A Metrical Analysis of Syncope in Tlingit [1]

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A seemingly idiosyncratic set of verbal prefixes in Tlingit undergo an ellipsis alternation very similar to standard cases of syncope. I argue for a constraint-based analysis of this alternation, in which the ellipsis results from constraints governing metrical well-formedness. This analysis is shown to explain many puzzling nuances of the alternation, including the seemingly idiosyncratic set of prefixes it applies to. Furthermore, the metrical system proposed for Tlingit is strikingly similar to that reported for certain Athabascan languages, the sole difference resting in the relative rank of two constraints.

1. Introduction

The premiere issue for phonological theory since at least the 1990's has been the extent to which the structure of the output is the proper locus of phonological explanation (Bromberger & Halle 1989, Prince & Smolensky 1993, Hermans & van Oostendorp 1999, Blevins (to appear)). One compelling idea underlying many otherwise disparate proposals is that phonological systems are 'goal oriented'. Under such a view, phonological alternations are, at base, 'repairs' introduced to improve the output forms with respect to certain universal markedness constraints (Paradis 1988, Calabrese 1988, Paradis & LaCharité 1993, Calabrese 1995). A basic empirical challenge to this view are the many instances of allomorphic variation that appear highly 'irregular' and 'idiosyncratic' in character, and which do not seem insightfully described in terms of constraints found operable in other languages. Of course, this empirical challenge is met by demonstrating either that such alternations are not governed by the language's phonological system, or that they are not as 'idiosyncratic' as might first appear. Adopting the latter tactic, the analyst attempts to factor a complex and seemingly irregular alternation into a number of interacting components, each of which might be aptly viewed in terms consistent with a markedness-driven, output-oriented phonological architecture.

This project of 'explaining away' idiosyncratic phonological alternations finds an excellent testing ground in the Na-Dene languages.[2] These languages are renowned for

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[2] Throughout this paper, I follow Thompson (1996) in his use of the term 'Na-Dene' to mean a language phylum containing the Athabascan languages, Tlingit and the extinct language Eyak. Although the original 'Na-Dene Hypothesis' included the Haida language within this phylum, the inclusion of Haida remains

displaying within their verbal prefix strings a bewildering variety of complex and irregular allomorphic alternations. Traditionally, these alternations are described using the machinery of phonological rules and boundary symbols. In recent years, however, progress has been made towards the description of the surface phonetics and phonotactics of these languages, as well as their relation to the phonological alternations witnessed in the verbal prefix string (McDonough 2003, Tuttle 1998). By illuminating the phonotactics of particular morphological domains, much of the apparent idiosyncrasy and irregularity of certain phonological alternations may be eliminated.[3]

This paper may be considered one contribution to the much wider project of analyzing the complex prefixal allomorphy of the Na-Dene languages in a constraint-based, output-oriented framework. We will focus primarily on a seemingly irregular vowel-zero alternation in Tlingit. I will argue that a proper understanding of this alternation requires that one attend to the surface phonotactics of the Tlingit verbal prefix string. Once attention is paid to the range of surface forms available at different portions of the string, many of the rule's apparent idiosyncrasies melt away, and the alternation may be viewed as a fully productive phonological process, driven by independently motivated, universal constraints.

The paper is organized as follows. In the next section, I introduce the phonological inventory and traditional orthography of the Tlingit language. This orthography will be used throughout the paper to represent the sounds of Tlingit, and it differs from IPA in ways that may at first be confusing to the linguist. The second section also introduces the inventory of Tlingit verbal prefixes, as well as the traditional, templatic description of their ordering. In the third section, the reader is introduced to the Tlingit syncope alternation, the phonological phenomenon of primary discussion in this paper. The fourth section motivates the use of a constraint-based architecture in the analysis of this alternation. The various conditions under which Tlingit syncope is 'phonotactically blocked' are analyzed in section 5. Section 6 puts forth a set of hypotheses that together derive the seemingly idiosyncratic set of verbal prefixes subject to Tlingit syncope. It is in section 7 that the constraints hypothesized to ultimately drive Tlingit syncope are finally introduced and motivated. Tlingit syncope is argued to be an instance of so-called 'metrical syncope'; the constraints forcing the syncope alternation govern the well-formedness of foot structure in the language. Unfortunately, Tlingit is a tone language, and no clear descriptions of its metrical structure exist. Nevertheless, it is shown that a metrical system extant among the related Athabascan languages will produce the Tlingit syncope alternation upon a re-ranking of only two constraints. The paper's concluding discussion is found in section 8. It explores the consequences of this analysis for our theory of phonology, our standard descriptions of the Na-Dene languages, and our understanding of the structure of their common ancestor. There are, finally, three appendices, which contain the crucial ranking arguments for the constraint system put forth in section 7, a collection of forms illustrating the 'phonotactic blocking' of Tlingit syncope, and a discussion concerning the merits of abandoning boundary symbols within the study of Na-Dene languages.

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quite controversial. See Dürr & Renner (1995) and Manaster Ramer (1996) for excellent overviews and contemporary discussions of this debate.

[3] See, in particular, Tuttle 1998 section 6.5.

2. Phonological, Morphological and Orthographic Preliminaries

2.1 Phonemic Inventory of Tlingit

Throughout this paper, I represent Tlingit segments using the practical orthography for Tlingit (Dauenhauer & Dauenhauer 2000). The chart below provides featural descriptions of the consonantal sounds represented by each of the consonant symbols of the orthography.

(1) Consonantal Inventory of Tlingit (Leer 1991)

		Alveolar	Lateral	Palatal	Velar		Uvular		Glottal	
					plain	round	plain	round	plain	round
Stop	plain	d			g	gw	g̱	g̱w	.	.w
	aspirated	t			k	kw	ḵ	ḵw		
	glottalized	t’			k’	k’w	ḵ’	ḵ’w		
Affricate	plain	dz	dl	j						
	aspirated	ts	tl	ch						
	glottalized	ts’	tl’	ch’						
Fricative	plain	s	l	sh	x	xw	x̱	x̱w	h	hw
	glottalized	s’	l’		x’	x’w	x̱’	x̱’w		
Nasal		n								
Glide				y		w				

As this chart indicates, the consonantal system of Tlingit has the following properties. There are no bilabial consonants. Velar, uvular and glottal sounds contrast in rounding; coronal, palatal and lateral sounds do not. All obstruents may be glottalized, except for “sh” and “h” and “.”. The only voiced segments are “n”, “y” and “w”; the contrast between the sounds represented, for example, by “d” and “t” is one of aspiration, not voicing. Interestingly, fricatives do not contrast in aspiration, only in glottalization.

The linguist should be mindful of the following potential sources of confusion this orthography introduces. As just mentioned, the sounds represented by the symbols “d”, “g”, “g̱”, “dz” “dl” and “j” are not voiced; they are voiceless unaspirated segments. Similarly, the sound represented by the symbol “l” is not voiced; rather, it is the voiceless lateral fricative represented in Navajo orthography by the symbol “ł”. Furthermore, note that the digraphs “gw,” “kw,” “k’w,” “g̱w,” “ḵw,” “ḵ’w,” “xw,” “x’w,” “x̱w,” “x̱’w,” and “hw” do not represent consonant clusters, but single labialized segments. Finally, note that the symbols representing uvular sounds are distinguished from those representing velar sounds by means of underlining.

The orthography used to represent the vocal segments of Tlingit is introduced in the chart below.

(2) Vowel Inventory of Tlingit (Leer 1991)

		Front	Central	Back
High	long/tense	ee		oo
	short/lax	i		u
Mid	long/tense	ei		
	short/lax	e	a	
Low	long/tense		aa	
	short/lax			

As this chart indicates, the vocalic system of Tlingit has the following properties. It contains a high front vowel "ee", a mid front vowel "ei", a low central vowel "aa" and a high back vowel "oo". The high back vowel is the only rounded vocal segment. Vowels contrast in quantitative length. Furthermore, quantitative length is correlated with tenseness (or ATR). Not indicated in this chart is Tlingit's contrast between high and low toned vowels. Tlingit is a 'high-toned' language; its default tone is low. Contour tones do not exist in Tlingit. Tone value is unpredictable in Tlingit nouns. However, tone is largely predictable in Tlingit verbs, where it has a paradigmatic status (see Story & Naish 1973 pp. 379 – 382).

The linguist should carefully note the following properties of this orthography. The digraphs "ee" and "oo" do not represent mid vowels, but high vowels. The digraph "ei" does not represent a diphthong, but rather a pure long mid vowel. Furthermore, the symbols "i", "u" and "e" represent lax vowels, not tense vowels. Similarly, the symbol "a" does not represent a low vowel, but represents either a schwa /ə/ or its stressed variant /^/. Finally, high tone is orthographically represented by an acute accent; low tone is not orthographically represented.

2.2 Morphological Template of Tlingit

Tlingit is a Na-Dene language, and it shares with related Athabascan languages a verbal morphology consisting predominately of prefixes. The order of prefixes in Tlingit is not easily derivable from general principles, and so it is standardly described by use of a stipulative 'morphological template'. The template encodes certain co-occurrence restrictions as well as linear ordering.

Throughout this paper, I adopt a morphological template for Tlingit which amalgamates those employed in Naish (1966), Story (1966), Story & Naish (1973), Leer (1991) and Dauenhauer & Dauenhauer (2000). I emphasize that I adopt this template purely as a descriptive device; see McDonough (2000b) p. 139 – 141 and Rice (2000) for strong arguments against the serious use of the template in the analysis of Na-Dene morphology.

The Tlingit verb contains fifteen prefixal 'positions'.

(3) Shape of the Tlingit Verb

15 – 14 – 13 – 12 – 11 – 10 – 9 – 8 – 7 – 6 – 5 – 4 – 3 – 2 – 1 – ROOT-Suffixes

Most positions may only be occupied by at most one prefix. Interestingly, prefix positions 15 and 13 (and also possibly 9 and 8) may be occupied by more than one prefix. The following are the prefixes occupying each position in the template above.

(4) The Prefixes [4]

Position 15: Adverbial Proclitics

g̱unayéi, áa, shóo, héeni, gági, éeg̱i, dáag̱i,
yan, yax̱, neil, neilx̱, haat, haax̱, yoox̱, ḵut, ḵux̱, yóot, yux̱, yóox̱, yaax̱,
kei, yeiḵ, daaḵ, daak
yei, yoo, yaa

Position 14: Reciprocal: woosh (alternately: wooch)

Position 13: Number (3rd Person Subject Agreement)

has *(animate plural)*
dax̱ (*inanimate plural/distributive*)

[4] Both Story (1966) and Leer (1991) list a verbal prefix for Tlingit which I do not mention here. Story and Leer both report that between the theme prefix "ka" and the aspect/conjugation marker "ga" there is found a 'self-benefactive' prefix "ga". However, neither Story nor Leer discusses the morphophonology of this prefix. I therefore put this prefix aside for the present discussion, and hope to return to it in future work.

Position 12: Object Agreement

x̲at	(*first person singular*)
haa	(*first person plural*),
i	(*second person singular*)
yee	(*second person plural*)
a	(*third person non-focal*)
ash	(*third person focal*),
k̲u	(*areal*)
at	(*indefinite*)
aa	(*partitive*)
sh	(*reflexive*).

Position 11: Unreduced Incorporated Nouns

yaan, shakux, yata, x̲'asakw, g̲ax̲, kanik, xei, k̲ee, yee, yak̲a, saa, .aan, naa, sha.ax̲w, yakw, hin, tux'

Position 10: Reduced (Grammaticalized) Incorporated Nouns

ji, x̲'e, tu, sha, lu, se, sa, x̲a, shu, gu, ta, (etc.)

Position 9: Theme Prefix: ya

Position 8: Theme Prefix: ka

Position 7: Aspect/Conjugation Marker 1

ga	(*future; third conjugation*)
Ø	(*first conjugation*)

Position 6: Irrealis Prefix: u [5]

Position 5: Aspect/Conjugation Marker 2

g̲a	(*fourth conjugation*)
na	(*progressive; second conjugation*)

Position 4: Aspect

g̲a	(*imperfective*)
wu	(*perfective*)

[5] There is perhaps evidence of up to three different prefixes with the form "u/oo" occupying this position. The evidence comes primarily from differences in how hiatus introduced by "u" is resolved, depending on the morphosyntactic context of the prefix (Leer 1991; p. 111). Although important, I leave these details aside, and adopt the simplifying assumption that there is a single 'irrealis' prefix matched to Position 6.

Position 3: Distributive Prefix: dag̲a

Position 2: Subject Agreement

x̲a	(*first person singular*)
too	(*first person plural*)
ee	(*second person singular*)
yi	(*second person plural*)
du	(*fourth person*)
Ø	(*third person*)

Position 1: Classifier

ya, da, di, Ø, li, l, dli, la, si, s, dzi, sa, shi, sh, ji, sha

Position 0: Root

There exist approximately 1,500 verbal roots in Tlingit.

Now that these phonological and morphological basics have been properly introduced, we may turn our attention to a rather interesting vowel-zero alternation affecting a small subset of the prefixes in (4).

3. Basic Description of the Phenomenon

The following verbal prefixes in Tlingit alternate between CV and C forms (see Story 1966, chapter 7; Leer 1991, chapter 5).

(5) Prefixes undergoing CV ~ C alternation

x̲a (~ x̲)	*first person singular subject agreement*
yi (~ y)	*second person plural subject agreement*
dag̲a (~ dax̲)	*distributive*
wu (~ w)	*perfective*
g̲a (~ x̲)	*imperfective*
g̲a (~ x̲)	*conjugation marker*
na (~ n)	*progressive/conjugation marker*
ga (~ k) [6]	*future/conjugation marker*
ka (~ k)	*theme prefix*

See section 2.2 for the location of these prefixes within the overall morphological template for Tlingit verbs. Note that not all verbal prefixes of CV shape undergo this alternation.

[6] The Tlingit practical orthography represents all coda stops as aspirated. This is due to a neutralization of the aspiration contrast at this position, perhaps in the direction of aspiration. For an alternative view, see Maddieson et al. (2001).

The alternation is conditioned by a number of factors, the foremost of which is the structure of the syllables surrounding the prefix. In general, if any of the above prefixes are preceded by an open syllable and followed by a syllable *which is not part of the verbal root*, they surface without vowels. Otherwise, they surface in their CV form.[7] [8]

(6) a. yaa **na**-gút
along prog-go
He's going along. (Story & Naish 1973; p. 352)

b. **na**-gú
conj-go
Go! (Story & Naish 1973; p. 352)

c. yaa **n**-x̲a-gút
along prog-1sg-go
I'm going along. (Story 1966; p. 125)

d. yaa **n**-da-shán
along prog-CL-be.old
He's getting old. (Story 1966; p. 11)

e. yaa s-**na**-da-shán
along plur-prog-CL-be.old
They're getting old. (Story 1966; p. 11)

f. k'idéin (#) **na**-du-s-nee-ch
well prog-4th-CL-do-generic
They repaired it. (Story 1966; p. 148)

Let us first observe that the environment in which this vowel-zero alternation occurs is essentially the 'two-sided open syllable' VC_CV, with the added condition that the sequence 'CV' not be a part of the verbal root. In many languages, the two-sided open syllable is an environment for unambiguous cases of syncope, vowel-deletion (Gouskova 2003). Let us therefore adopt the view that the vowel-zero alternation witnessed in (6) is one of *ellipsis*.[9] Furthermore, we can simplify our statement of the

[7] Throughout this paper, I restrict my attention to the northern, coastal dialect of Tlingit, which is the dialect taught in Tlingit language instruction. The syncope rule differs somewhat in the southern and interior dialects of Tlingit.

[8] There are other vowel-zero alternations within the Tlingit verbal prefix string. However, the environments of these other alternations include specific morpho-syntactic information. For example, certain classifier prefixes lose their vowels before a phonologically non-natural set of inflectional prefixes (Leer 1991; p. 175). In as much as the environment of these other alternations differs from the environment governing the alternation in (5), I consider them beyond the scope of the analysis put forth in this study.

[9] Further evidence for the syncope analysis of this alternation comes from the complex behavior of the imperfective prefix "g̲a". This will become clear in section 7.2.3, where the reader may be challenged to find an equally successful analysis of imperfective "g̲a" that assumes epenthesis to underlie the alternation in (6).

environment for this ellipsis by postulating a phonological domain which excludes the verbal root. Let us name this domain the ‘Prefix String’ and assume that it contains all the verbal prefixes, but excludes the root.[10]

(7) Prefix String Domain:

[prefix string]
15 – 14 – 13 – 12 – 11 – 10 – 9 – 8 – 7 – 6 – 5 – 4 – 3 – 2 – 1 – ROOT-Suffixes

We may now simplify our statement of the ellipsis illustrated in (6) as follows.

(8) Syncope Rule 1
For a given prefix X listed in (5), the (final) vowel V in X is deleted if V follows an open syllable *and* is not final in the Prefix String.

Bear in mind that the rule in (8) is meant purely as a descriptive device. In the next section, we will consider reasons to prefer a constraint-based analysis of this alternation.

Interestingly, the syncope rule in (8) is blocked when its application would create certain sequences of consonants. Both Story (1966) and Leer (1991) recognize that the prefixes “na”, “ga”, “ka” will not syncopate if they are followed by a syllable beginning in a sonorant. Moreover, Story (1966) notes that the prefixes “ga”, “ka” and “g̲a” will not syncopate if the resulting string would contain a cluster of “contiguous like consonants” (Story 1966, p. 140). Independent investigation reveals that the full range of sequences that block syncope are the following.

(9) Sequences Syncope will not Create [11]

n.y, k.y, k.n, k.w, k.g, k.k, x̲.g̲

It is instructive to compare the set in (9) to the set of sequences which syncope can output.

(10) Sequences Syncope will Create [12]

n.s, n.dz, n.sh, n.j, n.l, n.dl, n.d, n.x̲, n.t, n.g̲
y.s, y.dz, y.sh, y.j, y.l, y.dl, y.d
w.s, w.dz, w.sh, w.j, w.l, w.dl, w.d, w.t,
x̲.s, x̲.dz, x̲.sh, x̲.j, x̲.l, x̲.dl, x̲.d, x̲.t, x̲.y
k.s, k.dz, k.sh, k.j, k.l, k.dl, k.d, k.x̲, k.t, k.g̲, k.k̲

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[10] McDonough (2003) Chapter 3 argues that in Navajo there is a similar, major phonological domain encompassing the verbal prefixes but excluding the verbal root.
[11] See section 9.2.1 in the appendices for forms illustrating the inability for syncope to create these sequences.
[12] See section 9.2.2 in the appendices for forms and argumentation supporting the ability for syncope to create these sequences.

When we compare the sequences in (9) to those in (10) several generalizations come into view. First, it appears that syncope in Tlingit will not output a form in which a voiceless stop precedes a sonorant.[13] Second, syncope appears not to output forms in which a nasal precedes a glide. Finally, syncope will not output a form in which an obstruent is followed by an obstruent sharing the same place of articulation. All other sequences are possible outputs of the syncope rule [14]. Given these generalizations, we might restate our syncope rule to the following.

(11) Syncope Rule 2
For a given prefix X listed in (5), the (final) vowel V in X is deleted if V follows an open syllable *and* is not final in the Prefix String, *unless* the resulting form would contain sequences of any the following sort.

(i) a voiceless stop preceding a sonorant
(ii) a nasal preceding a glide
(iii) two adjacent obstruents sharing the same place of articulation

Perhaps the most interesting feature of this syncope process is its 'directionality'. A verb in Tlingit may contain several prefixes from the list in (5). Thus, it often happens that the syncope rule in (11) applies multiple times within a single verb. Such iterated syncope is illustrated in (12) below.

(12) a. ax' yéi **wu**-da**g̲a**-du-ya-.oo → ax' yéi **w**-da**x̲**-du-wa-.oo
there thus perf-dist-4th-CL-put
They were put there. (Leer 1991; p. 106)

b. ka-**wu**-da**g̲a**-li-s'éil' → ka-**w**-da**x̲**-li-s'éil'
theme-perf-dist-CL-be.torn
They were torn. (Story 1966; p. 98)

Furthermore, it is regularly the case that within a verb two prefixes from (5) appear adjacent to one another. Typically, in such a case, the rule in (11) applies first to the rightmost prefix. This application of the rule then serves to 'bleed' any further application of the rule to the remaining, leftmost prefix. This generalization is apparent from the prefix charts provided in Leer (1991) pp. 185 – 202, and is illustrated in the following examples.

