems and roots to which they attach, despite changing the overall shape of the word. Subsequently, there are three aspects that learners must consider to evaluate the position of stress in unknown forms and come to a more specific analysis: phonological, morphological, and lexical.

Learners of all metrical systems must consider the effect of phonological structure on the position of stress (see e.g. Dresher 1999 for consideration of this learning process). Root-based stress systems are additionally dependent on a learner's acquired morphological knowledge, and thus have greater potential for change when morphology becomes frozen. In essence, I suggest that there may come a point where morphology become too opaque for a root-internal stress system to be passed on without modification.

Consider the following near-minimal pair in Gitksan. The first form is monomorphemic; the second vowel is derived via a regular phonological process epenthesizing "echo vowels" after postvocalic glottal stops (Rigsby 1986; Tarpent 1987). Thus, stress is not expected on the second vowel. The second form has the same shape, but is polymorphemic; stress occurs on the second vowel.

(24) a. [ˈmo.ʔon] /moʔn/ 'salt'
b. [mɪ.ˈʔɪn] /mə-ʔin/ 'smoke' cf. root: [jeːn] 'cloud'

Once phonological change has sufficiently distanced a derived form from its historical root such that a learner cannot transparently connect them, as could be the case in (24b), it is unclear how the derived form should be categorized with respect to root-status. Once the derived nature of a form is unclear, how might the system change in response?

The notion of pertinacity (discussed in metrical systems by e.g. Lahiri and Dresher 1999, Dresher and Lahiri 2005) is relevant here. Pertinacity concerns the aspects of a system that learners maintain—what remains constant in a language—when reanalysis occurs. The system itself may be maintained; it may be a robust enough system that exceptions do not hinder the learner from making the relevant generalization. Alternately, the output forms alone may be maintained, and the underlying system changed to accommodate it.

The first type of pertinacity is essentially a form of regularization of the input by the learner. This is what is seen in the Coast Tsimshian loans: full nativization of stress ([ˈkæ.bɪʤ] → [ka.ˈbɪts]). The same process could happen language internally as well, for either phonological or morphological reasons. Consider two forms from the hypothetical Language X below, based on Gitksan. InTable 8, a form which previously relied on epenthesis of its second-syllable vowel to derive an initial stress pattern is reanalyzed with two underlying vowels. Being an anomalous exception to both of the predictably root-final stress systems developed in Section 2, the form is eventually changed to fit the majority of the rest of the system. In Table 9, a historically complex form which was morphologically reanalyzed as atomic undergoes the same process.

The second kind of pertinacity does not involve change in the actual form of words, but rather in the internal organization of the system itself: it operates like output faithfulness. In a system

Table 8: Phonological reanalysis of *namk̲'ap* 'bank of stream' in Language X

/namqʔp/	→	[ˈnam.qʔap]	Stress derived by epenthesis
/namqʔap/	→	[ˈnam.qʔap] ?	Reanalysis of underlying form
/namqʔap/	→	[nam.ˈqʔap]	Reanalysis of stress

Table 9: Morphological reanalysis of *mi'in* 'smoke' in Gitksan'

/mə - ʔin/	→	[mɪ.ˈʔɪn]	Complex form
/miʔn/	→	[mɪ.ˈʔɪn] ?	Reanalysis of morphology
/miʔn/	→	[ˈmɪ.ʔɪn]	Reanalysis of stress

with a large number of idiosyncrasies, there may be a simpler analysis not held by adult speakers which is able to account for the data equally well, or better. If the learner encountering the system analyzes it with this method, then both old and new generations would produce the same output forms, but utilize different internal processes for storing and deriving them. An example would be the reanalysis of stress in Middle English, as discussed by Dresher and Lahiri (2005): the Germanic pattern of initial stress could not account for the influx of Latinate-stressed words borrowed from French. At some stage, learners acquired the Latinate stress pattern, which was able to account both for the loanwords and for the majority of native English words.

For root-based stress systems, which are subject to pressures of both morphological and phonological opacity, it is inevitable that eventually the learner will be dealing with a larger and larger number of forms that they cannot break down to the original root. When this happens, I suggest that one "simpler analysis" that learners might come to is one where stress is determined lexically, by the incorporation of underlying accent.

At what point does it become easier to determine the position of stress via memorization than by generalized rule? Yang (2005) discusses the critical threshold for the productivity of morphological rules: should the number of exceptions to a morphological rule fall above approximately 20% of the relevant lexicon, it cannot be analyzed as a productive rule. If this percentage can be taken as a generalized threshold that also holds for phonological rules, then, for a lexicon of about 180 roots, it would take about 35 exceptions for it to be just as much work to memorize all forms in the lexicon as "exceptional"—that is, lexically determined.

Let us assume that this is the case in Language Y. In this language, a combination of phonological and morphological reanalysis of root forms leads to an increasing number of forms having initial stress, some for no easily discernable reason such as vowel length. Learners of this language decide to mark these forms as exceptionally marked for stress, as in Table 10. When this number rises over the critical threshold of 20%, learners simply mark all forms for their underlying stress, as stress marking cannot be reliably called productive. This is shown in Table 11.

While it is unclear where Gitksan is in its diachronic development, I propose that the combined factors of morphological and phonological opacity in a root-based stress system might be one of the ways that lexical accent systems arise over time. As the rules determining the placement of root-internal stress become more complex, or as increasing numbers of exceptions to these rules develop, it would be increasingly likely for memorization of individual stress patterns to be a simpler, more

Table 10: Lexical stress marking for *namk̲'ap* 'bank of stream' in Language Y

/namqʔp/	→	[ˈnam.qʔap]	Stress derived by epenthesis
/namqʔap/	→	[ˈnam.qʔap] ?	Reanalysis of underlying form
/na̲mqʔap/	→	[ˈnam.qʔap]	lexically

Table 11: Lexical stress marking for *gwila* 'blanket' in Language Y

/gʷila/	→	[gʷɪ.ˈla]	Root-final stress
/gʷila̲/	→	[gʷɪ.ˈla]	Stress marked lexically

favorable option for achieving the correct output forms. For systems with small numbers of root forms, like Gitksan, the critical threshold for this simplification is much smaller.

5 Conclusion

In this paper I have described the stress patterns within polysyllabic roots in Eastern Gitksan (Gitxsanim̲x̲) and considered two potential metrical analyses: a fixed-stress analysis (Rigsby 1986), and a quantity-sensitive analysis. Both systems required additions to account for some initial-stressed exceptions to these rules. These included epenthesis (I discussed variation motivating a new type of epenthesis between sonorants and dorsal fricatives), and cyclic affixes capable of moving stress from the root. Further, I discussed some differences in the nativization of stress in loanwords between Gitksan, in the east, and related Coast Tsimshian, in the west. These differences were suggestive of different analyses at work in the metrical component between the two languages.

Finally, I discussed how such a metrical system might develop, based on two different notions of pertinacity: one resulting in the regularization of stress, and one resulting in underlying reanalysis that allowed for output faithfulness. Either of the two different outcomes might be expected on the basis of the size of the relevant lexicon and the number of exceptions a learner must account for.

I argued that the second option, where the output stress of all forms is retained but the underlying analysis is simplified, is a route by which lexically-based metrical systems may develop. A stress system's dependency on morphological knowledge means it will be vulnerable to the rise of morphological opacity: such a metrical system cannot be maintained if morphological knowledge is not correspondingly maintained.

The synchronic place of Gitksan on a continuum between regular root-internal productive stress assignment and lexically-determined stress is as yet unknown. This calls for future investigation into the question of speakers' morphological awareness.

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