(13) a. haa **g̲a**-**yi**-sa-neix̲ → haa **g̲a**-**y**-sa-neix̲ ; * haa **x̲**-**yi**-sa-neix̲
1pl 4conj-2pl-CL-save
Save us! (Story 1966; p. 111)

[13] This statement is, of course, a tad redundant, since all stops in Tlingit are voiceless. However, this particular wording foreshadows the analysis I will later propose for this generalization.
[14] Of course, there are many sequences constructible from the Tlingit inventory which appear in neither (9) nor (10). Such lacunae are accidents of the language's morphology. For example, the sequence "x̲.w" cannot occur simply because neither the imperfective nor the conjugation prefixes can co-occur with the perfective prefix (see section 2.2).

b. a-**ga**-u-**ga**-la-xwéin → a-**gu**-**x**-la-xwéin ; * a-**kw**-**ga**-la-xwéin [15]
3Obj-fut-irr-imperf-CL-spoon
He'll spoon it. (Story 1966; p. 65)

c. ji-**ka**-**ga**-du-tee-ch → ji-**ka**-**x**-du-tee-ch ; * ji-**k**-**ga**-du-tee-ch
hand-theme-4conj-4th-carry-generic
One carries it. (Story 1995; p. 324)

d. yaa ka-**na**-**xa**-sha-xít → yaa ka-**na**-**x**-sha-xít ; * yaa ka-**n**-**xa**-sha-xít
along theme-prog-1sg-CL-write
I'm writing it all down. (Story 1966; p. 112)

e. yaa **ga**-**xa**-la-.úk-ch → yaa **ga**-**x**-la-.úk-ch ; * yaa **k**-**xa**-la-.úk-ch
along 3conj-1sg-CL-boil-generic
I start it boiling. (Story 1966; p. 118)

f. ya-u-**na**-**ga**-yi-ya-dlaak-i [16] → ya-**na**-**x**-yeey-dlaak-i [17] ; * ya-**n**-**ga**-yeey-dlaak-i
theme-irr-prog-imperf-2pl-CL-win-sub
You (pl) can't win. (Story 1966; p. 123)

g. doo x'éi a-**ka**-u-**xa**-dli-xéetl' → a-**koo**-**x**-dli-xéetl' ; * a-**kw**-**xa**-dli-xéetl'
his mouth 3Obj-theme-irr-1sg-CL-fear
I'm afraid of what he will say. (Story & Naish 1973; p. 18)

This right-to-left application of (11) is violated only in cases where the imperfective prefix "ga" directly precedes the second person plural subject agreement prefix "yi". In such cases, the leftmost imperfective prefix is syncopated, rather than the rightmost subject agreement.[18]

(14) x'e ya-**ga**-**yi**-da-nook → ya-**x**-**yi**-da-nook ; * ya-**ga**-**y**-da-nook
mouth theme-imperf-2pl-CL-happen
Let you (pl) taste it! (Story 1966; p. 116)

First, let us note that the 'bleeding' relationship illustrated in (13) does not follow from our present statement of the syncope rule in (11). When the vowel of the rightmost prefix is elided, the leftmost prefix remains non-final in the Prefix String. Thus, our rule in (11) would derive the incorrect form "haa x-y-sa-neix" as the output form for (13a). How may we amend (11) so that such output forms are not derived? Note that all such

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[15] Compare: a-**ga**-u-**ga**-Ø-xwéin → a-**kw**-**ga**-xwéin ; * a-**gu**-**x**-xwéin
3Obj-fut-irr-imperf-CL-shovel
He'll shovel it. (Story 1966; p. 65)

[16] This verb, ungrammatical on its own, is taken from the phrase "Tléil aadei yanaxyeeydlaaki yé". The gloss given is for the aforementioned phrase, which is also to be found at the citation given.

[17] The output sequence "yeey" is a portmanteau morph unrelated to the syncope alternation. I hope to present in a later paper an analysis of it I have developed within the Distributed Morphology framework.

[18] This fact is explicitly stated in Story (1966) p. 111 and is apparent from the prefix charts in Leer (1991) p. 190.

illicit outputs would contain tri-consonantal clusters. Indeed, we may view the ‘bleeding’ relationship illustrated in (13) as another instance in which the syncope rule is blocked if the resulting output would contain certain consonantal sequences. Therefore, we may amend our rule in (11) to the following.

(15) Syncope Rule 3 [19]
For a given prefix X listed in (5), the (final) vowel V in X is deleted if V follows an open syllable *and* is not final in the Prefix String, *unless* the resulting form would contain sequences of any the following sort.

- (i) a voiceless stop preceding a sonorant
- (ii) a nasal preceding a glide
- (iii) two adjacent obstruents sharing the same place of articulation
- (iv) a tri-consonantal cluster

Now let us pause to consider the ‘irregular’ rule application witnessed in (14). Is there a relatively simple way to state the application of (15) from which this apparent ‘irregularity’ might follow? Note that the only syncopating prefixes ordered to the right of the imperfective prefix are “dag̲a”, “x̲a” and “yi” (see section 2.2). Since the syncopated form of “dag̲a” is “dax̲”, the syncope of “dag̲a” will not interact with the syncope of “g̲a”; neither one’s syncope bleeds the other’s. Furthermore, whenever “x̲a” appears directly to the right of “g̲a”, the portmanteau morph “k̲a” results. Thus, the syncope of “x̲a” will never interact with the syncope of “g̲a”. Therefore, the facts of Tlingit are consistent with the following statement: the syncope rule in (15) applies first to the imperfective prefix “g̲a” and then applies to the remainder of the word in a right-to-left fashion. Let us update our statement of the Tlingit syncope rule accordingly.

(16) Syncope Rule 4
For a given prefix X listed in (5), the (final) vowel V in X is deleted if V follows an open syllable *and* is not final in the Prefix String, *unless* the resulting form would contain sequences of any the following sort.

- (i) a voiceless stop preceding a sonorant
- (ii) a nasal preceding a glide
- (iii) two adjacent obstruents sharing the same place of articulation
- (iv) a tri-consonantal cluster

This rule applies first to the imperfective prefix “g̲a”, and then applies to the rest of the word in a right-to-left fashion.

In summary, there is an ellipsis process in Tlingit which applies to an apparently idiosyncratic set of prefixes. This process applies when a member of the set follows an open syllable and is not final within the Prefix String. However, this process is blocked when certain consonant strings would result from its application. In particular, the ellipsis will not create sequences containing tri-consonantal clusters, nor will it create

[19] There is a certain redundancy in this statement of the rule. That syncope cannot apply to a prefix following a closed syllable may be seen to derive from the condition that it not create a tri-consonantal cluster. Nevertheless, this statement of the rule provides an expository ease that we shall make use of in our discussion. The redundancy inherent in this statement will not be found in the final analysis.

sequences in which a voiceless stop precedes a sonorant, a nasal precedes a glide, or two adjacent obstruents share their place of articulation. This ellipsis rule applies iteratively across the Prefix String. First, it applies to the imperfective prefix "g̲a", and then it applies to the remainder of the prefixes in a right-to-left fashion.

4. Towards an Analysis of Tlingit Syncope: The Advantage of Constraints

Thus far, we have discussed the alternation illustrated in (6), (12), (13) and (14) as if it were the product of a 'rule'. Indeed, it is often quite natural to describe such complex alternations in rule-based terminology; such terminology provides a concrete metaphor which may aid one's internalization and reproduction of the facts. However, we must ask whether it is insightful to describe the morphophonological system of Tlingit by means of rules such as that stated in (16).

One clear failing of the rule in (16) is its stipulation that the rule may not apply if its output contains a tri-consonantal cluster. As it stands, this stipulation is logically independent of what seems an intimately related property of the Tlingit verb. Note that all the prefixes listed in (5) are found in Positions 1 – 8 of the Tlingit verbal template (see section 2.2). Within this range of positions, no morphemes have either complex codas or complex onsets. Such prefixes are, however, possible in Position 15. It therefore appears that there is a phonotactic constraint independently preventing complex onsets and codas from appearing within prefix Positions 1 – 8. Under a rule-based conception of Tlingit morphophonemics, this constraint governing possible prefix shapes is *entirely distinct* from the similar condition appearing in rule (16). As we shall see, there are many instances in which Tlingit's morphophonological rules seem to 'conspire' with its surface phonotactics in this way. Such 'rule conspiracies' are widely acknowledged as a conceptual failure of rule-based theories of phonology.[20]

A unique advantage of constraint-based theories of phonology is that they explicate this intimate link between the phonological alternations of a language and its surface phonotactics. Indeed, within the constraint-based framework of Optimality Theory (McCarthy 2002), the phonotactic constraints governing the form of possible lexical items may *themselves* perform the explanatory role played by rules in earlier conceptions of phonology. I will argue that many of the more puzzling nuances of Tlingit syncope follow from phonotactic constraints independently visible in the verbal morphophonemics. Therefore, I shall seek a constraint-based analysis of the alternation described in (16). As the best-understood and best-tested of the constraint-based frameworks is standard Optimality Theory, I shall seek an analysis within its terms.

Let us therefore attempt to understand the alternation described in (16) as emerging from conflicts between constraints governing phonological well-formedness. Over the next few sections, our discussion will focus primarily on those constraints which sometimes prevent Tlingit syncope from occurring. Only later will we attempt to derive the existence of Tlingit syncope – as well as its peculiar 'directionality' – by means of constraints on metrical structure. Since the ultimate cause of the vowel ellipsis in (6), (12), (13) and (14) will not concern us for the moment, let us provisionally adopt a 'proxy' constraint to facilitate our immediate discussion. This constraint will momentarily perform the work of enforcing the 'right-to-left' vowel elision in the

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[20] See McCarthy (2002) pp. 53 – 55 and Kenstowicz (1994) pp. 524 – 532.

prefixes from (5) when they follow open syllables. The constraint is named 'Syncopate!' and is defined as follows.

(17) Syncopate! :
This constraint assigns one violation mark to a candidate for every prefix from (5) which follows an open syllable and is not final in the Prefix String, *but* which surfaces containing all its underlying vowels. Also, this constraint assigns two violation marks to a candidate for every prefix from (5) which surfaces with all its underlying vowels, and directly follows a prefix from (5) that surfaces without all its underlying vowels and follows an open syllable.

Note that 'Syncopate!' is technically not a well-defined OT constraint.[21] Again, I stress that this constraint is only adopted provisionally, and is not intended as a serious proposal. Our real analysis of the elision enforced by this constraint comes later.

In the next section, we shall begin developing our Optimality Theoretic account of Tlingit syncope. Before we begin this project in earnest, however, let me first dispense with one immediate objection. I have argued against a rule-based analysis of Tlingit syncope on the grounds that it would obscure the fundamental role played by the surface phonotactics of the language. On the other hand, it would seem that a rule-based analysis – particularly one employing the Cycle – might nicely explain the predominant 'right-to-left' ordering of the ellipsis. If Tlingit syncope were treated as a 'cyclic rule', then its right-to-left ordering would follow from the Tlingit verb having a fairly natural right-branching morphosyntactic structure. However, a strong argument against this nascent cyclic analysis is that the Tlingit verb most likely does *not* have a right-branching structure. Due to their genetic relationship, Tlingit shares many properties with the Athabascan language family. Many convincing arguments are put forth by Rice (2000) in support of the thesis that a verbal prefix in an Athabascan language structurally dominates those prefixes occurring to its *left*. Interestingly, a significant number of Rice's arguments also go through for Tlingit. It follows that the Tlingit prefix string must have a *left*-branching morphosyntactic structure. Therefore, if Tlingit syncope were treated as a cyclic rule, it would have a 'left-to-right' order, contrary to fact.

As the preceding discussion suggests, the morphosyntactic structure of the Tlingit verb is an extraordinarily difficult subject. I will therefore avoid treading very deeply into these waters. Instead, I will assume merely the 'flat' structure provided by the morphological template in section 2.2. I should add that this 'template' is not offered here as a serious proposal, but is merely a descriptive tool. I will argue later that various phonological domains map onto portions of this 'template'. Such claims should be understood as proxy for a more sophisticated theory in which the template is replaced with a hierarchical morphosyntactic structure. In general, then, I will not at present seek to derive aspects of Tlingit morphophonology from aspects of its morphosyntax. As we shall see, there are other explanations available for the predominately 'right-to-left' directionality of Tlingit syncope.

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[21] This constraint is also empirically insufficient. It does not correctly derive the behavior of the distributive prefix "dag̲a" nor the imperfective prefix "g̲a". Our final analysis will not, of course, be troubled by these insufficiencies. In the meantime, we will simply avoid problematic examples containing "dag̲a" or the imperfective prefix.

5. Phonotactic Blocking in Tlingit Syncope

We shall now begin to construct our Optimality-Theoretic analysis of Tlingit syncope. As syncope is a process of vowel ellipsis, the constraint ‘Max(V)’ in Tlingit must be dominated by those constraints preferring the absence of the affected vowels. Recall that we provisionally assume that Tlingit syncope is driven by the constraint ‘Syncopate!’. It follows that ‘Syncopate!’ must outrank ‘Max(V)’ in the phonology of Tlingit.

(18)

Syncopate!
|
Max(V)

‘Syncopate!’, however, is not undominated. The fact that syncope in Tlingit is limited by certain surface phonotactics indicates that the constraint ‘Syncopate!’ is dominated by markedness constraints active in Tlingit. According to the rule in (16), there are four conditions under which syncope will not occur.

(19) Syncope will not create sequences of the following sort:
- (i) a voiceless stop preceding a sonorant
- (ii) a nasal preceding a glide
- (iii) two adjacent obstruents sharing the same place of articulation
- (iv) a tri-consonantal cluster

Let us begin with condition (19iv). It was noted in section 4 that there exists a phonotactic constraint preventing the appearance of complex onsets or codas within prefix Positions 1 – 8. Actually, it seems this constraint prevents the appearance of such clusters in Positions 9 – 14 as well (see section 2.2). Let us therefore postulate the existence of a phonological domain encompassing all and only prefix Positions 1 – 14, and let us name this domain the ‘Conjunct Domain’.[22]

(20) Conjunct Domain:

[$_{\text{prefix string}}$]
  [$_{\text{conjunct}}$]
15 – 14 – 13 – 12 – 11 – 10 – 9 – 8 – 7 – 6 – 5 – 4 – 3 – 2 – 1 – ROOT-Suffixes

That complex onsets and codas may not appear within the Conjunct Domain entails the activity of a constraint violated by such sequences. We will name this constraint ‘*Complex$_{CD}$’ and provide it the following definition.

(21) *Complex$_{CD}$:
This constraint assigns one violation mark to a candidate for every complex coda or onset it contains within its CD.

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[22] The term ‘Conjunct Domain’ is taken from the traditional terminology of Athabascan linguistics. For more information, see Rice (2000), pp. 401 – 405, as well as McDonough (2003) p. 33.

Note that the definition in (21) explicitly limits the activity of this constraint to the Conjunct Domain. In future work, I hope to employ a more sophisticated system, in which such definitions are eliminated in favor of a principled theory of the interaction of phonological domains.

The limited forms available to the prefixes in Positions 1 – 14 demonstrates that ‘*Complex$_{CD}$’ exists and is active in Tlingit. Furthermore, if ‘*Complex$_{CD}$’ is ranked above ‘Syncopate!’, we derive the inability for Tlingit syncope to create tri-consonantal clusters. The following tableau illustrates.

(22)

[$_{CD}$] (haa) (**g̲a**)-(**y**i)-(sa)-neix̲	*Complex$_{CD}$	Syncopate!	Max(V)
[$_{CD}$] (haa) (**g̲a**)-(**y**i)-(sa)-neix̲		**!	
[$_{CD}$] (haa) (**g̲a**-**y**)-(sa)-neix̲		*	*
[$_{CD}$] (haa **x̲**)-(**yi**)-(sa)-neix̲		**!	*
[$_{CD}$] (haa **x̲**-**y**)-(sa)-neix̲	*!		*
[$_{CD}$] (haa **x̲**)-(**y**-sa)-neix̲	*!		*

Our OT analysis may therefore derive the blocking condition (19iv) from precisely the phonotactic constraint which it would seem to redundantly enforce.

Now let us consider condition (19i). First, it should be noted that, in practice, condition (19i) serves to rule out particular sequences of *syllables*. A syncopating prefix is always preceded by a V and followed by a CV sequence. It follows that the structure resulting from syncope is one in which the onset of the syncopating prefix is incorporated as the coda of the preceding syllable.

(23) before syncope: CV – CV – CV(C)
after syncope: $[CV - C]_\sigma - [CV(C)]_\sigma$

Condition (19i) could therefore be rephrased to “Syncope will not create a sequence in which a voiceless stop coda precedes a sonorant onset.” Stated in this way, condition (19i) is nothing more than the Syllable Contact Constraint (Vennemann (1988), Davis & Shin (1999), Gouskova (to appear)). In a wide variety of languages, there is a clear preference for syllable codas *not* to be adjacent to onsets of greater sonority. Individual languages differ in the degree of sonority rise they permit across syllable boundaries. The strongest degree of sonority rise occurs when a voiceless stop coda precedes a sonorant onset. Such syllable sequences are therefore among the worst violators of the Syllable Contact Constraint, and the phonologies of many languages conspire to eradicate them.

It therefore seems that our Optimality-Theoretic account of condition (19i) should make explicit appeal to the Syllable Contact Constraint. There is, however, an ongoing debate regarding the proper representation of the Syllable Contact Constraint within Optimality Theory. One quite sophisticated proposal is put forth in Gouskova (to appear).

Gouskova (to appear) argues on typological grounds that the Syllable Contact Constraint must be decomposed into a hierarchy of distinct constraints, each regulating the 'distance' of permissible sonority increase across syllable boundaries. Gouskova assigns a 'distance' of sonority rise to each consonantal sequence, based upon the sonority value of each segment in the sequence. For example, the sequence 'k.n' is calculated to have a 'distance +4' sonority rise, while the sequence 'g.s' is calculated to have a 'distance +1' sonority rise. Gouskova proposes that for every 'distance N', there is a markedness constraint '*Dist N' which is violated by a sonority rise of 'distance N' occurring across a syllable boundary. Furthermore, it is assumed that a constraint '*Dist N' is universally outranked by all constraints '*Dist M', where M is greater than N. It follows from these assumptions that any language not tolerating a trans-syllabic sonority rise of 'distance N' will also not tolerate any trans-syllabic sonority rise of greater degree. Thus, Gouskova's system is able to derive an implicational typology which is argued to be inexplicable in other systems.

The theory of the Syllable Contact Constraint put forth in Gouskova (to appear) is an impressive one, and we shall see that it provides a rather elegant analysis of conditions (19i) and (19ii). Let us therefore seek to incorporate Gouskova's theory of the Syllable Contact Constraint into our analysis of Tlingit syncope.

Note, first, that several prefixes from Positions 11, 12 and 15 end in voiceless stops. These prefixes can directly precede prefixes beginning in sonorants. However, no prefixes in Positions 11, 12 and 15 are reported to undergo any allomorphy related to the Syllable Contact Constraint.[23] This suggests that the Syllable Contact Constraint is not active over prefix Positions 11 – 15. On the other hand, *no* prefixes from Positions 1 – 10 end in voiceless stops. Furthermore, Tlingit syncope occurs strictly within prefix Positions 1 – 10, and it has been shown that Tlingit syncope is regulated by the Syllable Contact Constraint. This suggests that the Syllable Contact Constraint *is* active over prefix Positions 1 – 10.

Let us therefore introduce a new phonological domain encompassing prefix Positions 1 – 10, and let us call this domain the 'Inner Conjunct Domain'.

(24) Inner Conjunct Domain:

```
[prefix string                                            ]
    [conjunct                                             ]
                      [inner conjunct                     ]
 15 – 14 – 13 – 12 – 11 – 10 – 9 – 8 – 7 – 6 – 5 – 4 – 3 – 2 – 1 – ROOT-Suffixes
```

According to the system put forth in Gouskova (to appear), sequences in which a voiceless stop precedes a sonorant have a 'distance +4' sonority rise. Thus, the absence

[23] For example, consider the form in tableau (36) below.

of such sequences from the Inner Conjunct Domain would follow from the activity of the following constraint.

(25) *Dist+4$_{ICD}$:
This constraint assigns one violation mark to a candidate for every syllable sequence of 'distance +4' sonority rise within its Inner Conjunct Domain.

As the following tableau demonstrates, condition (19i) would follow from the ranking *Dist+4$_{ICD}$ >> Syncopate!.

(26)[24]

[CD] [ICD] a-ya-**ka**-na-dán	*Dist+4$_{ICD}$	*Complex$_{CD}$	Syncopate!	Max(V)
[CD] [ICD] a-ya-**ka**-na-dán			*	
[CD] [ICD] a-ya-**k**-na-dán	*!			*

Thus far, our OT analysis nicely derives conditions (19i) and (19iv) from the activity of constraints known to influence a diverse group of languages. Can the same be done for condition (19ii)? Note that several prefixes from Positions 11 and 15 end in nasal consonants. Although these prefixes can directly precede prefixes beginning in glides, none of them are reported to undergo any allomorphy in such an environment. This suggests that Tlingit does allow nasal-glide sequences to appear within Positions 11 – 15.[25] On the other hand, *no* prefixes from within the Inner Conjunct Domain end in nasals. Furthermore, Tlingit syncope occurs strictly within the Inner Conjunct Domain, and it is known to be prevented from creating nasal-glide sequences. This all suggests that there is a constraint active in Tlingit which prevents nasal segments from directly preceding glides within the Inner Conjunct Domain.

Now, what could that constraint be? Note that within Gouskova's system, such nasal-glide sequences are assigned a sonority-rise value of 'distance +3'. Furthermore, due to accidents of the language's inventory, no other sequences of 'distance +3' are ever created by Tlingit syncope. Thus, the absence of nasal-glide sequences within the Inner Conjunct Domain would follow from the activity of the following constraint.

(27) *Dist+3$_{ICD}$:
This constraint assigns one violation mark to a candidate for every syllable sequence of 'distance +3' sonority rise within its Inner Conjunct Domain.

[24] "Yei ayakanadán" = 'It's snowing hard'. See Dauenhauer & Dauenhauer (2000) p. 116.
[25] Consider, as well, the fact that the Position 15 prefix "g̲unayéi" has, for many individuals, the variant form "g̲unyéi" [(g̲un)(yéi)] (Gillian Story, p.c.).

As the tableau in (28) demonstrates, condition (19ii) would follow from the ranking $*Dist+3_{ICD}$ >> Syncopate!

(28)[26]

$[_{CD}$] $[_{ICD}$] CV-**na**-yeey-'root'	$*Dist+4_{ICD}$	$*Dist+3_{ICD}$	$*Complex_{CD}$	Syncopate!	Max(V)
$[_{CD}$] $[_{ICD}$] CV-**na**-yeey-'root'				*	
$[_{CD}$] $[_{ICD}$] CV-**n**-yeey-'root'	*!				*

The tableau above nicely illustrates an intimate relationship between conditions (19i) and (19ii). Recall that in the system of Gouskova (to appear), a constraint '*Dist N' is universally outranked by all constraints '*Dist M', where M is greater than N. It follows that if the constraint '*Dist+3' outranks the constraint 'Syncopate!', then so must the constraint '*Dist+4'. It is no coincidence, then, that Tlingit syncope is subject to conditions (19i) and (19ii). Both conditions derive from a common source: the ranking of '*Dist+3' above the constraints enforcing syncope. Gouskova's system therefore provides us a simpler, more elegant picture of phonotactic blocking in Tlingit syncope. In turn, we find in Tlingit additional support for the typological claim made by Gouskova (to appear).

Finally, let us consider condition (19iii). Note that several prefixes from Positions 11 - 15 end in the obstruents "g̲", "g", "x̲", "x", "d" and "t". Each of these prefixes can precede a prefix beginning in an obstruent that shares its place of articulation. However, none of the prefixes in 11 – 15 are reported to undergo any allomorphy in such environments. On the other hand, no prefixes from within the Inner Conjunct Domain end in obstruents. As has already been mentioned, Tlingit syncope occurs strictly within the Inner Conjunct Domain, and is prevented from creating homorganic obstruent clusters. This suggests the activity of a constraint that prevents homorganic obstruent sequences from appearing within the Inner Conjunct Domain.[27] We shall name this constraint '$No\text{-}Gem_{ICD}$' and define it as follows.

[26] The input in tableau (28) is a schematic prefix string, taken from Leer (1991) p. 192.

[27] Interestingly, it is quite common for syncope to be 'blocked' from creating sequences of identical consonants (McCarthy 1986, Odden 1988, Rose 2000); this phenomenon is typically known as 'antigemination'. Note that the restriction applying to Tlingit syncope is somewhat stronger than antigemination; Tlingit syncope cannot create consonant sequences sharing their place of articulation. It seems that the constraint applying to Tlingit syncope should inform our discussion of antigemination constraints on syncope in other languages. In particular, Tlingit syncope might breathe new life into the OCP analysis of antigemination (McCarthy 1986).

(29) No-Gem$_{ICD}$ [28]:
This constraint assigns one violation mark to a candidate for every homorganic obstruent cluster within its Inner Conjunct Domain.

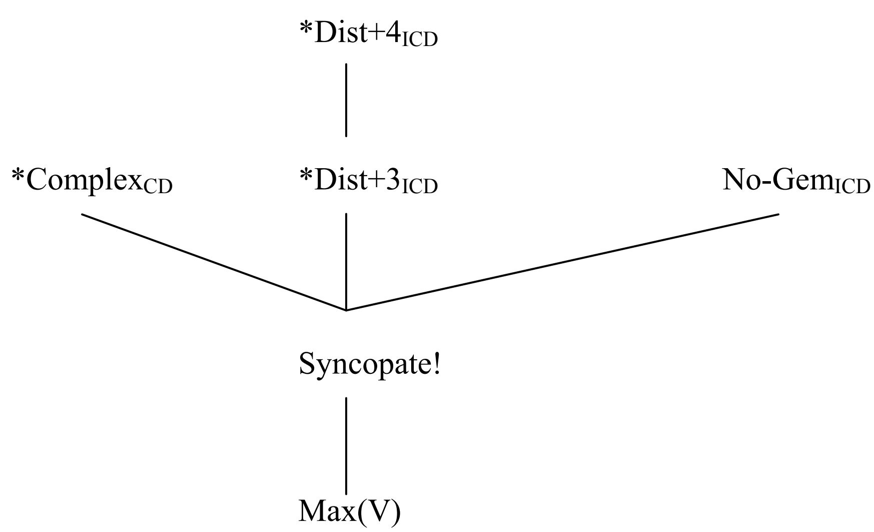
Tableau (30) demonstrates that we may derive condition (19iii) by ranking 'No-Gem$_{ICD}$' above 'Syncopate!'.

(30)[29]

[$_{CD}$] [$_{ICD}$] ji-**ka**-**ga**-gút-ch	*Dist+4$_{ICD}$	No-Gem$_{ICD}$	*Dist+3$_{ICD}$	*Comp$_{CD}$	Syncopate!	Max(V)
[$_{CD}$] [$_{ICD}$] ji-**ka**-**ga**-gút-ch					*	
[$_{CD}$] [$_{ICD}$] ji-**k**-**ga**-gút-ch		*!				*

The constraint system we have thus far constructed for Tlingit is presented in a Hasse diagram below.

(31) Constraint System that Derives Blocking of Tlingit Syncope:



We have seen that this system captures the various conditions under which Tlingit syncope is blocked, and derives them from phonotactic constraints more generally active within the language. By deriving the blocking conditions in (16) from the surface

[28] The name of this constraint is taken from Rose (2000). However, its definition here differs from that given in Rose (2000), so that it may serve to rule out all homorganic sequences, and not simply those in which two identical consonants are paired.
[29] "Yaa jikagagútch" = 'it is lowered'. See Story (1995) p. 323 [line 060].

phonotactics of Tlingit, we are able to eliminate from our theory of Tlingit syncope the awkward ‘conspiracies’ inherent in a purely rule-based analysis.

In the remainder of this paper, I shall demonstrate that all the essential properties of Tlingit syncope can be made to follow from a single constraint ranking. I begin, in the next section, by showing how additional phonotactic constraints may derive the seemingly idiosyncratic set of prefixes in (5).

6. Eliminating Idiosyncrasy: Deriving the Alternating Prefixes

Both our syncope rule in (16) and our definition of ‘Syncopate!’ in (17) imply that Tlingit speakers must simply memorize which verbal prefixes undergo the syncope alternation. Such hypotheses presume that the set in (5) is entirely arbitrary, that there is no system, no logic behind which prefixes appear in (5) and which do not. As we shall see, this wholly negative view is not correct; there are a small number of hypotheses from which the full set in (5) may be derived. Of course, the unity underlying the prefixes in (5) is by no means obvious. There are several quite difficult questions that must be answered by any analysis seeking to treat Tlingit syncope as a fully productive alternation.

(32) Questions that Challenge Attempts to Derive Syncopating Prefixes

a. Why does the subject agreement prefix “too” not syncopate?
b. Why does the subject agreement prefix “du” not syncopate?
c. Why does the distributive prefix “dag̲a” syncopate only to “dax̲”? Why is “d.g̲a” not possible?
d. Why does the portmanteau prefix “k̲a” not syncopate?[30]
e. Why does no prefix to the left of theme prefix “ka” undergo syncope? That is, why do no prefixes from Positions 9 – 15 syncopate?

Note that if answers are provided to all the questions in (32), the set of syncopating prefixes in Tlingit will have been successfully derived. The prefixes in (5) may be characterized as follows. They are all the prefixes from Positions 1 – 8 *except* “too”, “du”, “k̲a”, the classifier prefixes and the vocalic prefixes “u” and “ee” (see section 2.2). That the classifier prefixes are not subject to syncope follows from their always appearing final in the Prefix String. That the vocalic prefixes “u” and “ee” are not subject to syncope follows from their not being of CV shape.[31] Therefore, to derive the set in (5), one need only explain why “too”, “du” and “k̲a” do not syncopate, nor do any prefixes from Positions 9 – 15. Furthermore, an answer to question (32c) would eliminate a final instance of apparent idiosyncrasy in the Tlingit syncope rule: the fact that only the *final* vowel of the prefix “dag̲a” may be deleted by syncope. Thus, by answering all of (32), one eliminates the need for memorized lists in the description of Tlingit syncope, and the alternation may be treated as a fully productive phonological process.

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[30] Since “k̲a” is a portmanteau morpheme, it is not listed in section 2.2. However, prefix order in complex forms indicates that “k̲a” appears no further left than position 7. That this prefix is not subject to syncope may be seen from the prefix charts in Leer (1991) pp. 189 – 190.

[31] That is, we might suppose that syncope is unable to target these prefixes because an undominated ‘Minimal Exponence’ constraint prevents syncope from completely obliterating a prefix.

As we will be attempting in the following sub-sections to derive the list in (5) from more general phonotactic properties of the Tlingit verb, it is imperative that we amend our proxy constraint ‘Syncopate!’ so that it makes no reference to this stipulative list. Let us therefore replace ‘Syncopate!’ with a new constraint, ‘Syncopate!*’, defined as follows.

(33) Syncopate!* :
This constraint assigns one violation mark to a candidate for every prefix which follows an open syllable and is not final in the Prefix String, *but* which surfaces containing all its underlying vowels. Also, this constraint assigns two violation marks to a candidate for every prefix which surfaces with all its underlying vowels and directly follows a prefix that surfaces without all its underlying vowels and follows an open syllable.

Once again, I stress that this constraint is only adopted provisionally, and is not intended as a serious proposal. It will be replaced with a much more sophisticated system of constraints in section 7.

Note that substitution of ‘Syncopate!*’ for ‘Syncopate!’ in no way affects our theory of phonotactic blocking developed in section 5. Furthermore, note that the analysis of section 5 is not relevant to the discussion below, and so we shall ignore constraints ‘*Complex$_{CD}$’, ‘*Dist+3$_{ICD}$’ and ‘No-Gem$_{ICD}$’ in the tableaux that follow.

6.1 The Distribution of Coronal Stops

We shall now begin our attempt to answer the questions in (32). Let us consider first the questions in (32a), (32b) and (32c). Note that “du”, “too” and “daga” are the only prefixes in Positions 2 – 8 which begin in coronal stops (see section 2.2). Recall that the structure resulting from syncope is one in which the onset of the syncopating prefix is incorporated as the coda of the preceding syllable. It follows that if either the prefix “du” or “too” were to syncopate, the output structure would contain syllables with voiceless coronal stops in their codas. Likewise, the illicit syncope of “daga” to “d.ga” would create syllables containing voiceless coronal stop codas. Furthermore, since these prefixes are the only ones in Positions 2 – 8 to begin in a coronal stop, it is accurate to state that Tlingit syncope never creates sequences in which voiceless coronal stops appear in coda position.

Interestingly, voiceless coronal stops are among the most non-sonorous of speech sounds. There is a strong tendency across languages for syllable codas to contain only the most sonorous sounds (Zec 1995). On cross-linguistic grounds, then, there is strong evidence for a constraint violated by the appearance codas containing voiceless coronal stops. For our limited purposes here, let us simply name that constraint ‘*Coda(t)’ and define it as follows.[32]

[32] Donca Steriade (p.c.) disputes the universality of a ‘*Coda(t)’ constraint. I leave as an open matter whether the constraints ‘*Coda(t)’ and, later, ‘*Coda(k)’ have any universal applicability. That they are at least active within the phonology of Tlingit is the primary argument of this section. It is interesting to note, however, that in some Athabascan languages (e.g. Ahtna) “d” is the only possible coda in the prefix string (Keren Rice, p.c.).

(34) *Coda(t) :
This constraint assigns one violation mark to a candidate for every syllable it contains whose coda is a voiceless coronal stop.

Could it be that “du” and “too” are unable to syncopate because ‘*Coda(t)’ is active over a certain portion of the Tlingit prefix string? Additional evidence for such an idea may be found in the form of the first person singular subject agreement prefix, “x̲a”. Note that this prefix is nearly homophonous to the first person singular *object* agreement prefix “x̲at”. The only difference between the two is that the object agreement prefix contains a voiceless coronal stop coda. We might, then, simplify the inventory of Tlingit agreement prefixes by postulating that “x̲at” is an invariant first person singular agreement form, which becomes “x̲a” in subject position as a result of a general constraint against coda ‘t’s in that portion of the verb.

We have thus come upon additional evidence that ‘*Coda(t)’ is active over a portion of the Tlingit verb. We have yet to determine, however, the exact domain of ‘*Coda(t)’ in Tlingit. Note, first of all, that coda ‘t’s do appear in Position 12. Moreover, no prefix from within the Inner Conjunct domain possesses a coronal stop coda. Now, none of the prefixes in Position 11 contain coronal stop codas either, but this may be a mere morphological accident. All prefixes in Position 11 are nominal roots, none of which undergo any segmental alteration in Position 11. Thus, there is a strong feeling that if one of the nominal roots permitted in Position 11 were to end in a coronal stop, then that segment would surface faithfully within Position 11. Therefore, it would likely be most accurate to state that the ‘*Coda(t)’ constraint applies to the Inner Conjunct Domain alone. Let us, then, postulate the existence of a constraint ‘*Coda(t)$_{ICD}$’, whose difference in meaning from the constraint in (34) should by now be clear. As the following tableaux demonstrates, by ranking ‘*Coda(t)$_{ICD}$’ above ‘Max(C)’, we may derive the alternation between object agreement “x̲at” and subject agreement “x̲a”.

(35)

[$_{ICD}$] yaa – na – **x̲at** – gút	*Coda(t)$_{ICD}$	Max(C)
[$_{ICD}$] yaa – n – **x̲at** – gút	*!	
[$_{ICD}$] yaa – n – **x̲a** – gút		*

(36)[33]

[$_{ICD}$] **x̲at** – ya – k’éi	*Coda(t)$_{ICD}$	Max(C)
[$_{ICD}$] **x̲at** – ya – k’éi		
[$_{ICD}$] **x̲a** – ya – k’éi		*!

[33] “X̲at yak’éi” = ‘I am fine’. See Dauenhauer & Dauenhauer (2000) p. 83.

Returning to the subject of prefix syncope, the tableaux in (37) and (38) demonstrate that the ranking '*Coda(t)$_{ICD}$ >> Syncopate!*' would alone prevent the prefixes "too" and "du" from ever undergoing syncope.

(37)[34]

$[_{ICD}$] na-**too**-shi-'root'	*Coda(t)$_{ICD}$	Syncopate!*	Max(V)
$[_{ICD}$] na-**too**-shi-'root'		*	
$[_{ICD}$] na-**t**-shi-'root'	*!		*

(38)

$[_{ICD}$] na-**du**-ji-'root'	*Coda(t)$_{ICD}$	Syncopate!*	Max(V)
$[_{ICD}$] na-**du**-ji-'root'		*	
$[_{ICD}$] na-**d**-ji-'root'	*!		*

Furthermore, this ranking also prevents the illicit syncope of "dag̲a" to "d.g̲a", as the following tableau illustrates.

(39)[35]

$[_{ICD}$] dax̲-a-**da**g̲a-l'eix̲	*Coda(t)$_{ICD}$	Syncopate!*	Max(V)
$[_{ICD}$] dax̲-a-**da**g̲a-l'eix̲		*	
$[_{ICD}$] dax̲-a-**d**.g̲a-l'eix̲	*!		*

We see, then, that questions (32a), (32b) and (32c) may all receive a single answer. The ranking of '*Coda(t)$_{ICD}$' above 'Syncopate!*' entails that Tlingit syncope may not create forms in which voiceless coronal stops occupy the syllable coda. In turn, this condition on syncope entails that the prefixes "du" and "too" may not syncopate, and that the prefix "dag̲a" may only syncopate to "dax̲". It seems that independently identifiable phonotactic constraints on certain parts of the Tlingit verb may go a long way towards explaining the membership of (5). In the next section, we shall see that this approach may also provide an answer to question (32d).

[34] The input in tableaux (37) and (38) are schematic prefix strings, taken from Leer (1991) p. 191.
[35] "Dax̲adag̲al'eix̲" = 'they were dancing'. See Leer (1991) p. 130.

6.2 The Distribution of Uvular Stops

The portmanteau prefix "ḵa" appears when the prefix "x̱a" is adjacent to either of the two prefixes of the form "g̱a".[36] Unlike "x̱a" and "g̱a", however, "ḵa" is not subject to syncope. Are there any independent features of Tlingit that might explain why "ḵa" is immune from the syncope process?

Note that if syncope were to target "ḵa", it would create a syllable whose coda contains a voiceless uvular stop. There is evidence that Tlingit does not permit in certain parts of the verb codas consisting of voiceless uvular stops. Only in Position 15 are there any prefixes ending in uvular stops. Furthermore, although syllables beginning in the uvular stop "g̱" may undergo syncope, the input "g̱" becomes spirantized to "x̱" in the output (see the list in (5)). The behavior of coda "g̱" within prefix Positions 1 – 14 suggests that there exists a constraint preventing voiceless uvular stop codas from appearing within the Conjunct Domain. We shall name this constraint '*Coda(ḵ)$_{CD}$', and we will define it as follows.

(40) *Coda(ḵ) :
This constraint assigns one violation mark to a candidate for every syllable it contains within its Conjunct Domain whose coda is a voiceless uvular stop.

As tableau (41) illustrates, the constraint ranking '*Coda(ḵ)$_{CD}$ >> Syncopate!* >> Ident(stop)' may derive the spirantization of "g̱" to "x̱" in coda position.

(41)[37]

[$_{CD}$] na-**g̱a**-too-'root'	*Coda(ḵ)$_{CD}$	Syncopate!*	Ident(stop)	Max(V)
[$_{CD}$] na-**g̱a**-too-'root'		*!		
[$_{CD}$] na-**g̱**-too-'root'	*!			*
[$_{CD}$] na-**x̱**-too-'root'			*	*

Unfortunately, this constraint ranking incorrectly predicts that the prefix "ḵa" undergoes the same spirantization as "g̱a". Tableau (42) illustrates.

[36] In a later paper, I shall present an analysis of the portmanteau form "ḵa" within the framework of Distributed Morphology. That paper will contain arguments that the existence of "ḵa" is not the result of a phonological process, but of a *morphosyntactic* one. Therefore, I assume throughout that the prefix "ḵa" is a component of the phonological input, and is not derived therefrom.

[37] The input in this tableau is a schematic prefix string, taken from Leer (1991) p. 197.

(42) [38]

[$_{CD}$] na-**k̲a**-si-‘root’	*Coda(k̲)$_{CD}$	Syncopate!*	Ident(stop)	Max(V)
[$_{CD}$] na-**k̲a**-si-‘root’		*!		
[$_{CD}$] na-**k̲**-si-‘root’	*!			*
[$_{CD}$] na-**x̲**-si-‘root’			*	*

Although the behavior of “g̲” supports the view that uvular stops may not stand as codas within the Conjunct Domain, the question now arises of why coda “k̲” does not undergo the spirantization of its unaspirated cousin.

First, let us note that Tlingit does not distinguish between voiced and voiceless obstruents (see section 2.1). The difference between the sound represented by “k̲” in Tlingit orthography and that represented by “g̲” is *aspiration*; the former is aspirated and the latter is unaspirated. Furthermore, although aspiration is distinctive in Tlingit stops and affricates, it is not distinctive in Tlingit fricatives. We may therefore hypothesize that the feature ‘aspiration’ is simply absent from the phonological representation of Tlingit fricatives. Assuming that aspiration is a privative feature, we would thus provide the contrasting segments “k̲”, “g̲” and “x̲” the following featural decomposition.

(43) a. / k̲ / = {uvular, + stop, aspirated}

b. / g̲ / = {uvular, + stop}

c. / x̲ / = {uvular, – stop }

Under this featural analysis, the correspondence between “k̲” and “x̲” is less faithful than that between “g̲” and “x̲”, since the former involves an additional loss of aspiration. It follows that if the constraint ‘Max(asp)’ were ranked above ‘Syncopate!’, the resulting system would be one in which the prefix “k̲a” would not be subject to syncope.

(44)

[$_{CD}$] na-**k̲a**-si-‘root’	Max(asp)	Coda(k̲)$_{CD}$	Syncopate!*	Ident(stop)	Max(V)
[$_{CD}$] na-**k̲a**-si-‘root’			*		
[$_{CD}$] na-**k̲**-si-‘root’		*!			*
[$_{CD}$] na-**x̲**-si-‘root’	*!			*	*

[38] The input in this tableau is a schematic prefix string, taken from Leer (1991) p. 197.

Of course, since the correspondence between "g̲" and "x̲" involves no loss of aspiration, the spirantization of "g̲" in coda position is still entailed by this constraint ranking.

(45)

[CD] na-**g̲a**-too-'root'	Max(asp)	Coda(k̲)CD	Syncopate!*	Ident(stop)	Max(V)
[CD] na-**g̲a**-too-'root'			*		
[CD] na-**g̲**-too-'root'		*!			*
[CD] na-**x̲**-too-'root'				*	*

We therefore find that a single constraint ranking can derive (i) the inability of the prefix "k̲a" to syncopate, and (ii) the fact that if a syllable of the form "g̲a" undergoes syncope, the onset becomes spirantized. In essence, we have discovered that two phonotactic generalizations answer questions (32a) – (32d): the Inner Conjunct Domain may not contain codas consisting of voiceless coronal stops, and the Conjunct Domain may not contain codas consisting of voiceless uvular stops. It is only by observing the phonotactic properties of the Tlingit verb that the list in (5) begins to form a coherent system. Indeed, the surface phonotactics alone nearly derive the full set of syncopating prefixes; for the moment, we lack only an answer to question (32e). In the next section, we will endeavor to understand why syncope may not apply to prefixes occupying any position further left than Position 8.

6.3 The Extended Inner Prefix Domain

Thus far, we have derived a prefix's immunity to syncope from its phonological shape and the phonotactics of the Tlingit verb. As has already been mentioned, every prefix occupying Positions 9 – 15 fails to undergo syncope. The range of phonological forms these prefixes may assume should lead us to doubt that a phonotactic approach along the previous lines is viable here. Our answer to question (32e) must therefore make no appeal to the phonological shape of the prefixes in 9 – 15.

Let us first put aside for the moment question (32e) and consider a new morpho-phonological puzzle, one that will aid our thinking. There are in Tlingit three verbal prefixes of the form "ya": the classifier "ya" in Position 1, the theme prefix "ya" in Position 9, and the proclitic "yaa" in Position 15. The Position 15 proclitic never follows another verbal prefix, and so it is irrelevant to our immediate discussion.

When the Position 1 classifier "ya" follows a rounded vowel, it surfaces as "wa".

(46) k̲u-**ya**-k'éi → k̲u-**wa**-k'éi ; * k̲u-**ya**-k'éi
areal-CL-be.good
The weather's fine. (Dauenhauer & Dauenhauer 2000; p. 101)

However, when the Position 9 theme prefix "ya" follows a rounded vowel, it does not surface as "wa". Rather, it surfaces faithfully.

(47) s'íksh tóo-nax **ku**-**ya**-wu-du-ya-wál → ku-**ya**-w-du-wa-wál ; * ku-**wa**-w-du-wa-wál
hellebore inside-through areal-thm-perf-4th-CL-bore.holes
They bored holes through the hellebore. (Naish & Story 1973; p. 110)

This inability for the onset of the theme prefix "ya" to round when following rounded vowels is not due to a general inability for it to round. The onset can round when vowel ellipsis causes it to directly precede a rounded vowel.[39]

(48) tléil aa-dei **ya**-u-na-ga-xa-ya-dlaak → tléil aa-dei **w**-u-n-kaa-dlaak
not it-to thm-irr-conj2-imperf-1sg-CL-win
I can't win it. (Story 1966; p. 128)

It is thus an interesting puzzle why the onset of the Position 1 prefix "ya" rounds after rounded vowels, but not the onset of the Position 9 prefix "ya". An intuitive solution to this puzzle might be to posit the existence of a phonological domain within which glides must round after rounded vowels. Perhaps if this domain were to contain Position 1 but exclude Position 9, the difference between the two prefixes might follow?

Unfortunately, a problem for this simple analysis is that the prefixes which induce rounding in the Position 1 "ya" may occupy positions to the *left* of the Position 9 "ya". Note that the areal prefix induces rounding of classifier "ya" in example (46), but fails to induce such rounding when it directly precedes the theme prefix "ya" in example (47). Moreover, note that example (47) illustrates that the position of theme prefix "ya" lies *between* the positions of the areal prefix and the classifier "ya". If the areal prefix and the classifier prefix are components of the domain in which the post-vocal rounding constraint is active, how can this domain exclude the theme prefix that intervenes between them?

Let us, however, meet the challenge posed by this criticism. Note how this objection presupposes that a phonological domain must always map to the *same* morpho-syntactic material. Suppose, however, that a phonological domain can be 'contextually defined', in the following manner. First, we shall introduce a phonological domain encompassing prefix Positions 1 – 8; we shall name this domain the 'Inner Prefix Domain'.[40]

(49) Inner Prefix Domain:

$[_{\text{prefix string}}$]
$[_{\text{conjunct}}$]
$[_{\text{inner conjunct}}$]
$[_{\textbf{inner prefix}}$]
15 – 14 – 13 – 12 – 11 – 10 – 9 – 8 – 7 – 6 – 5 – 4 – 3 – 2 – 1 – ROOT-Suffixes

[39] Interestingly, the syllables "yoo" and "yu" are generally possible in Tlingit; note the Position 15 proclitic "yoo". This suggests that the 'prevocalic y-rounding' alternation is also specific to a particular verbal domain.
[40] Note that the introduction of the 'Inner Prefix Domain' here is perhaps unnecessary. However, it will be shown in a later paper that the rule of 'U-Absorption' (Leer 1991; p. 197) makes crucial appeal to the Inner Prefix Domain.

Now, let us introduce also a second phonological domain, defined in terms of the Inner Prefix Domain.

(50) Extended Inner Prefix Domain:
The Extended Inner Prefix Domain (h.f. ‘EIPD’) consists of the Inner Prefix Domain and the syllable adjacent to its left boundary (if such a syllable exists).

[prefix string]
[conjunct]
[inner conjunct]
{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{EIPD]
[inner prefix]
15 – 14 – 13 – 12 – 11 – 10 – 9 – 8 – 7 – 6 – 5 – 4 – 3 – 2 – 1 – ROOT-Suffixes

It follows from the definition in (50) that the prefix positions contained within the EIPD of a given verb depend upon which prefixes are present within the verb. For example, if the verb contains no prefixes past Position 8, the EIPD is identical to the IPD.

(51) {EIPD]
[IPD]
na – ga – too – ‘root’
5 4 2 0

Of course, if the verb contains a prefix from Position 12 directly adjacent to a prefix from Positions 1 – 8, then the EIPD will contain prefix Position 12.

(52) {EIPD]
[IPD]
ku – ya – k’éi
12 1 0

However, if the verb also contains a prefix from Position 9, then the EIPD will contain prefix Positions 1 – 9, but will exclude prefix Position 12.

(53) {EIPD]
[IPD]
ku – ya – wu – du – ya – wál
12 9 4 2 1 0

In certain cases, the left boundary of the EIPD can extend as far as Position 15.

(54) {EIPD]
[IPD]
yaa – na – xa – gút
15 5 2 0

We see, then, that the EIPD does not always map onto the same morphosyntactic structure. The left boundary of the domain falls one prefix past the left boundary of the IPD. Since the extra prefix contained within the EIPD may occupy any of the positions in 9 – 15, the morphosyntactic positions contained within the EIPD depend upon which morphemes are present in the verbal structure.

Consider now the hypothesis that the EIPD is the domain in which “y” must round to “w” when following rounded vowels. This hypothesis entails that the Position 1 classifier prefix “ya” should always surface as “wa” after a rounded vowel. By definition, the Position 1 prefix “ya” is part of the IPD. Thus, if this prefix directly follows a rounded vowel, the syllable containing that vowel should form part of the EIPD. The phonotactics of the EIPD therefore force the rounding of classifier “ya” to “wa” in this environment. On the other hand, this hypothesis entails that the Position 9 theme prefix “ya” should *never* surface as “wa” after a rounded vowel. Note that theme “ya” is *not* contained within the IPD. Therefore, if theme “ya” is present in the EIPD, it is the leftmost syllable within the EIPD. Thus, the EIPD can never contain both the theme prefix “ya” and a preceding rounded vowel. The phonotactics of the EIPD will therefore never force the rounding of theme “ya” in this environment. Since the post-vocalic rounding constraint is active only within the EIPD, it follows that the theme prefix “ya” will *never* round to “wa” following a rounded vowel.

It is apparent that the EIPD provides a solution to the puzzle of why the classifier “ya” is subject to post-vocalic rounding, but not the homophonous theme prefix “ya”. The ‘context sensitive’ definition of the EIPD explains how a phonological domain could in some instances contain a pair of prefixes X and Z, but in other instances exclude a prefix Y occupying a position between X and Z.

Now, the importance of this digression to our analysis of Tlingit syncope should become clear. Example (6c) demonstrates that syncope in Tlingit may be triggered by a prefix occupying Position 15.

(6) c. yaa **n**-x̲a-gút
along prog-1sg-go
I’m going along. (Story 1966; p. 125)

It appears, then, that the constraint ‘Syncopate!*’ is active within the entire Prefix String. But, if this were true, how could the prefixes in Positions 9 – 15 fail to undergo syncope?

(55)[41]

a-**sha**-na-s-téen	Syncopate!*	Max(V)
a-**sha**-na-s-téen	*!	
a-**sh**-na-s-téen		*

It seems as if the domain for ‘Syncopate!*’ sometimes includes Position 15, and sometimes excludes Positions 9 - 14. How is such a domain possible?

[41] “Daak áwé ashanastéen doo yaagóo” = ‘He keeps moving his boat and anchoring it further out’. See Naish & Story (1973) p. 19.

Of course, the answer to this question is provided by the ‘context-sensitive’ definition of the EIPD. Suppose that the constraint ‘Syncopate!*’ were active only within the EIPD. That is, let us replace the constraint ‘Syncopate!*’ with the constraint ‘Syncopate!*$_{\text{EIPD}}$’, whose definition should be clear. Within such a system, no prefix from Positions 9 – 15 would be subject to the syncope alternation. Consider any structure containing a prefix P from Position 9 – 15. If P lies outside of the EIPD, then clearly it is not subject to the syncope alternation. Now, suppose that P lies within the EIPD. By definition, P is not part of the IPD. Thus, P must constitute the leftmost prefix within the EIPD. It follows that the EIPD cannot also contain an open syllable preceding P. The constraint ‘Syncopate!*$_{\text{EIPD}}$’ is therefore not violated if P follows such an open syllable within the larger verbal structure. We conclude that the constraint ‘Syncopate!*$_{\text{EIPD}}$’ cannot force syncope of P. This point is illustrated in the following tableau.

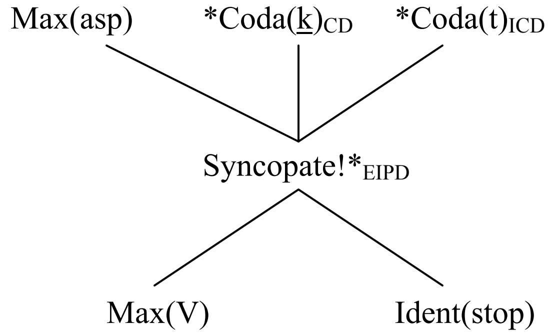
(56)

{$_{\text{EIPD}}$] [$_{\text{IPD}}$] yaa **ji** – ka – ga – gút – ch	Syncopate!*$_{\text{EIPD}}$	Max(V)
{$_{\text{EIPD}}$] [$_{\text{IPD}}$] yaa **ji** – ka – ga – gút – ch	*	
{$_{\text{EIPD}}$] [$_{\text{IPD}}$] yaa **j** – ka – ga – gút – ch	*	*!

Furthermore, this analysis correctly predicts that every prefix within Positions 1 – 8 should be, in principle, subject to syncope. Consider a structure in which a prefix P from within the Inner Prefix Domain is directly preceded by an open syllable S. By definition, P lies within the EIPD. If S constitutes a prefix occupying a position within 1 – 8, then by definition S also lies within the EIPD. If S constitutes a prefix occupying a position within 9 – 15, then by assumption S also lies within the EIPD. If follows that both S and P are contained within the EIPD. If P is also non-final, then the constraint ‘Syncopate!*$_{\text{EIPD}}$’ is violated unless the vowel in P is deleted. We conclude that the constraint ‘Syncopate!*$_{\text{EIPD}}$’ can force the syncope of P, just as long as the higher ranking phonotactic constraints are not violated by such a structure.

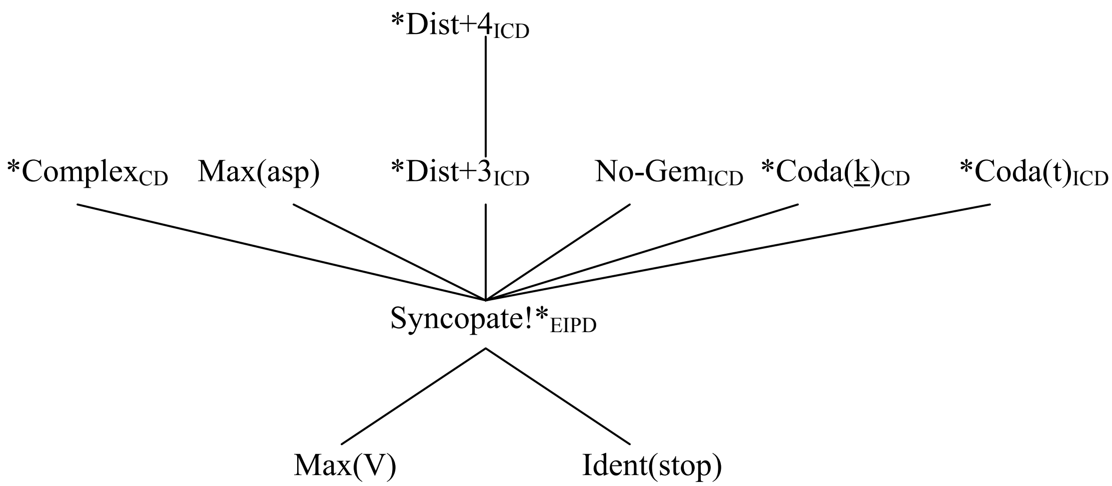
By limiting the activity of ‘Syncopate!*’ to the EIPD, we thus derive the inability for the prefixes in 9 – 15 to undergo syncope. In brief, our answer to question (32e) is that the constraints motivating Tlingit syncope are active only within a very specific domain, one whose definition entails that only the prefixes in Positions 1 – 8 should be subject to the alternation. When we combine this solution with our solutions to questions (32a) – (32d), we find that the constraint system illustrated below derives precisely the list of prefixes given in (5).

(57) Constraint System which Solves (32a) – (32e)



Now, let us now combine this constraint system with that which derives the blocking conditions in (19). The resulting system, illustrated in (58), encapsulates nearly all the empirical content of the rule in (16).

(58) Constraint System which Derives Prefixes in (1) and Blocking Conditions



Furthermore, nearly all the constraints in (58) are thoroughly plausible, classic OT constraints; most of them receive independent cross-linguistic support. The only certain exception is the proxy constraint 'Syncopate!*$_{EIPD}$'. This highly dubious, richly descriptive constraint is the final obstacle standing between us and a fully explanatory analysis of Tlingit syncope. Once we successfully replace 'Syncopate!*$_{EIPD}$' with a well-motivated constraint sub-system, we will have a serious, constraint-based analysis of Tlingit syncope.

In the next section, we will attempt to uncover the constraints that motivate Tlingit syncope and are responsible for its puzzling 'order'. Since we have already elucidated the constraints which prevent syncope from occurring, we will no longer concern ourselves with cases in which syncope is blocked. Therefore, we will from now on ignore all structure outside the Extended Inner Prefix Domain, and we will make the idealizing assumption that syncope takes place there without exception. Unless explicitly stated otherwise, a markedness constraint is from now on assumed to apply strictly within the EIPD.

7. Tlingit Syncope: a Metrical Analysis

7.1 Syncope, Metrical Structure and Prominence in Tlingit

Throughout all our previous discussion, we have described the ellipsis affecting the prefixes in (5) as 'syncope'. Let us, however, pause to consider whether this description is apt. Under its standard usage, the term 'syncope' describes an ellipsis process which deletes vowels in word-internal syllables (Kenstowicz 1994, p. 48; Gouskova 2003). Recall that our system of phonotactic constraints in (58) factors out from the Tlingit syncope alternation its restriction to the prefixes in (5) and its various blocking conditions. In this section, we will also demonstrate how the puzzling 'directionality' of Tlingit syncope may be factored out. Therefore, we might state the Tlingit syncope alternation in the following terms.

(59) Tlingit Syncope
The vowel in a CV syllable is deleted if it follows an open syllable and is not final in the Prefix String.

Happily, the requirement in (59) that an open syllable precede the syncopating syllable is redundant. Given that the syncopating syllable may not be final in the Prefix String, this requirement would already follow from our ranking of '*Complex' above 'Syncopate!*'. We may therefore further simplify the rule in (59) to the following.

(60) Tlingit Syncope
The vowel in a CV syllable is deleted if it is neither initial nor final in the Prefix String.

Clearly, the rule in (60) satisfies the definition of 'syncope'. This is fortunate, since syncope processes are a remarkably well-studied phenomenon. Though they are still only partly understood, there exists a great body of doctrine concerning syncope alternations and an enormous number of languages evincing them.[42] We might therefore gain insight into the constraints which drive Tlingit syncope by consulting the wide literature on this subject.

When we turn to this literature, however, we find that Tlingit seems to raise an empirical challenge to some otherwise quite successful theories regarding syncope. There are two properties of Tlingit syncope which also hold of syncope alternations in other languages: its 'directionality' and its inability to apply to final syllables. Cross linguistic study reveals that whether a syncope rule possesses these properties typically depends upon the metrical structure of the language. In a variety of languages, these two properties have been shown to follow from independently established features of the language's system of metrical footing. For example, it is shown in Kager (1999) that the

[42] Indeed, the language Tonkawa possesses a syncope rule quite similar to that found in Tlingit (Gouskova 2003; p. 122 – 162).

inability for Arabic syncope to apply to the final syllable of a word follows from an independently visible condition that the final syllable of an Arabic word be extrametrical. A similar result is demonstrated in Gouskova (2003) for the syncope rule of Hopi. In general, the 'non-finality' of a language's syncope alternation derives from the extrametricality of final syllables in the language.[43] Furthermore, the directionality of the syncope rules in Tonkawa and Southeastern Tepehuan have been shown in Gouskova (2003) to derive from features of the languages' foot structure. Indeed, the metrical analysis of Gouskova (2003) remains the only serious explanation of 'directionality' in syncope alternations. If Gouskova's analyses of Tonkawa and Tepehuan were abandoned, the directionality of their syncope alternations would simply have to be independently stipulated; this fact will be reiterated for Tlingit syncope.

It seems, then, that the directionality and non-finality of Tlingit syncope should derive somehow from the language's metrical structure. Tlingit, however, is a tone language which has never been explicitly described as having rhythmic, meter-based prominence. Although much has been written on the tonal system of Tlingit (Naish 1966, Story 1966, Leer 1991, Leer 1999, Maddieson et al. 2001), no authors have ever described any system of metrical stress or foot structure for the language.[44] How could any properties of Tlingit syncope be argued to follow from the language's metrical structure if it doesn't have one?

Although Tlingit has never been described as possessing a foot structure, let us nevertheless proceed with a metrical analysis of Tlingit syncope. The reason for pursuing such an analysis is simply that it will provide a uniquely elegant explanation of the non-finality and directionality of the alternation. We shall see that the puzzling directionality of Tlingit syncope follows nicely from a particular metrical system. Furthermore, there seems to be no other viable means for capturing this directionality within a constraint-based analysis. This fact is made vivid by the following question: if one considers only the segmental content of the strings, how is the starred form in (13a) to be distinguished from the grammatical form? This question is rendered insoluble by the output form given in (14). The form in (14) demonstrates that the starred form in (13a) cannot be ruled out on purely segmental or syllabic grounds. We must instead locate the deficiency of that string in more abstract properties, and we shall see that metrical grouping provides a satisfying explanation.

I am, in fact, optimistic that future phonetic research will reveal concrete evidence for the existence of metrical footing in Tlingit. The subject of stress within the Na-Dene languages is a vexed one. Under the classical description of these languages, they do not possess meter and do not distinguish between stressed and unstressed syllables. In recent

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[43] It has also been argued that the source of a syncope rule's 'non-finality' may be the activity of an 'Anchor-R(Root)' constraint (Gouskova 2003, p. 152). We may put aside such an analysis for Tlingit on the grounds that it would entail the existence of constraints explicitly enforcing faithfulness to affixes. If such constraints were admitted, our theory would predict unattested patterns in which faithfulness to the stem is sacrificed to preserve faithfulness to its affixes (Kawahara 2003).

This is, in general, the reason why I have developed an analysis in which *markedness* constraints are relativized to particular prefixal domains, and not faithfulness constraints. By relativizing only markedness constraints to prefixal domains, one avoids any prediction that languages might exist where, given a choice between violating faithfulness to the affix and violating faithfulness to the stem, the language opts to violate faithfulness to the stem.

[44] The one exception to this is a brief remark made in Story (1966), which I will discuss in a moment.

years, however, evidence has increasingly come to light that in some Athabascan languages there does exist a dimension of prominence independent of tone, and that this prominence may be aptly described in metrical terms. Rice (1987) argues on primarily phonological grounds that stress co-exists with tone in Hare, a language related to Tlingit. This paper also reports an audible distinction between stressed and unstressed syllables in Hare, but rigorous phonetic argumentation is not provided. Phonetic studies have, however, been carried out on other Athabascan languages, and a number have concluded that these languages possess a metrically-based dimension of syllable prominence that is independent of tone (Tuttle 1998, Potter et al. 2000, Tuttle 2002)[45]. However, the strongest reason to suspect that Tlingit does possess phonetic stress is the following remark made in Story (1966).

> The tonic ['tone-bearing' – SC] syllable is generally the stressed syllable, though syllables are little differentiated by stress…in tone patterns 5 and 6 the syllable immediately after the tonic syllable, when it contains a long vowel, may be equally stressed with the tonic syllable. (Story 1966, p. 15)

In this passage, the author makes a clear distinction between the syllables that bear tone and those which bear 'stress'. Unfortunately, this distinction is made nowhere else in Story (1966), nor in any other study of Tlingit known to me. Nevertheless, this passage strongly suggests that future research with Tlingit speakers will reveal the existence of phonetically implemented stress distinct from tone.

Of course, if phonetic measures of the Tlingit stress pattern become established, we must compare the metrical system proposed here on phonological grounds to that which may be detected by physical means. Such a 'physical' test would be essential to our understanding of Tlingit syncope. Certain features of the metrical system I shall propose for Tlingit are arbitrary, and numerous metrical systems might be equally able to derive the targeted properties of Tlingit syncope. The best means for deciding between these systems would be to compare them against the stress pattern that may be directly observed in the Tlingit speech signal.

However, until such independent, phonetic evidence is discovered, the imagination is free to compose a metrical system which accounts for the targeted properties of Tlingit syncope in a manner that is aesthetically appealing and typologically plausible. I reiterate that the existence of *some* abstract metrical structure in Tlingit is effectively beyond doubt; a metrical system is all but entailed by the 'non-finality' and right-to-left directionality of Tlingit syncope. Until those features of Tlingit syncope receive an analysis in different terms, they require us to postulate that Tlingit groups syllables into feet. Furthermore, I remind the reader that a *non*-metrical analysis of Tlingit syncope would be suspect on cross-linguistic grounds, given that all syncope alternations studied to this date derive their non-finality and directionality from the foot structure of the language.

Accepting that Tlingit syncope is regulated by some system of metrical structure, let us now consider the question of which constraints motivate the V-ellipsis that constitutes the syncope alternation. Syncope has classically been understood as a kind of

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[45] Indeed, there is soon to be released a volume specializing in papers exploring the existence of stress within the Athabascan languages (Keren Rice, p.c.).

'economy' phenomenon (Kisseberth 1970); under this view, a syncope rule deletes from the input as many vowels as the phonotactics of the language permit. This classical view has been implemented in Optimality Theory via the adoption of such constraints as '*Struc(σ)' (Zoll 1996) and '*V' (Hartkemeyer 2000). Such constraints assign a violation mark to a candidate for every syllable or vowel it contains. If ranked above 'Max(V)', these constraints force the elision of all vocal segments from the input. However, if these constraints are also dominated by other phonotactic constraints, the resulting system is one in which deletion of vowels occurs up to phonotactic acceptability.

This 'economy theory' of syncope is strongly challenged in Gouskova (2003). Gouskova puts forth a two-pronged argument against the economy constraints '*Struc' and '*V'. First, it is argued that these constraints drastically upset the typological insights that have been gained from OT. Even when ranked very low, constraints such as '*Struc' and '*V' can derive a number of bizarre and unattested patterns (Gouskova 2003, p. 70). These unnatural patterns counter-exemplify certain accurate predictions made by standard OT. For example, one may with economy constraints describe a system in which a reduplicant cannot contain any consonants, an instance of 'emergence of the *marked*'.

Gouskova next argues that economy constraints are superfluous to our understanding of syncope. In every analysis of syncope employing these constraints, their activity must be regulated by the metrical constraints of the language. However, when one studies the resulting systems, one finds that the metrical constraints may alone perform the work of the economy constraints. That is, Gouskova argues that although syncope does create a string with less syllables, it also creates a string with an improved foot structure.[46] Thus, one may derive the syncope alternation of a language simply by ranking its constraints governing metrical well-formedness above Max(V). Our theory of syncope therefore has no need of '*Struc' constraints. In light of their negative effect on typological theory, Gouskova concludes that these constraints must be eliminated from OT.

Gouskova (2003) makes a strong case against the use of economy constraints in one's analysis of syncope. Instead, one should seek to derive a language's syncope alternation from features of its metrical structure. Let us therefore attempt to follow the example of Gouskova (2003) in our treatment of Tlingit syncope. In the next section, we shall develop a metrical system for Tlingit which derives its unique syncope alternation. The resulting constraint system will cover the empirical ground of the 'Syncopate!*' constraint employed in earlier sections, and all the components of the Tlingit syncope rule will have thus been explicated.

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[46] A point of clarification is in order here. Certain syncope rules only target syllables headed by particular vowel qualities. These have been named 'differential syncope rules' in the literature. Gouskova (2003) proposes a distinct analysis of 'differential syncope rules', but one that still does not employ economy constraints. Since Tlingit syncope is clearly not an instance of 'differential syncope', I implicitly exclude such instances of syncope from our discussion.

7.2 The Metrical Structure of Tlingit

In this section, I defend an analysis of Tlingit metrical structure, one that derives all the hitherto unexplained properties of Tlingit syncope while simultaneously maintaining a strikingly close similarity to the metrical systems of related languages.

Section 7.2.1 provides a general introduction to the constraint system I shall defend. The stress pattern that this constraint ranking predicts is compared to the stress systems of the languages Salcha and Minto, distant cousins of Tlingit. Furthermore, the constraint ranking is itself compared to the constraint rankings proposed for Salcha and Minto in Tuttle (1998). It is shown that the proffered constraint ranking for Tlingit is nearly identical to those proposed by Tuttle.

The empirical adequacy of the Tlingit constraint ranking is demonstrated in section 7.2.2. It is shown that the proposed system derives nearly all the crucial properties of Tlingit syncope. The one feature which this system alone does not cover is the 'irregular' left-to-right ordering that occurs when the imperfective prefix "g̲a" directly precedes the second person plural subject agreement prefix "yi". This strange phenomenon is addressed in section 7.2.3, where it is argued to be illusory. I hypothesize that the vowel-zero alternation which occurs for imperfective "g̲a" is *epenthesis* and not ellipsis. Such an analysis is shown to derive the unusual behavior of the imperfective prefix in a manner fully consistent with the metrical analysis of the syncope alternation.

7.2.1 Meter in Tlingit and Related Languages

The metrical system which I will propose for Tlingit employs the following constraints, all of which are familiar from the phonological literature.

(61) Constraints Employed in Tlingit Metrical System

a. 'Lx = Pr' :
This constraint assigns a violation mark to a candidate if none of its syllables are parsed into feet.

b. 'Trochee' :
This constraint assigns one violation mark to a candidate for every foot it contains whose head is not left-most.

c. 'FtBin' :
This constraint assigns one violation mark to a candidate for every 'degenerate' (mono-moraic) foot it contains.[47]

d. '*(HL)' [a.k.a. 'RhHarm' (Prince & Smolensky 1993, p. 59)] :
This constraint assigns one violation mark to a candidate for every (HL) trochee it contains.

[47] Throughout this paper, I assume that coda consonants are moraic.

e. 'Non-Fin(σ)' :
This constraint assigns a violation mark to a candidate if its final syllable is stressed.

f. 'WTS' :
This constraint assigns one violation mark to a candidate for every unstressed heavy syllable it contains.

g. 'STW' :
This constraint assigns one violation mark to a candidate for every stressed light syllable it contains.

h. 'Parse(σ)' :
This constraint assigns one violation mark to a candidate for every syllable it contains which is not parsed into a foot.

i. 'Max(V)' :
(Definition elementary)

j. 'Align(Ft, R, EIPD, R)' :
This constraint assigns one violation mark to a candidate for every syllable intervening between the right edge of a foot and the right edge of the EIPD.

We shall see that the following arrangement of these constraints derives nearly all the crucial properties of Tlingit syncope. Thus, I propose that the constraint ranking in (62) is the Tlingit metrical system.

(62) Metrical System of Tlingit: Constraint Ranking [48]

Lx=Pr >>
{ Trochee, FtBin, *(HL), Non-Fin(σ) } >>
{ WTS, STW } >>
Parse(σ) >>
{ Max(V), Align(Ft, R, EIPD, R) }

Before we discuss how this ranking elucidates the nature of Tlingit syncope, let us examine the system of footing it encapsulates. Assuming that the input undergoes no syncope, this constraint ranking assigns it metrical structure in a manner equivalent to the following algorithmic statement.

[48] A significant subset of the rankings in (62) are 'crucial', in the technical sense. This means that if one assumes that the constraints in (61) are those which are relevant for the Tlingit syncope alternation, the various output forms of Tlingit *entail* the sub-rankings in question. See Appendix 9.1 for the proof that the attested outputs of syncope entail the sub-ranking 'Lx=Pr >> Non-Fin(σ) >> {WTS, STW} >> Parse(σ) >> {Max(V), Align(Ft, R, EIPD, R)}'.

(63) Metrical Structure of Tlingit: Algorithmic Statement
"*Stress all and only the non-final heavy syllables. If there are no non-final heavy syllables, then stress the penultimate syllable. If there is no penultimate syllable, then stress the sole syllable in the string.*"

According to the statement in (63), the metrical system of Tlingit assigns foot structure in the following fashion.

(64) <u>INPUT</u>		<u>FOOTED OUTPUT</u>
CV CV CV CV	→	CV CV (CV' CV)
CV CVC CV CV	→	CV (CVC') CV CV
CV CVC CVC CV	→	CV (CVC') (CVC') CV
CV CV CV CVC	→	CV CV (CV' CVC)

The tableaux in (65) and (66) demonstrate that the mapping in (64) is indeed derived by the ranking in (62).

(65)

CV CV CV CV	Lx=Pr	Trochee	FtBin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
CV CV CV CV	*!							****		
(CV' CV)(CV' CV)							**!			**
(CV' CV) CV CV							*	**		*! *
CV CV (CV' CV)							*	**		
CV CVC CV CV										
CV CVC (CV' CV)						*!	*	**		
CV (CVC') (CV' CV)							*!	*		**
(CV' CVC) (CV' CV)						*!	**			**
CV (CVC') CV CV								***		**
CV (CVC' CV) CV				*!				**		*
CV CVC CVC CV										
CV CVC (CVC') CV						*!		***		*
CV (CVC' CVC) CV						*!		**		*
CV (CVC') (CVC') CV								**		***

(66)

CV CV CV CVC	Lx=Pr	Trochee	FtBin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
CV CV CV (CVC')					*!			***		
CV CV (CV' CVC)						*	*	**		
CV (CV' CV) CVC						*	*	**		*!

It is interesting to compare this metrical system to the one described in Tuttle (1998) for the Athabascan languages Minto and Salcha.[49] The stress pattern for Minto and Salcha, which has been detected through phonetic study, is slightly different from that predicted above for Tlingit. As the mapping in (68) indicates, stress in these languages is assigned in a manner consistent with the algorithmic statement in (67).

(67) Metrical Structure of Minto and Salcha: Algorithmic Statement [50]
"Stress all non-final heavy syllables. From the remaining syllables, create trochees in a right-to-left order."

(68) <u>INPUT</u>		<u>FOOTED OUTPUT</u>
CV CV CV CV	→	(CV' CV) (CV' CV)
CV CVC CV CV	→	CV (CVC') (CV' CV)
CV CVC CVC CV	→	CV (CVC') (CVC') CV
CV CV CV CVC	→	(CV' CV) (CV' CVC)

Tuttle (1998) derives this metrical system from the following constraint ranking.

(69) Metrical Structure of Minto and Salcha: Constraint Ranking

Align-R(Pword, Foot) >>
Non-Fin(σ) >>
Trochee, FtBin, WTS >>
Parse(σ) >>
STW (Tuttle 1998; Chapter 5; p. 215, 216)

Note, however, that the definitions for the constraints in (69) differ in Tuttle (1998) from those given (61). For example, the constraint 'Trochee' is defined in Tuttle (1998) so that it is violated by (HL) feet; Tuttle's analysis therefore does not require the use of the constraint '*(HL)'. Furthermore, the constraint 'Align-R(Pword, Foot)' is defined so that

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[49] Minto and Salcha are very similar in form; it is common to hear them described as 'dialects' of the Tanana language.

[50] Tuttle (1998) demonstrates that the stress system of Tanana Athabascan interacts with morphological structure in certain complex ways. For instance, Tuttle argues that a principle exists requiring roots to be always stressed, even when final. In my discussion of Tuttle's analysis, I abstract away from these 'morpho-phonological' constraints, since I assume that they are not relevant to the analysis of Tlingit syncope.

it is not violated by multiple feet. Thus, Tuttle's analysis needn't rank its alignment constraint below 'Parse(σ)' to yield multiply footed structures. If we were to employ the constraints in (69) with the definitions given in (61), the resulting constraint system would appear as follows.

(70) Metrical Structure of Minto and Salcha: Constraint Ranking 2

Lx=Pr >>
Non-Fin(σ) >>
*(HL), Trochee, FtBin, WTS >>
Parse(σ) >>
{ STW , Align-R(Pword, Foot) }

Let us also note, moreover, that certain of the rankings represented in (70) are not crucial. In particular, though Tuttle's analysis requires that 'Non-Fin(σ)' outrank 'WTS', it does not require that the constraint also dominate 'Trochee' and 'FtBin'. In fact, the following re-ranking still derives the targeted pattern.

(71) Metrical Structure of Minto and Salcha: Constraint Ranking 3

Lx=Pr >>
{ Trochee, FtBin, *(HL), Non-Fin(σ) } >>
WTS >>
Parse(σ) >>
{ STW , Align-R(Pword, Foot) }

The constraint system in (71) bears a striking resemblance to that proposed for Tlingit in (62). Indeed, there are only two differences between the systems: (i) in Tlingit the constraint 'STW' outranks the constraint 'Parse(σ)'; (ii) in Tlingit, the constraints 'STW' and 'Parse(σ)' outrank 'Max(V)'. From these two differences in ranking derive the two core differences between the metrical systems of these languages: (i) in Tlingit, there can be only one (LL) Trochee per word; (ii) in Tlingit, vowels elide to facilitate a more optimal foot structure. Aside from these two differences, the languages share a host of properties in common, including the following.

(72) Similarities between the Metrical Structures of Tlingit, Minto and Salcha [51]

- Foot type is 'moraic trochee'
- No (HL) feet are permitted
- No 'degenerate' (mono-moraic) feet
- Feet are aligned to the right
- All non-final heavy syllables are stressed, even when they are adjacent
- No final syllable may be stressed, even if it is heavy

[51] One salient difference, however, between the metrical system of Tanana and that proposed for Tlingit is that in the former, the prefix string is *not* a domain edge for the purposes of 'Non-Finality'. See the examples of (5:19) in Chapter 5 of Tuttle (1998).

Of course, there is a certain degree of contrivance in these similarities. Until metrical prominence is directly measured in Tlingit, the most one can honestly claim is that a metrical system remarkably similar to those discovered for languages related to Tlingit is sufficient to derive the Tlingit syncope pattern.[52] Note, however, that this point is of no small interest. It takes but a re-ranking of *two* constraints to transform the metrical system of the Tanana Athatbaskan languages into one which derives the Tlingit syncope alternation. I take this close proximity in typological space as strong evidence favoring the analysis in (62) over other metrical systems that might also derive the correct pattern for Tlingit.

7.2.2 Deriving the Tlingit Syncope Alternation

Although its similarity to known metrical systems is reassuring, the real motivation behind the constraint ranking in (62) is that it derives the Tlingit syncope alternation. To prove this claim efficiently, let us first factor the Tlingit syncope alternation into three generalizations.

(73) Properties of Tlingit Syncope[53]

(i) Non-Finality: The V of a light syllable will never elide if that syllable is final in the Prefix String.
(ii) The Core Alternation: The V of a light syllable will elide when the syllable follows an open syllable and is not final in the Prefix String. This ellipsis may occur multiple times in a string.
(iii) Directionality: Given two light syllables directly adjacent to one another CV_1CV_2, if neither syllable is final in the Prefix String and both are preceded by open syllables, then the V of CV_2 elides and the V of CV_1 does not.

Certain aspects of these generalizations already follow from the phonotactic constraints introduced in prior sections; the reader will be reminded of these as they arise in the ensuing discussion. Note, moreover, that generalization (iii) ignores the irregular 'left-to-right' ordering which occurs when the imperfective prefix "g̠a" precedes subject agreement "yi". This apparent irregularity will be covered in section 7.2.3. In this section, we will demonstrate that the constraint ranking in (62) predicts the generalizations in (73).[54]

7.2.2.1 The Non-Finality of Tlingit Syncope

Let us begin with generalization (73i), the requirement that final vowels not syncopate. As the following argument demonstrates, this condition follows from the activity of the

[52] It bears emphasizing, however, that the similarities noted in (72) follow from the 'crucial' rankings for both Tlingit and Tanana. If it is assumed that the same set of constraints governs the metrical systems of both Tlingit and Tanana, the available data *entail* that the metrical systems of Tlingit and Tanana converge on these properties.
[53] Recall that we are here already factoring out from the alternation certain 'blocking conditions' it is subject to, as well as any appeal to the prefix list in (5).
[54] Note, however, that not all the rankings asserted in (62) are crucial for the proper derivation of Tlingit syncope. See section 9.1 in the appendices for the full subset of crucial rankings in (62).

constraints ‘Non-Finality(σ)’ and ‘WTS’. In brief, syncope of final vowels does not occur in Tlingit because it would always adversely affect the foot structure of the word, incurring either extraneous violations of ‘Non-Finality(σ)’ or of ‘WTS’.

Observe, in the tableaux below, that syncope of a final V causes the EIPD to end in a heavy syllable. The resulting string will therefore violate either ‘Non-Finality(σ)’ or ‘WTS’. On the other hand, if the final light syllable is permitted to surface faithfully, the worst possible constraint violation it will incur is one of ‘STW’. ‘Non-Finality(σ)’ dominates ‘STW’, and so any ‘syncope-candidates’ violating ‘Non-Finality(σ)’ will lose to the correct ‘nonsyncope-candidate’. This interaction can be seen in each of tableaux (74), (75) and (76).

Suppose now that the best syncope-candidate violates only ‘WTS’. Suppose, moreover that the best nonsyncope-candidate violates ‘STW’. Since the best nonsyncope-candidate violates ‘STW’, there must be no non-final heavy syllables in the prefix string.[55] If this is the case, however, then it must also be that the best *syncope*-candidate violates ‘STW’.[56] Thus, the best syncope-candidate will incur violations of both ‘WTS’ *and* ‘STW’, while the best nonsyncope-candidate will incur only a violation of ‘STW’.

It follows from this argumentation that some nonsyncope-candidate will always be more optimal than every syncope-candidate in which syncope targets the final syllable. Thus, this system predicts that syncope in Tlingit will not target final syllables.

(74)

CV **CV**	Lx=Pr	Trochee	FtBin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
(CV’ **CV**)							*			
CV **CV**	*!							**		
CV**C**	*!					*		*	*	
(CV**C**’)					*!				*	

(75)

CV CV **CV**	Lx=Pr	Trochee	FtBin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
CV (CV’ **CV**)							*	*		
CV (CV**C**’)					*!			*	*	
(CV’ CV**C**)						*	*!		*	

[55] This can be seen from tableau (75). If there were a non-final heavy syllable in the string, it could bear stress, and there would be no need for the best nonsyncope-candidate to violate ‘STW’.
[56] This can be seen from tableau (76). The lack of a non-final heavy syllable and the ranking of ‘Non-Finality(σ)’ entails that the best syncope candidate in this case will contain a light syllable bearing stress.

(76)

CVC CV **CV**	Lx=Pr	Trochee	FtBin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
(CVC') (CV' **CV**)							*!			**
CVC (CV' **CV**)							*!	*		
(CVC') CV **CV**								**		**
(CVC') (CV**C**')					*!				*	*
(CVC' CV**C**)						*!			*	

7.2.2.2 The Core Alternation

We see, then, that generalization (73i) follows rather easily from the constraint ranking in (62). Let us now consider generalization (73ii). We wish to derive that syncope will apply to any non-final light syllable following an open syllable. We will begin by establishing that syncope is predicted to apply to any *penultimate* light syllable preceded by an open syllable. The tableaux in (77) illustrates our argument.

(77)

CV CV CV **CV** CV	Lx=Pr	Trochee	FtBin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
CV (CV' CV)(**CV**' CV)							*! *	*		* *
CV CV CV (**CV**' CV)							*!	***		
CV CV (CV**C**') CV								***	*	*
CVC CV **CV** CV										
(CVC' CV) (**CV**' CV)				*!			*	*		* * *
(CVC') CV (**CV**' CV)							*!	*		* * *
(CVC') CV **CV** CV								* *! *		* * *
(CVC') (CV**C**') CV								*	*	* * *
CVV **CV** CV										
(CVV') (**CV**' CV)							*!			* *
(CVV') **CV** CV								* *!		* *
(CVV**C**') CV								*	*	*

First, suppose that a penultimate light syllable CV_i is preceded by a string of light syllables. If CV_i surfaces faithfully, the output must incur a violation of 'STW'. However, if the vowel of CV_i is elided, the output will incur no violation of 'STW'.

Given that ‘STW’ outranks ‘Max(V)’, the constraint system predicts that syncope should target a penultimate light syllable in this environment.

Now suppose that a penultimate light syllable CV_i is directly preceded by an open syllable, but a heavy syllable also exists somewhere in the prefix string. The ranking of ‘*(HL)’ and ‘STW’ above ‘Parse(σ)’ entails that a light syllable is footed if and only if it is penultimate and *no* heavy syllable exists in the prefix string.[57] Thus, if CV_i surfaces faithfully, it must be unfooted. It follows that any candidate in which CV_i surfaces faithfully incurs at least one violation of ‘Parse(σ)’. If the vowel of CV_i is elided, however, it can no longer incur a violation of ‘Parse(σ)’. It follows that any candidate in which syncope targets CV_i will incur at least one fewer violation of ‘Parse(σ)’. Given that ‘Parse(σ)’ dominates ‘Max(V)’, the constraint system predicts that syncope should target a penultimate syllable in this environment.

We have thus proven that the constraint system in (62) predicts that syncope should target any penultimate light syllable preceded by an open syllable. Let us now establish that syncope also targets any *non*-penultimate, non-final light syllable preceded by an open syllable. The tableau in (78) illustrates our general argument.

(78)

… CVC CV **CV** CVC…	Lx= Pr	Trochee	Ft Bin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
…(CVC’) (CV**C**’) (CVC’)…									*	***…
…(CVC’) CV **CV** (CVC’)…								*! *		***…
…(CVC’)(CV’**CV**)(CVC’)…							*!			****…
…(CVC’ CV) **CV** (CVC’)…				*!				*		**…
…(CVC’) CV (**CV**’ CVC)…						*!	*	*		***

Suppose that a non-penultimate, non-final light syllable CV_i is preceded by an open syllable. Again, the ranking of ‘*(HL)’ and ‘STW’ above ‘Parse(σ)’ entails that a light syllable is footed if and only if it is penultimate and no heavy syllable exists in the prefix string. Since CV_i is not penultimate, it follows that if CV_i surfaces faithfully, it must be unfooted. By familiar reasoning, any candidate in which syncope targets CV_i will incur at least one fewer violation of ‘Parse(σ)’ than any candidate in which CV_i surfaces faithfully. Given that ‘Parse(σ)’ dominates ‘Max(V)’, the constraint system predicts that syncope should target a light syllable in this environment.

We have proven that both penultimate and non-penultimate light syllables undergo vowel elision when non-final and preceded by an open syllable. It follows that the proffered constraint ranking predicts that the V of *any* light syllable will elide when the syllable follows an open syllable and is not final in the Prefix String. Our constraint system thus derives the explicit ‘if-direction’ of the generalization in (73ii). However,

[57] This can be seen from the last two tableaux in (77). It follows from the fact that, given the availability of a heavy syllable to bear stress and satisfy ‘Lx=Pr’, the ranking ‘*(HL) >> Parse(σ)’ prevents a light syllable from being the second syllable of a foot, while the ranking ‘STW >> Parse(σ)’ prevents a light syllable from being the first syllable in a foot.

this generalization also contains an implicit ‘only-if direction’ which we must now prove that our analysis also predicts.

It has already been established in section 7.2.2.1 that final syllables are predicted not to be targets of syncope. But what of initial syllables? Note that syncope of an initial light syllable could help to avoid a violation of ‘Parse(σ)’.

(79)

CV CVC CV	Lx= Pr	Trochee	Ft Bin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
CV (CVC’) CV								* *!		
(**C**CVC’) CV								*	*	

Our present constraint ranking therefore seems to incorrectly predict that initial syllables should also sometimes undergo syncope. However, this argument ignores the presence of ‘*Complex$_{CD}$’ within our theory. Recall that ‘*Complex$_{CD}$’ has been shown to outrank all the metrical constraints above. Bearing this in mind, we see that our constraint system indeed predicts that initial syllables should not syncopate.

(80)

CV CVC CV	*Comp$_{CD}$	Lx= Pr	Trochee	Ft Bin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R, EIPD,R)
CV (CVC’) CV									* *		
(**C**CVC’) CV	*!								*	*	

The presence of ‘*Complex$_{CD}$’ in our ranking also derives an aspect of syncope which has been hitherto neglected. Examples such as (55) demonstrate that a CV prefix will not undergo syncope if it is followed by only a consonantal prefix. The following tableau reveals that our ranking of ‘*Complex$_{CD}$’ easily derives this property of Tlingit syncope.

(81)

a sha **na** s	*Comp$_{CD}$	Lx= Pr	Trochee	Ft Bin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R, EIPD,R)
a (sha’ **nas**)							*	*	*		
(a’ sha**n**s)	*!						*	*		*	

Tableau (81) demonstrates that the undominated status of ‘*Complex$_{CD}$’ predicts that syncope cannot target closed syllables. Note that the activity of ‘*Complex$_{CD}$’ predicts that Tlingit syncope should neither target syllables preceded by closed syllables, as shown in (82).

(82)

CVC **CV** CV	*Comp$_{CD}$	Lx= Pr	Trochee	Ft Bin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R, EIPD,R)
(CVC') **CV** CV									* *		**
(CVC**C**') CV	*!								*	*	*
(CVC') **C**CV	*!								*	*	*

Our constraint ranking therefore predicts that Tlingit syncope should not target final syllables, initial syllables, or syllables following closed syllables. Thus, we derive that Tlingit syncope targets all and only non-final syllables preceded by an open syllable. We must now ask whether this system predicts that Tlingit syncope should target only light syllables. It has already been shown that the system predicts Tlingit syncope to not target closed syllables. We must finally ask, then, whether it predicts that Tlingit syncope should not target open syllables with long vowels. As the following tableau demonstrates, this is not a prediction of our constraint ranking.

(83)

CV **CVV** CV	*Comp$_{CD}$	Lx= Pr	Trochee	Ft Bin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R, EIPD,R)
CV (**CVV**') CV									* *!		*
(CV**C**') CV									*	*	*

Nevertheless, our overall analysis does predict that Tlingit syncope should not apply to CVV syllables. Note that the only prefixes of this form within the IPD are "too" and "ee", and that our system already predicts their syncope to be impossible. It follows that the EIPD will not contain a CVV syllable in a non-initial position.[58] Our analysis therefore predicts that only light syllables will be targets of Tlingit syncope. We may conclude that this analysis predicts the following generalization.

(84) A vowel will elide if and only if it is the nucleus of a light syllable which is non-final and follows an open syllable.

Let us finally note that the ranking of 'Parse(σ)' above 'Align(Ft, R, EIPD, R)' entails that iterative footing is possible in Tlingit. It should therefore be possible for syncope to apply multiple times within a single form. This is demonstrated in the following tableau.

---

[58] It is the case that other processes of hiatus resolution can derive CVV syllables in non-initial positions within the EIPD. These CVV syllables do not seem to be subject to syncope. This might follow from the same 'Minimal Exponence' constraint that prevents the syncope (and total obliteration) of the prefixes "ee" and "u", or it may be that this is the result of some form of opacity. Of course, this fact may also signal an empirical weakness of the present analysis.

(85) [59]

ka **wu** da**ga** li	Lx= Pr	Trochee	Ft Bin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
ka **wu** da (**ga**’ li)							*!	****		
ka **wu** (dax’) li								**! *	*	*
(kaw’) (dax’) li								*	**	* * *

We have therefore proven that our constraint system derives generalization (73ii). In brief, the ranking of ‘STW’ and ‘Parse(σ)’ over ‘Max(V)’ predicts that light syllables within the EIPD should be deleted when they follow open syllables. Over-application of this elision is prevented by the more highly ranked constraints ‘Non-Fin(σ)’ and ‘*Complex$_{CD}$’. Finally, the ranking of ‘Parse(σ)’ over ‘Align(Ft, R, EIPD, R)’ predicts that this elision may occur multiply within a single word.

There is now but one feature of Tlingit syncope which we have yet to address: its puzzling ‘directionality’.

7.2.2.3 The Directionality of Tlingit Syncope

We shall now demonstrate that the constraint ranking in (62) derives generalization (73iii). Suppose that an input contains two potentially syncopating syllables adjacent to one another, that both syllables are non-final and both follow an open syllable. As has already been demonstrated, the high ranking of ‘*(HL)’, ‘STW’ and ‘Parse(σ)’ entails that at least one of these two syllables must syncopate. Furthermore, the high ranking of ‘*Complex$_{CD}$’ entails that syncope of both these syllables is impossible. Thus, exactly one of the two syllables must undergo syncope. Syncope of the leftmost syllable incurs exactly the same number of violations as syncope of the rightmost syllable on all the constraints outranking ‘Align(Ft, R, EIPD, R)’. Thus, the choice of which syllable to syncopate is made by the constraint ‘Align(Ft, R, EIPD, R)’. The following tableaux illustrate this argument.

[59] “Kawdaxlis’éil’” = ‘They were torn’. (Story 1966; p. 98)

(86)

CV **CV** **CV** CV	*Comp$_{CD}$	Lx=Pr	Troch.	Ft Bin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R, EIPD,R)
CV **CV** (**CV**’ CV)								*!	* *		
(CV**CC**’) CV	*!								*	* *	*
(CV**C**’) **CV** CV									* *	*	* *!
CV (**CVC**’) CV									* *	*	*
CV **CV** **CV** CVC CV											
CV **CV** **CV** (CVC’) CV									* * *! *		*
(CV**CC**’) (CVC’) CV	*!								*	* *	* * *
CV (**CVC**’) (CVC’) CV									* *	*	* * *
(CV**C**’) **CV** (CVC’) CV									* *	*	* * * * !

We find, then, that the ‘right-to-left’ directionality of Tlingit syncope follows from the activity of the language’s rightward foot alignment constraint. In brief, a foot in Tlingit must be aligned towards the right of the EIPD. Thus, syncope targets the rightmost of two potentially syncopating prefixes because doing so places the resulting (H) foot closer to the right edge of the domain. This constraint ranking has therefore been shown to derive generalization (73iii).

Recall, however, that generalization (73iii) is not perfectly accurate. In words where both the imperfective prefix “g̱a” and the subject agreement prefix “yi” may syncopate, syncope targets the *leftmost* syllable to the exclusion of the rightmost one.

(14) x̱’e ya-**g̱a**-**yi**-da-noog → ya-**x̱**-**yi**-da-noog ; * ya-**g̱a**-**y**-da-noog
mouth theme-imperf-2pl-CL-happen
Let you (pl) taste it! (Story 1966; p. 116)

In the next section, we shall dispose of this apparent counterexample to generalization (73iii) by drastically reanalyzing the vowel-zero alternation of the imperfective prefix.

7.2.3 The Exceptionality of Imperfective “G̱a”

We noted in section 3 that the syncope of the imperfective prefix “g̱a” seems to apply ‘before’ the syncope of any other prefixes in the string. This preference to syncopate “g̱a” whenever possible may be stated in the following ‘optimality-theoretic’ language.

(87) Principle of Consonantal Preference for “G̱a” :
When given a choice between realizing the imperfective prefix as a consonantal form and realizing any other prefix as a consonantal form, the grammar of Tlingit prefers the former over the latter.

Let us note here that the principle in (87) entails that the imperfective prefix, when following an open syllable, will only surface as a CV syllable if it is either final in the

Prefix String or followed by a consonantal classifier prefix. It follows from this generalization that the imperfective prefix surfaces as a CV syllable in just four environments.

(88) Environments Where Imperfective Prefix Surfaces as “G̲a” :
- (i) When preceded by a closed syllable
- (ii) When followed by a single consonantal classifier prefix.
- (iii) When string initial.
- (iv) When string final.

These distributional properties of imperfective “g̲a” permit us the following reanalysis of the imperfective prefix and its vowel-zero alternation. Let us suppose that the underlying form of the imperfective prefix is not the CV syllable “g̲a”, but rather the simple unaspirated uvular stop “g̲”. That is, let us adopt the hypothesis that the vowel-zero alternation occurring for the imperfective prefix is not one of elision, but one of *epenthesis*. Although it may be less elegant to claim that certain vowel-zero alternations in the Tlingit prefix string are the result of elision and others the result of epenthesis, claims of this sort are by no means uncommon in the literature on Na-Dene languages. Tuttle (1998) cites numerous such proposals to bolster the hypothesis that verbal prefixes in the Tanana Athabascan languages differ as to whether their surface vowels are present underlyingly (Tuttle 1998; section 6.5).

The hypothesis that the vowel-zero alternation of the imperfective prefix is one of epenthesis requires that we introduce the constraint ‘Dep(V)’ into our ranking. As the following tableaux demonstrate, the ranking of ‘Dep(V)’ below ‘*Complex$_{CD}$’ predicts that “g̲a” should appear in environments (88i), (88ii) and (88iii).

(89)

CVC **g̲** CV	*Comp$_{CD}$	Lx=Pr	Dep(V)	Troc	Ft Bin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R, EIPD,R)
(CVC**x̲**’) CV	*!									*		*
(CVC’) **g̲**CV	*!									*		*
(CVC’) **g̲a** CV			*							* *		* *

(90)

CV **g̲** C	*Comp$_{CD}$	Lx=Pr	Dep(V)	Troc	Ft Bin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R, EIPD,R)
CVC**x̲**C	*!	*						*		*		
(CVC**x̲**C’)	*!						*					
(CVC’) **g̲a**C			*					*		*		*

(91)

g̲ CVC CV	*Comp$_{CD}$	Lx= Pr	Dep(V)	Troc	Ft Bin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R, EIPD,R)
(**g̲**CVC') CV	*!									*		*
g̲a (CVC') CV			*							* *		*

Tableau (89) illustrates that epenthesis is predicted to target "g̲" when it follows closed syllables. The underlying form cannot surface in this environment because it would entail the existence of either a complex onset or a complex coda in the surface string.[60] These same reasons underlie the vowel epenthesis which occurs when "g̲" precedes a consonantal classifier or is initial in the Prefix String, as tableaux (90) and (91) illustrate.

We must now ask why the imperfective prefix should surface as "g̲a" when final in the Prefix String. Let us pursue the notion that this is for reasons relating to the WTS principle. By ranking 'Dep(V)' below 'WTS', we predict that epenthesis will act to rid the Prefix String of final heavy syllables.

(92)

CV CV **g̲**	*Comp$_{CD}$	Lx= Pr	Troc	Ft Bin	*(HL)	Non-Fin(σ)	WTS	Dep(V)	STW	Parse(σ)	Max(V)	Al(Ft,R, EIPD,R)
(CV' CV**x̲**)							*!		*			
CV (CV' **g̲a**)								*	*	*		

When the imperfective prefix is both final and initial in the Prefix String, the constraint 'Lx=Pr' forces the appearance of its CV allomorph.

(93)

g̲	*Comp$_{CD}$	Lx= Pr	Troc	Ft Bin	*(HL)	Non-Fin(σ)	WTS	Dep(V)	STW	Parse(σ)	Max(V)	Al(Ft,R, EIPD,R)
g̲		*!										
(**g̲a'**)				*		*		*	*			

Of course, this hypothesis that the vowel of the imperfective prefix is the result of epenthesis faces some rather difficult empirical challenges. We shall come to those shortly. For now, let us note that this constraint ranking predicts that the imperfective prefix should surface as "g̲a" in all the environments listed in (88). This constraint

[60] Note that epenthesis is not predicted to target "g̲" in this environment if it precedes the vocalic prefix "ee". This prediction still derives the correct output for such configurations, the string "g̲ee". Under the classic analysis where the imperfective prefix is underlyingly "g̲a", the output "g̲ee" is derived from the activity of hiatus avoidance, a process more generally visible in this domain.

system also predicts that epenthesis should not target the imperfective prefix in any other environments.

(94)

CV **g** CV	*Comp$_{CD}$	Lx= Pr	Troc	Ft Bin	*(HL)	Non-Fin(σ)	WTS	Dep(V)	STW	Parse(σ)	Max(V)	Al(Ft,R, EIPD,R)
(CV**x**') CV										*		
CV (**ga**' CV)								*!	*	*		
CV **g** yi CV												
(CV**x**') yi CV										* *		* *
CV **ga** (yi' CV)								*!	*	* *		
CV (**ga**y') CV								*!		* *	*	*

The tableaux above illustrate that the principle in (87) is the straightforward result of the imperfective prefix possessing a consonantal underlying form. The grammar of Tlingit prefers strings containing the consonantal form of the imperfective prefix over those containing the consonantal form of any other prefix because the latter strings incur gratuitous faithfulness violations.

We find, then, that the 'irregular' left-to-right ordering of Tlingit syncope is illusory. The syncope alternation in Tlingit possesses a uniform right-to-left directionality, which follows the requirement that feet in Tlingit be aligned towards the right. However, there are other vowel-zero alternations within the Tlingit prefix string which superficially appear to be instances of syncope. Once it is recognized that these processes are not syncope, but are in fact instances of vowel epenthesis, all the apparent ordering anomalies of the Tlingit syncope process disappear. Cases in which syncope seems to apply in an unexpected order are truly cases in which no syncope occurs, and all the relevant prefixes surface faithfully.[61]

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[61] Donca Steriade (p.c.) has suggested a promising alternative analysis of the vowel-zero alternation in the imperfective prefix. Kager (1996) argues convincingly that prosodic constraints, including 'STW', may select between two equally faithful, stored allomorphs of a given affix. Briefly, it is argued that two allomorphs – A_1 and A_2 – of an affix may be stored in the lexicon, and that markedness constraints may freely select between the candidates 'root-A_1' and 'root-A_2', as both are equally faithful to an assumed morphosyntactic input. Steriade suggests that the V-zero alternation of imperfective "ga" might be profitably analyzed along these lines. The forms "ga" and "g" might both be stored as admissible Spell-Outs of the feature 'Imperfective'. The 'irregular ordering of syncope' in forms such as (14) would follow, as in my account, from the fact that the consonantal allomorph of the imperfective prefix is wholly faithful, while the consonantal allomorphs of all other prefixes entail a violation of 'Max(V)'.

Although this analysis warrants serious consideration, there are two reasons for my not developing it in this paper. The first is that the cases examined in Kager (1996) involve uncontroversial instances where two allomorphs of a prefix are 'lexically' stored. In these cases, no productive or even natural phonological process seems to relate the alternating forms (e.g., /ŋun/ alternates with /n/ in Djabugay). Adopting Kager's analysis to the vowel-zero alternation of the Tlingit imperfective prefix would ignore the fact that a very natural and simple phonological process relates the two allomorphs. Secondly, Kager's proposal requires drastic revisions to our standard conception of a 'phonological input'. For Kager's analysis, the input must be construed as some morphosyntactic bundle paired with the phonological string

Although this analysis accounts for the data at hand, and employs a standard analytical tactic within Na-Dene studies, it faces three difficult challenges. The most pressing difficulty concerns the behavior of other consonantal verbal prefixes. Within the EIPD, there exists a number of other prefixes which are underlying consonantal. All these prefixes are so-called 'classifier' prefixes, occupying the rightmost position in the prefix string. None of the consonantal classifier prefixes are reported to undergo the epenthesis which we postulate the imperfective prefix to undergo. For example, classifier prefixes are always final in the Prefix String, and yet they have no difficulty surfacing in their underlying C form.

(95) ka-x̱a-**sh**-xeet → ka-x̱a-**sh**-xeet ; * ka-x̱a-**sha**-xeet
theme-1sg-CL-write
I am writing (Dauenhauer & Dauenhauer 2000; p. 162)

That other consonantal prefixes in Tlingit do not exhibit the vowel-zero alternation of the imperfective prefix is a considerable challenge to our analysis. Nevertheless, we might imagine a reason why the classifier prefixes should be immune to this epenthesis. McDonough (2003) argues on phonological grounds that within Navajo, the classifier prefix and the verbal root together form a phonological domain. The arguments McDonough puts forth in support of this thesis easily generalize to many other Athabascan languages. Unfortunately, McDonough's arguments do not directly apply to Tlingit; Tlingit lacks the phonological alternations which motivate this domain within Athabascan. However, there are certain phonological alternations which suggest that the Tlingit classifier and verbal root also constitute a phonological domain. In particular, it has been widely reported that the an 's-class' classifier in Tlingit cannot appear with a verbal root containing a sibilant or affricate consonant. With such roots, an 'l-class' classifier may be used with the meaning typically assigned to classifiers of the 's-class' (see Story 1966, p. 65; Story & Naish 1973, p. 376; Leer 1991, pp. 99, 176). As is pointed out in Leer (1991), this distributional quirk suggests the existence of a phonological alternation that lateralizes coronal consonants when they are adjacent to roots of the relevant form.

(96) a. yax̱ ka-wu-**di**-ts'éin → yax̱ ka-w-**di**-ts'éin
to.rest theme-perf-CL-stop
It stopped.

b. yax̱ a-ka-wu-**si**-ts'éin → yax̱ a-ka-w-**li**-ts'éin
to.rest 3Obj-theme-perf-CL-stop
He stopped it. (Story 1966; p. 70)

That this 's-to-l' alternation applies only to classifiers and is sensitive only to the segmental content of the root suggests that it is limited to a domain containing only the classifier and the root. Let us name this domain the 'Stem'; it is illustrated in the following diagram.

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of the root. Although the analyst can imagine ways of improving upon this basic design, I prefer here to pursue an analysis in which standard conceptions of the phonological input may be fully retained.

(97) Stem: [62]
The Stem consists of the root and the classifier prefix.

```
[prefix string                                                    ]
     [conjunct                                                    ]
                    [inner conjunct                               ]
{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{EIPD                             ]
                           [inner prefix                          ]
                                                  [stem           ]
 15 – 14 – 13 – 12 – 11 – 10 – 9 – 8 – 7 – 6 – 5 – 4 – 3 – 2 – 1 – ROOT-Suffixes
```

If we accept the existence of the Stem domain, we are permitted a rather straightforward explanation of the inability for epenthesis to target the consonantal classifier prefixes. Note that such epenthesis would incur a violation of ‘$\text{Dep(V)}_{\text{STEM}}$’. [63] We may therefore prevent epenthesis from targeting the classifier prefixes by ranking ‘$\text{Dep(V)}_{\text{STEM}}$’ above ‘$\text{*Complex}_{\text{CD}}$’.

(98)

[eipd] [stem] ka <u>x</u>a **sh** xeet	Dep (V)$_{\text{STEM}}$	*Comp$_{\text{CD}}$	Lx= Pr	Troc	Ft Bin	*(HL)	NonFin (σ)	WTS	Dep(V)	STW	Parse (σ)	Max (V)	Al(Ft,R, EIPD,R)
[eipd] [stem] (ka’ <u>x</u>**ash**) xeet								*		*	*		
[eipd] [stem] ka (<u>x</u>a’ **sha**) xeet	*!								*	*	* *		

By the definition in (97), the Stem domain never contains the imperfective prefix. Thus, the highly ranked ‘$\text{Dep(V)}_{\text{STEM}}$’ is powerless to prevent epenthesis from targeting “<u>g</u>”.

(99)

[eipd] [stem] CVC **<u>g</u>** CV root	Dep (V)$_{\text{STEM}}$	*Comp$_{\text{CD}}$	Lx= Pr	Troc	Ft Bin	*(HL)	NonFin (σ)	WTS	Dep(V)	STW	Parse (σ)	Max (V)	Al(Ft,R, EIPD,R)
[eipd] [stem] (CVC’**<u>g</u>**) CV root		*!											*
[eipd] [stem] (CVC’) **<u>g</u>a** CV root									*				* *

[62] The ‘overlapping’ domain structure entailed by this definition of the Stem domain is rather unusual. Nevertheless, there are independently reported instances of such overlapping domains. See Seidl (2001), sections 2.6 and 2.7 for a discussion of two examples.

In short, the inability for other consonantal verbal prefixes in Tlingit to exhibit the vowel-zero alternation of the imperfective prefix may be due to their occupying a phonological domain within which such alternations are illicit.[64]

Another empirical challenge facing our analysis of the imperfective prefix concerns the behavior of verbal prefixes that end in closed syllables. There are a number of such prefixes in Positions 11 – 15, and it is possible for each to be final in the Prefix String. When they are string-final, these prefixes surface faithfully; epenthesis does not target their final consonant.

(100) **at** x̱a → **at** x̱a ; * **ata** x̱a
indef eat
He/she/it is eating. (Dauenhauer & Dauenhauer 2000; p. 192)

However, if we suppose that these prefixes lie within the EIPD when they are string-final, our constraint ranking wrongly predicts that epenthesis should target them.

(101)

[eipd] [stem] **at** x̱a	Dep $(V)_{STEM}$	$*Comp_{CD}$	Lx=Pr	Troc	Ft Bin	*(HL)	NonFin (σ)	WTS	Dep(V)	STW	Parse (σ)	Max (V)	Al(Ft,R, EIPD,R)
[eipd] [stem] (**at**') x̱a							*!						
[eipd] [stem] **at** x̱a			*!					*			*		
[eipd] [stem] (**a**' **ta**) x̱a									*	*			

Happily, there is a very straightforward solution to this difficulty. Recall how we have defined the Extended Inner Prefix Domain.

(50) Extended Inner Prefix Domain:
The Extended Inner Prefix Domain consists of the Inner Prefix Domain and the syllable adjacent to its left boundary (if such a syllable exists).

It follows from this definition that the EIPD domain is only present in a verbal structure if the IPD domain is present. If a verbal structure does not have an associated IPD domain, then the EIPD domain is undefined. There is no prefix within the IPD which ends in a

[63] The constraint '$\text{Dep(V)}_{\text{STEM}}$' is the one instance in this paper of a Faithfulness constraint relativized to a particular domain. It is accepted on the grounds that the Stem domain contains the verbal root; thus a highly ranked '$\text{Faith}_{\text{STEM}}$' constraint could not entail a preference to violate root-faithfulness.

[64] Note that I do not explain why the classifier prefixes cannot undergo *pre*-consonantal epenthesis. This option has also not yet been ruled out for the imperfective prefix. In general, our system does not yet derive the exact location of the epenthetic vowel. This is a difficult puzzle which I leave to future research.

closed syllable. Thus, if a prefix ending in a closed syllable is final in the Prefix String, it must be that the verbal structure does not contain any prefixes from Positions 1 – 8. It follows that this verbal structure does not possess an associated IPD domain. The definition in (50) entails that this verbal structure must also lack an EIPD domain. Therefore, the metrical constraints sensitive to the form of the EIPD cannot require that the consonant-final prefix undergo epenthesis. In brief, prefixes ending in closed syllables are not predicted to undergo epenthesis because they are never contained within the EIPD when they occupy positions that would otherwise require epenthesis.

The final empirical challenge faced by our analysis concerns the quality of the hypothesized epenthetic vowel. If our analysis is accurate, then the epenthetic vowel within the EIPD is the reduced vowel "a", which is represented in IPA with the symbol [^]. However, there are instances of vowel epenthesis in Tlingit where the inserted segment is the long high vowel "ee". Such epenthesis serves to break up tri-consonantal clusters occurring within larger prosodic domains.

(102) a. táakl-ch → táagl-ee-ch
hammer-instr
With a hammer. (Story 1966; p. 13)

b. ts'itskw tlein → ts'itsg-oo tlein [65]
songbird big
A big songbird (Story 1966; p. 13)

It appears, then, that the quality of the epenthetic vowel in Tlingit depends upon the domain within which it is inserted.

Although this chameleonic behavior of Tlingit epenthesis seems suspicious at first blush, it is not theoretically impossible. It is well known that languages differ in the quality of their epenthetic vowel; for the Salish languages, the epenthetic vowel is "a", while for Arabic it is "i". There are numerous ways to capture this linguistic difference using OT constraint rankings.[66] Throughout our analysis of Tlingit, we have made rather free use of co-phonologies. We may therefore hypothesize that the varying quality of the epenthetic vowel in Tlingit is due to differences in constraint ranking between the domains in which epenthesis occurs. In brief, we might suppose that the Tlingit EIPD has the constraint ranking of Salish, while its larger prosodic domains have the constraint ranking of Arabic.[67]

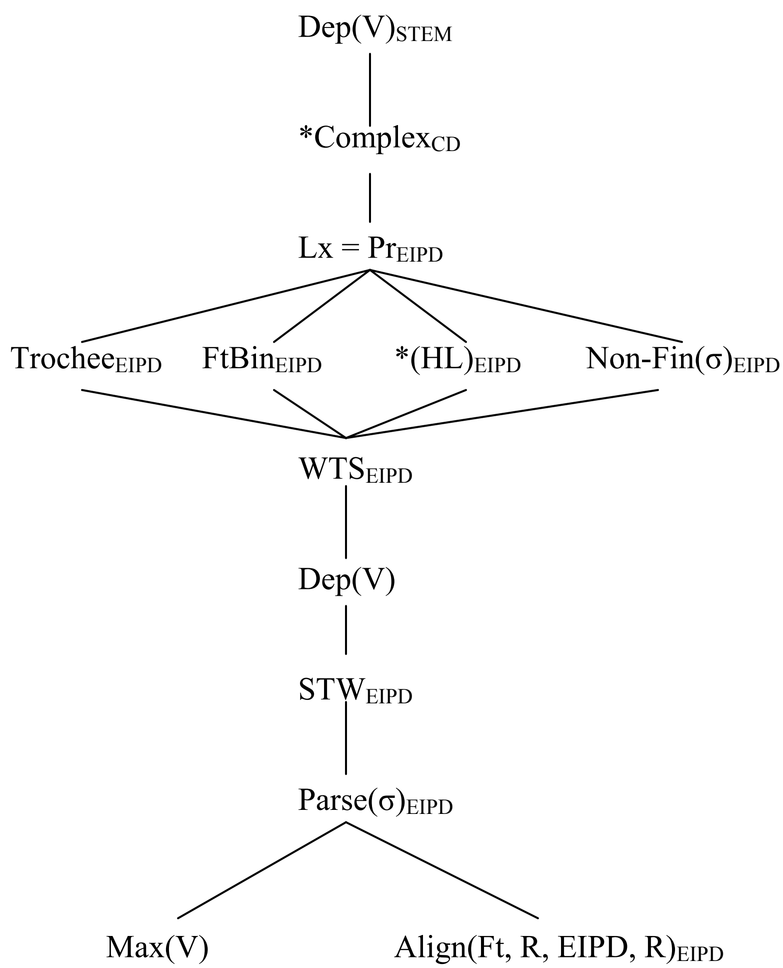
I conclude from this discussion that there is much to recommend the hypothesis that the imperfective prefix is underlyingly "g̲". This analysis nicely explains the otherwise mysterious distribution of the prefix's consonantal allomorph, and it permits us to derive the 'directionality' of Tlingit syncope from its rightward foot alignment.

[65] The appearance of "oo" as the epenthetic vowel is due to an independent process of rounding spread, which transforms "ee" to "oo" when following rounded segments.
[66] See Gouskova (2003) sections 4.3.2 and 4.4.4 for an extended discussion of one proposal.
[67] Further evidence for the epenthetic status of "a" in Tlingit may come from certain morphologically complex stems. Many such stems are of the form CV(C)CaC, where the initial CV(C)C sequence is an identifiable root, and the final C appears to be a fossilized suffix (Gillian Story, p.c.).

Although this analysis faces some difficult empirical challenges, each admits of an interesting and natural solution.

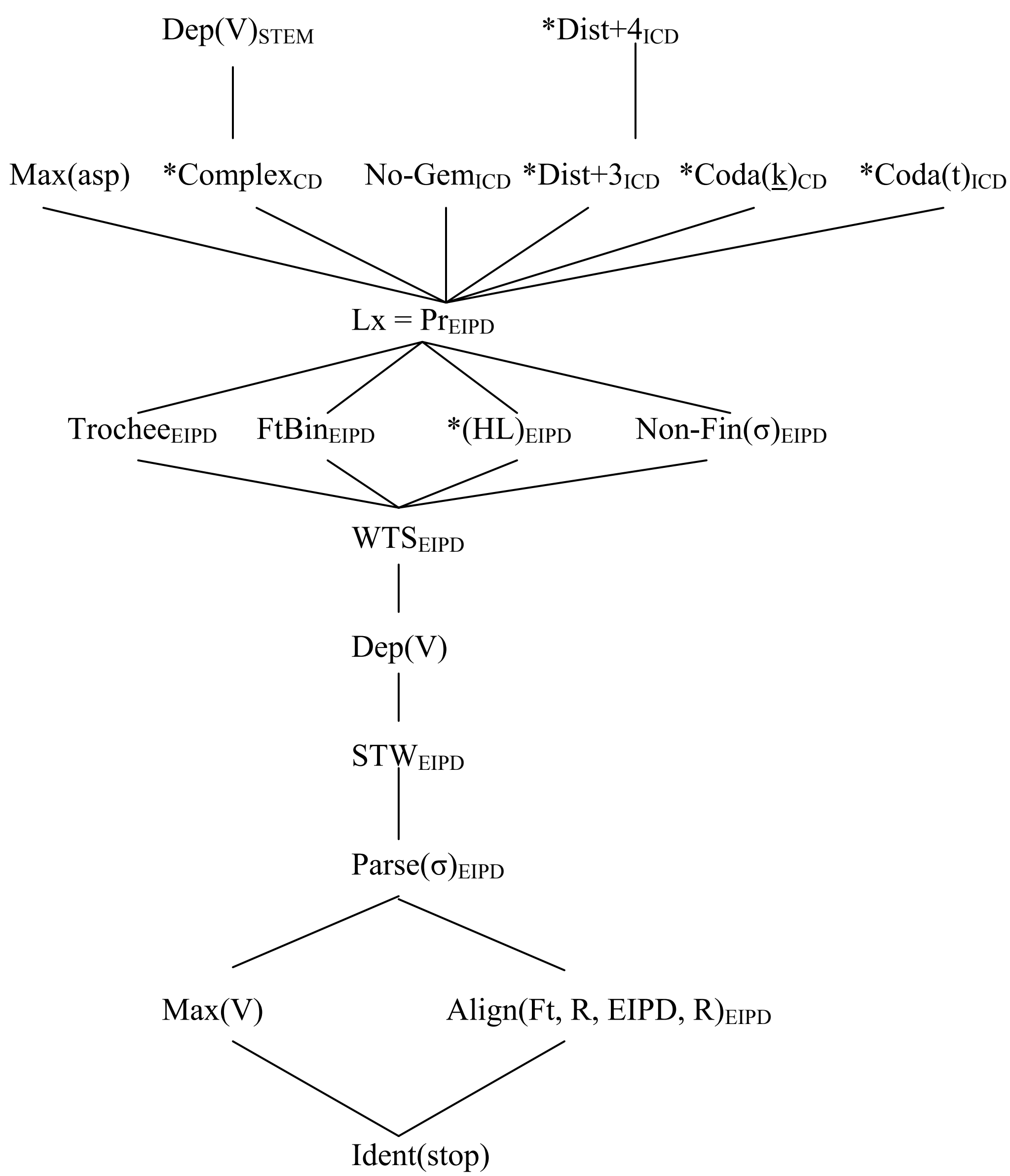
If we accept this analysis, as well as those proposed in prior sections, we obtain a constraint ranking which covers all the empirical ground of the constraint 'Syncopate!*' used in earlier sections. This constraint ranking is illustrated in a Hasse diagram below.

(103) Constraint Ranking to Replace 'Syncopate!*$_{EIPD}$'



We may therefore remove the constraint 'Syncopate!*' from our prior constraint systems, and replace it with the system illustrated in (103). The resulting system, illustrated in (104) is sufficient to produce the full Tlingit syncope alternation.

(104) Constraint System that Produces the full Tlingit Syncope Alternation



8. Conclusion

The body of this paper is an extended argument that the constraint system in (104) is sufficient to derive the alternation described by the rule in (16), and that it is to be preferred on theoretical and typological grounds. Let us now ask, if this argument is accepted, what is thereby learned about the phonology of Tlingit, the phonology of Na-Dene languages, and the nature of Universal Grammar?

The morphophonology of Na-Dene languages is notoriously complex. Especially within the Athabascan languages, verbal prefixes often assume strikingly different forms depending upon their morphological context. Simply discovering the morphophonemic alternations and stating them in rule form is often an accomplishment that takes years of study. Under such conditions, it might seem to the analyst that the morphophonological alternations of a Na-Dene language defy principled treatment, that they are arbitrary, language-specific phenomena. Within recent years, however, the morphophonologies of Na-Dene languages have begun to yield to sophisticated theoretical analysis. For example, verbal prefix order in Na-Dene – once thought to be idiosyncratic and without any principled basis – has been argued in several works to have a definite logic consistent with principles of Universal Grammar (Hale & Platero 1996, Rice 2000, Hale 2001). It is only a matter of time before the highly complex phonological alternations within the Na-Dene prefix string begin to shed their mystery and assume their rightful place within the space of possible linguistic form. That this prediction is not overly optimistic may be seen from our analysis of the Tlingit syncope alternation, a rule which at first blush seems idiosyncratically tied to particular prefixes, to apply in an idiosyncratic order, and to be blocked in a heterogeneous set of contexts. The system in (104) consists almost entirely of constraints that are well-known from the literature and whose activity may be observed in a variety of unrelated languages. Therefore, if we accept this analysis of the Tlingit syncope alternation, we should feel encouraged to seek principled analyses of other morphophonological alternations in Na-Dene, and to remove from those phenomena the mystery inherent in their stipulative, rule-based descriptions.

Although such a project aims to elucidate these phenomena in terms of well-established principles of Universal Grammar, it will also undoubtedly inform and shape our theory of UG. Within any analysis, a theorist must make certain assumptions that possess a degree of novelty. For example, our analysis of Tlingit syncope makes crucial appeal to the EIPD, a phonological domain which is defined in an unusual manner. If our analysis is to be accepted, then it must be possible for phonological domains to receive a 'context-sensitive' definition akin to that of the EIPD. Furthermore, our analysis of the imperfective prefix in Tlingit entails that it is possible for the quality of a language's epenthetic vowel to vary depending upon the morphological domain within which it is inserted. Perhaps most importantly, the acceptance of our analysis of Tlingit syncope entails the admission of 'goal-oriented' processes within phonology. In recent years, the notion that certain phonological processes, including syncope, are irreducibly oriented towards the improvement of output form has come under strong criticism from adherents of 'Evolutionary Phonology' (Blevins (to appear), Blevins (forthcoming)). Under this compelling view, phonological processes are the result of natural phonetic phenomena that are inherently local and not sensitive to the global well-formedness of the output. It is quite difficult to see how such an 'Evolutionary' framework could capture the blocking conditions on Tlingit syncope, its non-finality, or its right-to-left directionality. All these properties of Tlingit syncope can, however, be naturally understood as resulting from the global comparison of output forms with respect to certain well-formedness constraints. Although the analyses within Evolutionary Phonology may provide insight into the diachronic basis of certain markedness phenomena, the claim that *no* phonological processes are output-oriented is quite premature, and is strongly challenged by Tlingit syncope.

An increased scrutiny of the morphophonology of Na-Dene languages may also aid our understanding of their historical relationships and development. In our final analysis, the Tlingit verbal structure is mapped to six overlapping phonological domains.[68]

(105) Phonological Domains of the Tlingit Verb

```
[prefix string                                                         ]
     [conjunct                                                         ]
                          [inner conjunct                              ]
{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{{EIPD                                   ]
                                   [inner prefix                       ]
                                                              [stem       ]
 15 – 14 – 13 – 12 – 11 – 10 – 9 – 8 – 7 – 6 – 5 – 4 – 3 – 2 – 1 – ROOT-Suffixes
```

Each domain possesses a unique phonotactics. Furthermore, the phonotactics of the domains relate to one another in a manner that is isomorphic to the structural relations of the domains: if a domain X properly contains a domain Y, then the phonotactics of Y are more restrictive than the phonotactics of X. This prosodic structure is also a characteristic of Athabascan languages (Kari 1976, Chapter 2; Cook & Rice 1989, section 2.1; Rice 2000, Appendix 1). What is interesting, however, is that Athabascan languages differ from Tlingit in the number of phonological domains their verbal structures possess. Within most Athabascan languages, the verbal structure is mapped to only three phonological domains[69]: the Conjunct Domain, the Disjunct Domain and the Stem.[70] Moreover, in some languages, there exist only two phonological domains encompassing the verb (Kari 1976, Randoja 1990). In only one reported case does an Athabascan language divide its verb among as many as five phonological domains (Kari 1990). There has not yet been any report of an Athabascan language which maps its verbal structure to *six* phonological domains. Thus, Tlingit possesses more phonological domains than any other Na-Dene language.[71]

The genetic relationship between Tlingit and the Athabascan languages has been well-established (Krauss 1965; Pinnow 1968; Krauss 1969; Leer 1990, section 2; Manaster Ramer 1996). The strongest evidence for this relationship is that Tlingit possesses a number of morphemes which appear to be earlier forms of morphemes widely attested in Athabascan (Pinnow 1968, Krauss 1969).[72] That is, Tlingit seems to have retained features of proto-Athabascan that were subsequently lost within the modern Athabascan languages. It is widely held that, as time progresses, the affixes of a

[68] Of course, the possibility remains open that the prefix string is mapped to even more domains than just these six. There is a process of 'peg-vowel insertion' in Tlingit, akin to similar processes in the Athabascan languages. This process epenthesizes a vowel whenever Positions 1 – 12 are empty. The behavior of this alternation suggests that Positions 1 – 12 constitute an additional prosodic domain.

[69] See Rice (2000), Appendix 1.

[70] The Disjunct Domain is roughly equivalent to our Prefix String Domain.

[71] The security of this claim rests, of course, on the comparability of the domain systems proposed by different authors, possibly operating within different linguistic traditions. Clearly, a more careful analysis of the individual languages by a single author is needed before this claim can be given serious weight.

[72] In my exploration of the literature, I have not yet encountered an author who points out the apparent comparability of the Tlingit and Athabascan conjugation prefixes. Their similarity in form is so striking that I must assume I have not yet read widely enough.

language become more 'grammaticalized', more highly 'compacted' against the lexemes to which they attach. It is natural to suppose that two components of such prolonged 'compaction' are (i) a reduction in the number of phonological domains and (ii) an increase in the complexity of the morphophonological alternations. After all, as affixes become more highly incorporated with surrounding forms, the boundaries separating them begin to dissolve, and their underlying representations become more abstract. In as much as this process of 'compaction' is a true diachronic trend, we must conclude that the more articulated domain system of Tlingit reflects an earlier stage of Na-Dene verbal structure than any of the systems found within the Athabascan branch.

In addition to its more complex system of phonological domains, there exists another feature of Tlingit morphophonemics which may provide us a glimpse into the history of Na-Dene. Impressionistically speaking, the morphophonological alternations that occur within the Tlingit prefix string are nowhere near as complex as those typically occurring within the prefix strings of Athabascan languages. Although certain of the Tlingit alternations appear remarkably difficult to understand,[73] none are so drastic in their effect upon the form of the prefix as those which have been proposed for Navajo[74]. The morphophonemics of Tlingit largely consist of vowel-zero alternations, hiatus avoidance and rounding spread. Within the Athabascan languages, it is not unheard of for a full CV prefix to become a floating high tone when preceded by any other prefix (see Kari 1976, p. 37). Again, in as much as morphophonological alternations tend through time to become more complex, we must conclude that the more 'natural' processes at work in the Tlingit prefix string represent an earlier stage of the Na-Dene verbal system than those found within the Athabascan languages. [75]

Let us note one last historical speculation. The system of phonological domains proposed for Tlingit in (105) has one very unusual property. The Stem domain overlaps with the other five phonological domains, but it is not properly contained within them. Although this structure is unusual, there exists good evidence that it is the correct domain structure for Tlingit. The syncope alternation establishes that the classifier prefix marks the right boundary of a phonological domain containing it and the preceding prefixes, while the 's-to-l classifier alternation' establishes that the classifier prefix marks the left boundary of a phonological domain containing it and the following verbal root. To my knowledge, such an overlapping domain structure does not exist in any Athabascan language. Rather, some Athabascan languages group the classifier into a phonological domain with the root, and a complementary set group the classifier into a phonological domain with the preceding prefixes.[76] Given how typologically rare Tlingit's 'overlaping' domain system is, it seems unlikely that it developed from a system akin to those within the Athabascan branch. One might therefore hypothesize that the 'overlapping' domain system was inherited from the common ancestor of Tlingit and Athabascan. At some point in their history, the Athabascan languages lost the highly

[73] The following phenomena seem particularly challenging: the rule of 'U-Absorption', the 's-to-l classifier alternation' and the allomorphy of the perfective prefix. See Leer (1991), section 5.2.

[74] See Kari (1976), section 2.8.

[75] In this regard, compare the allomorphy of the Tlingit conjugation prefixes described throughout this paper to that of the apparently cognate Athabascan conjugation/mode prefixes (Rice & Hargus 1989).

[76] This evidential basis for this claim is fact that the classifiers in certain Athabascan languages are subject to epenthesis like verbal prefixes, while in other languages they incorporate into the verbal root (see McDonough 2000b; p. 159).

marked ‘overlapping’ domain system. In its place, certain languages grouped the classifier exclusively with the root, while others grouped it exclusively with the preceding prefixes.

9. Appendices

9.1 Crucial Ranking Arguments

In section 7.2, it is demonstrated that the constraint system hypothesized in (62) is sufficient to derive the core of the Tlingit syncope alternation. However, not all the rankings within that system are necessary for the generation of Tlingit syncope. Certain of the rankings are not ‘crucial’; they are arbitrary conventions imposed by the linear design of the OT tableau. Nevertheless, the system in (62) does contain numerous ‘crucial’ rankings; these rankings may be asserted on the basis of the available data. In this case, the only data that may be used to support a ranking are the vowel-zero alternations, since we do not yet have direct knowledge of the metrical system of Tlingit. In brief, a ranking can only be asserted if it is necessary for the system to produce the correct pattern of vowel elision and epenthesis.

I will demonstrate the crucial rankings in (62) by means of the comparative tableau (Prince 2002). In all the comparative tableaux below, I follow a convention whereby the uppermost form is the correct, ‘winner’ output form and the lowermost form the incorrect, ‘loser’ form.

(106) Parse(σ) >> { Max(V), Align(Ft, R, EIPD, R) }

ka wu daga li	Lx=Pr	Trochee	FtBin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
(kaw’) (dax’) li ka wu (dax’) li								W	L	L

(107) STW >> Parse(σ) [77]

CV ga xa li	Lx=Pr	Trochee	FtBin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
CV (gax’) li (CV’ ga) (xa’ li)							W	L	L	W

[77] The input to this tableau is an abstract prefix string, taken from Leer (1991) p. 194.

(108) WTS >> Parse(σ)

CVC CV CV	Lx=Pr	Trochee	FtBin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
(CVC’) CV CV (CVC’ CVC)						W		L	W	L

(109) Non-Fin(σ) >> STW

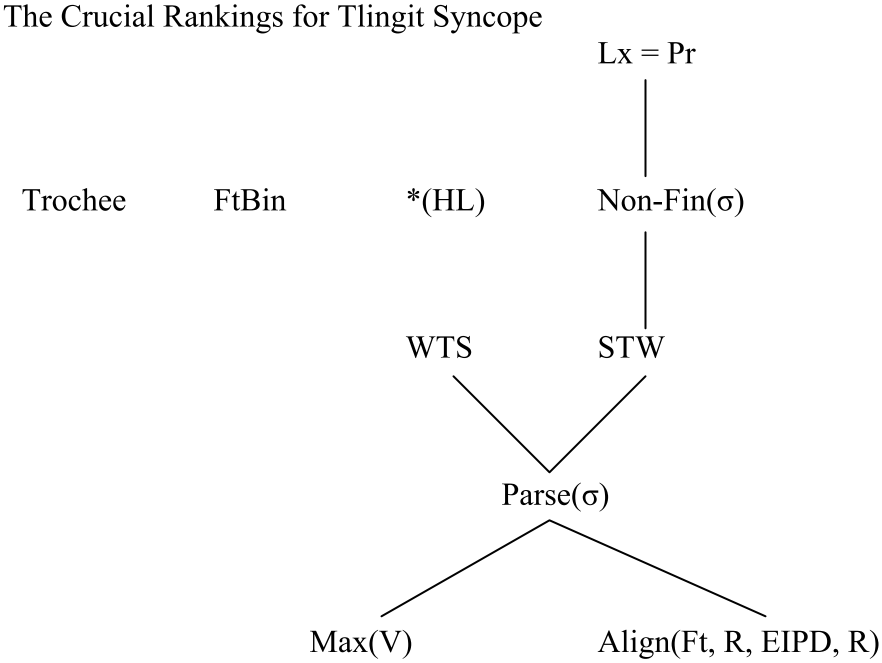
CV CV	Lx=Pr	Trochee	FtBin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
(CV’ CV) (CVC’)					W		L		W	

(110) Lx = Pr >> Non-Fin(σ)

G	Lx=Pr	Trochee	FtBin	*(HL)	Non-Fin(σ)	WTS	STW	Parse(σ)	Max(V)	Al(Ft,R,EIPD,R)
(ga’) g	W		L		L		L	W		

These comparative tableaux demonstrate that the rankings in (106) – (110) are crucial. We may represent the crucial rankings together in the following Hasse diagram.

(111) The Crucial Rankings for Tlingit Syncope



9.2 Forms Illustrating the Blocking and Application of Syncope

9.2.1 Forms Illustrating the Inadmissibility of Certain Consonantal Sequences

The following examples illustrate the inability for Tlingit syncope to output the sequences listed in (9).

(112) Impossibility of "n.y" [78]

CV-**na**-**yi**-l-'root' → CV-**na**-**yi**-l-'root' ; * CV-**n**-**yi**-l-'root'
prog-2pl-CL (Leer 1991; p. 192)

(113) Impossibility of "k.y"

a. CV-**ga**-**yi**-l-'root' → CV-**ga**-**yi**-l-'root' ; * CV-**k**-**yi**-l-'root'
3conj-2pl-CL (Leer 1991; p. 194)

b. náakw a daa yoo a-**ka**-**ya**-héik → a-**ka**-**ya**-héik ; * a-**k**-**ya**-héik
medicine 3Obj-thm-CL-rub
He's rubbing in medicine. (Story & Naish 1973; p. 177)

c. yáa táax'al' tlax̲ ka-**ka**-**ya**-tlei [79] → ka-**ka**-**ya**-tlei ; * ka-**k**-**ya**-tlei
this needle too thm-thm-CL-big
This needle is a little too fat. (Story & Naish 1973; p. 30)

(114) Impossibility of "k.n"

a. yaa **ka**-**na**-l-wál → yaa **ka**-**na**-l-wál ; * yaa **k**-**na**-l-wál
along thm-prog-CL-has.holes
It's getting holes in it. (Story 1966; p. 52)

b. nukshiyáan-ch ax̲ jín yaa a-**ka**-**na**-táx' → a-**ka**-**na**-táx' ; * a-**k**-**na**-táx'
mink-erg my hand 3Obj-thm-prog-bite.hard
The mink is biting hard on my hand.. (Story & Naish 1973; p. 30)

(115) Impossibility of "k.w"

a. tléil dax̲ a-**ka**-**wu**-s-yít → a-**ka**-**wu**-s-yít ; * a-**k**-**wu**-s-yít
not dist 3Obj-thm-perf-CL-stretch
He didn't stretch them. (Story 1966; p. 97)

---

[78] Examples (112), (113a) and (118) are schematic prefix strings taken from Leer (1991).

[79] The theme prefixes "ka" and "ya" may appear twice within their templatic 'slot'. The appearance of multiple prefixes within a single templatic Position clearly violates the standard notion of a 'morphological template'. Nevertheless, I leave the matter as an independent puzzle for future research.

b. a-**ka**-**wu**-sh-xeet-in → a-**ka**-**wu**-sh-xeet-in ; * a-**k**-**wu**-sh-xeet-in
3Obj-thm-perf-CL-write-decess
He had written it. (Story 1966; p. 111)

(116) Impossibility of "k.g"

a. yaa **ka**-**ga**-ga-du-tláakw → yaa **ka**-**ga**-x-du-tláakw ; * yaa **k**-**ga**-x-du-tláakw
along thm-fut-imp-4th-investigate
They are going to find out what happened. (Story & Naish 1973; p. 116)

b. yaa ji-**ka**-**ga**-gút-ch → yaa ji-**ka**-**ga**-gút-ch ; * yaa ji-**k**-**ga**-gút-ch
along hand-thm-3conj-go-generic
It is lowered. (Story 1995; p. 323; line 060)

(117) Impossibility of "k.k"

yaakw yaa **ka**-**ka**-na-l-tít → yaa **ka**-**ka**-na-l-tít ; * yaa **k**-**ka**-na-l-tít
boat along thm-thm-prog-CL-roll
The boat is really rolling along in the swell. (Story & Naish 1973; p. 175)

(118) Impossibility of "x.g"

CV-**ga**-**ga**-l-'root' → CV-**ga**-**ga**-l-'root' ; * CV-**x**-**ga**-l-'root'
4conj-imper-CL (Leer 1991; p. 196)

9.2.2Forms Illustrating the Admissibility of Certain Consonantal Sequences

Both Story (1966) and Leer (1991) contain 'prefix charts' which schematically illustrate the mapping of input prefix strings to their pronounced outputs.[80] Although these charts are of incalculable utility, they illustrate only the allomorphy of the prefixes in Positions 1 – 7. Happily, an examination of these charts easily establishes that the consonantal sequences in the five rows under (10) may be produced by Tlingit syncope. Nevertheless, simple consultation of the Leer and Story prefix charts cannot definitively establish whether syncope of the Position 8 prefix "ka" is blocked in precisely the environments where syncope is blocked for the position 7 prefix "ga", since the allomorphy of "ka" is not covered by those charts. Independent examination of available Tlingit materials does, however, reveal that all the sequences in the last row of (10) remain possible outputs when syncope targets the prefix "ka". The examples below argue for the derivability of each such sequence.

(119) Admissibility of "k.s"

a. naa.át a-**ka**-**sa**-gánt' → a-**k**-**sa**-gánt'
old.clothes 3Obj-thm-CL-burn
He's burning old clothes on the beach. (Story & Naish 1973; p. 38)

[80] See Leer (1991) p. 185 – 202 and Story (1966) p. 131 – 139.

b. sha-**ka**-**sa**-tán yáanax̱ aa → sha-**k**-**sa**-tán
head-thm-CL-steep mountain
That mountain is really steep. (Story & Naish 1973; p. 211)

(120) Admissibility of "k.dz"

yoo sh x̱'a-**ka**-**dzi**-yiḵg-ee aa → sh x̱'a-**k**-**dzi**-yiḵg-ee
refl. mouth-thm-CL-draw-subord
The one that draws itself up. (Story 1995; p. 321; line 022)

(121) Admissibility of "k.sh"

a. a-**ka**-**sha**-xéet → a-**k**-**sha**-xéet
3Obj-thm-CL-write
He's writing it. (Story 1966; p. 127)

b. té dynamite teen a-**ka**-**sha**-túkt → a-**k**-**sha**-túkt
rocks 3Obj-thm-CL-blow.up
They are blowing up the rocks with dynamite. (Story & Naish 1973; p. 32)

(122) Admissibility of "k.l"

a. sha-**ka**-**li**-g̱éi → sha-**k**-**li**-g̱éi
head-thm-CL-be.pretty
She's pretty. (Story & Naish 1973; p. 159)

b. x̱'a-**ka**-**la**-.ísh → x̱'a-**k**-**la**-.ísh
mouth-thm-CL-thread
Thread them! (Story 1966; p. 79)

(123) Admissibility of "k.dl"

a. áa **ka**-**dli**-x̱'at' → áa **k**-**dli**-x̱'at'
there thm-CL-be.unripe
They are unripe there. (Story & Naish 1973; p. 238)

b. áa a-**ka**-**u**-**dli**-xéetl' → áa a-**kw**-**dli**-xéetl'
there 3Obj-thm-irr-CL-be.afraid
He's scared of it. (Story 1966; p. 101)

(124) Admissibility of "k.d"

a. tu-**ka**-**da**-xíl'x̱ → tu-**k**-**da**-xíl'x̱
mind-thm-CL-worry
He worries. (Story 1966; p. 78)

b. k'úns' kei **ka-du**-héich → k'úns' kei **k-du**-héich
potato up thm-4th-dig
They dig up the potatoes. (Story & Naish 1973; p. 68)

(125) Admissibility of "k.x̲"

k'úns' daa-**ka-x̲a**-yéix̲ → k'úns' daa-**k-x̲a**-yéix̲
potato periphery-thm-1sg-peel
I'm peeling potatoes. (Story & Naish 1973; p. 147)

(126) Admissibility of "k.t"

a. yei **ka-too**-jéil → yei **k-too**-jéil
so thm-1pl-unload
We unloaded it. (Story & Naish 1973; p. 238)

b. yoo **ka-too**-ya-jee-k → yoo **k-too**-wa-jee-k
back-forth thm-1pl-CL-wonder
We wonder. (Story & Naish 1973; p. 249)

Unfortunately, I have not yet found examples in which the sequences "k.j", "k.k̲" or "k.g̲" are formed by syncope. However, I have neither been able to find examples in which syncope is blocked from creating these sequences. Given the proven ability for syncope of "ga" to create the sequences "k.j", "k.g̲" and "k.k̲",[81] as well as the ability for syncope of "ka" to create the sequences "k.d," "k.dl," "k.dz," and "k.x̲," it would be most reasonable to assume that these final two sequences are also generable by syncope.

9.3 The Absence of Boundary Symbols

Readers familiar with traditional Na-Dene studies may have noted that the analysis put forth in this paper makes no use of 'boundary symbols'. The traditional mechanism in the Na-Dene literature for limiting the application of a phonological process to a particular class of prefixes is by marking the boundaries of those prefixes with a unique 'boundary symbol'. The reader will no doubt have noted that the roles typically played by boundary symbols are in this work covered by the system of phonological domains illustrated in (105). But, was this change absolutely necessary?

In fact, the abandonment of boundary symbols is necessitated by the use of a constraint-based, output-oriented framework that seeks to derive phonological alternations from output phonotactics. Boundary symbols are an inherently rule-oriented formalism; the purpose of these symbols is to trigger the application of a rule, a transforming operation, and they do not fit well within an output-oriented framework. How, for example, would the analyst enforce phonotactic generalizations over prefixes adjacent to particular boundaries? A statement such as "a complex coda cannot appear to the right of any '+' boundary symbol" is much less natural than the simple requirement that complex codas not exist, relativized to a particular portion of the verbal complex.

[81] See Leer (1991) p. 194.

Furthermore, even if such uses of the boundary symbols are permitted, the boundary symbol formalism still acts to obscure certain crucial properties of the prosodic system. In particular, the boundary symbol formalism obscures the 'containedness relations' that hold between the various domains of the prefix string. To my knowledge, this point has not yet been adequately emphasized in the Na-Dene literature. Recall that within the ICD domain, coda coronal stops are deleted, but not within the CD domain. If our description of Tlingit phonology is to use boundary symbols, then the limited provenance of 'coda coronal stop deletion' would require that the prefixes of Positions 11 – 14 be separated by different boundary symbols from those separating the prefixes of Positions 1 – 10. Nevertheless, both the CD and the ICD observe the same constraint against high-toned vowels, and within both domains there applies a process of 'high-tone deletion'. High tones are deleted from the 'unreduced' incorporated nouns of the CD, and they are also deleted from the 'reduced' incorporated nouns of the ICD. In a system that employs only the formalism of boundary symbols, how would one state that the process of 'high-tone deletion' applies to all and only the prefixes of Positions 1 – 14? The best the analyst could do is state the generalization disjunctively, though a liberal use of 'curly brackets' would help to obfuscate the disjunction.[82]

On the other hand, if one were to employ the device of phonological domains, the distribution of the 'high-tone deletion' alternation could be captured by a single statement. Within such a system, the CD would be assumed to properly contain the ICD. Thus, the phonotactics of the CD might be enforced upon the prefixes of the ICD, but not *vice versa*. It would therefore be possible to state simply that the 'high-tone deletion' process occurs within the CD; nothing special need be said about the ICD prefixes. However, since the ICD is strictly smaller than the CD, it would be possible to remove coda coronal stops from within the ICD, but not thereby remove them from all prefixes of the CD.

It has been noted countless times in the literature that the phonotactic restrictions placed upon a Na-Dene prefix become weaker as one progresses further from the verbal root. This progressive phonotactic weakening is aptly captured within a system of nested phonological domains; the number of phonotactic restrictions a prefix is subject to would follow straightforwardly from the number of phonological domains it is contained within. Such progressively weakening phonotactics cannot be aptly captured within a system of boundary symbols. A single prefix is typically associated with but a single boundary symbol, and so at best one must stipulate that boundary symbols closer to the stem are subject to more stringent phonotactics than those further from the stem. Such a stipulation would be on equal ground to a stipulation randomly distributing the stringency of phonotactics across the prefix string, a phonological system that neither exists within the Na-Dene phylum, nor is describable within a framework employing phonological domains.

[82] There are numerous examples in the literature of rules technically stated disjunctively, though clearly intended to be a single rule applying over a continuous domain. To take one example at random, consider the rule of "*ghe*-Augmentation" put forth in Cook (1989, p. 153-154).

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