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Iterative Rounding Spread in Tlingit [Lingít] Towards an Account Grounded in Contrast

Tlingit [Lingít] is a Na-Dene language spoken largely in southeastern Alaska. Within this language, there exists an uncommonly productive rule of progressive rounding spread. This rounding spread occurs within roots, and all suffixes are subject to it. I will argue that a plausible analysis of Lingít rounding spread holds it to be grounded in mechanisms the language employs to accentuate the contrast between its rounded and unrounded segments.

The structure of this paper is as follows. In section 1, I introduce Lingít's rule of progressive rounding spread. After providing the segmental inventory of the language, I describe in three equivalent ways the process of rounding spread in Lingít. I follow this description of the process with examples illustrating its operation. Section 2 develops a basic OT system that generates the Lingít spread process. This basic system follows Kaun (1995) and McCarthy & Prince (1993) in hypothesizing that Alignment constraints drive the rightward spread of the rounding feature. Decisive criticisms are levied against this OT system in section 3. I begin to develop an alternative account in section 4 by introducing a number of hypotheses concerning how Lingít speakers articulate the various rounded and unrounded segments of their language. In section 5, I demonstrate how these hypotheses can be translated into an OT constraint system which successfully generates the Lingít spread process. The paper concludes in section 6 with a discussion of the merits and detriments of this proffered analysis.

1. Progressive Rounding Spread in Lingít

1.1 Segmental Inventory of Lingít

It will ease our description of Lingít rounding spread if we first introduce the sounds of the language. The consonantal inventory of Lingít is given in (1) and (2). Throughout this paper, I will use standard Lingít orthography to represent the segments of Lingít¹ (Dauenhauer & Dauenhauer 2000). Beside each segment in (1) and (2) is the IPA notation for the sound it represents.

¹ I will not, however, adopt the common orthographic convention amongst Lingít scholars of only indicating rounding on obstruents where it is contrastive.

(1)

		Alveolar	Lateral	Palatal
Stop	plain	d [t]		
	aspirated	t [t ^h]		
	glottalized	t' [t']		
Affricate	plain	dz [ts]	dl [tɬ]	j [tʃ]
	aspirated	ts [ts ^h]	tɬ [tɬ ^h]	ch [tʃ ^h]
	glottalized	ts' [ts']	tɬ' [tɬ']	ch' [tʃ']
Fricative	plain	s [s]	ɬ [ɬ]	sh [ʃ]
	glottalized	s' [s']	ɬ' [ɬ']	
Nasal		n [n]		
Glide				y [j]

(2)

		Velar		Uvular		Glottal	
		plain	round	plain	round	plain	round
Stop	plain	g [k]	gw [k ^w]	q [q]	qw [q ^w]	ʔ [ʔ]	(.w [ʔ ^w])
	aspirated	k [k ^h]	kw [k ^{hw}]	k̥ [q ^h]	k̥w [q ^{hw}]		
	glottalized	k' [k']	k'w [k' ^w]	ḳ' [q']	ḳ'w [q' ^w]		
Fricative	plain	x [x]	xw [x ^w]	χ [χ]	χw [χ ^w]	h [h]	(hw [h ^w])
	glottalized	x' [x']	x'w [x' ^w]	χ' [χ']	χ'w [χ' ^w]		
Glide			w [w]				

As shown in (2), the velar, uvular and glottal consonants of Lingít may all bear rounding phonemically. However, as can be seen in (1), there are no phonemically rounded coronal, lateral or palatal consonants in Lingít. Finally, in addition to its rounded stops and fricatives, Lingít also possesses a rounded glide: the labio-velar “w”.

The table in (3) displays the vocalic inventory of Lingít. Lingít possesses only two rounded vowels: the high back vowels “oo” and “u”.

(3)

		Front	Central	Back
High	long/tense	ee [i:]		oo [u:]
	short/lax	i [ɪ]		u [ʊ]
Mid	long/tense	ei [e:]		
	short/lax	e [ɛ]	a [ʌ]	
Low	long/tense		aa [a:]	
	short/lax			

Lingít therefore possess fourteen phonemically rounded segments: w, gw, kw, k'w, gw, kw, k'w, xw, x'w, xw, x'w, hw, oo, and u. We can, moreover, pair each of these rounded segments with an unrounded “counterpart.” The empirical motivation for such pairing will be apparent in the next section.

(4) ROUNDED: w gw kw k'w gw kw k'w xw x'w xw x'w hw oo u
 UNROUNDED: y g k k' g k k' x x' x x' h ee i

1.2 The Rounding Spread Generalization

Lingít is commonly described as having a wholly productive and regular process of “rounding spread” (Story 1966, p. 16; Naish 1966, p. 9; Leer 1991, p. 11). As we shall see, this process iterates in a manner reminiscent of standard rounding harmony. As might be expected, this entirely regular phonological process has a rather transparent phonotactic basis: the phonotactics of Lingít do not allow unrounded segments with rounded “counterparts” to follow rounded segments. This phonotactic generalization governs the root inventory of Lingít, and it will be shown to underlie phonological alternations visible in both nominal and verbal suffixes.

Let us first attempt to state the hypothesized “rounding spread generalization”; in the next subsection we will introduce a number of facts this generalization is intended to cover. The rule given in (5) compactly represents both the targeted phonotactic generalization, as well as its typical phonological reflex.

(5) Lingít Rounding Spread (Rule Statement):

If a rounded segment precedes a segment S with a rounded “counterpart”, then S is replaced with its rounded counterpart.

We might, however, wish to “unpack” the content of this rule in order to gain a more concrete statement of the generalization in question. The following description of the process as a surface generalization helps us to see details of the alternation more clearly.

(6) Lingít Rounding Spread (Phonotactic Generalization and Repairs):

Surface Generalization:

No sequences S_1S_2 where S_1 is rounded and S_2 is unrounded, and either

- (i) S_2 can bear rounding,*
- (ii) S_2 is a high vowel,*
- (iii) S_2 is a palatal glide.*

Repairs:

- (a) If (i) occurs in the input, then spread the rounding feature to S_2 .*
- (b) If (ii) occurs in the input, then S_2 is made back and supplied with rounding.*
- (c) If (iii) occurs in the input, then S_2 is replaced with the labio-velar glide.*

It will be shown in the next subsection that the rule in (5) and the repairs in (6) recursively iterate. In other words, the surface generalization stated in (6) holds absolutely of the output forms of Lingít; if a repair in (a) – (c) creates a form violating that generalization, then the appropriate repair in turn applies to that form.

Let us also observe here that a correct consequence of both (5) and (6) is that consonants for which rounding is not contrastive serve to “block” the rightward spread of rounding in Lingít. It follows from both (5) and (6) that a segment without a rounded “counterpart” is free to surface following a rounded segment. Moreover, its appearance there entails that the rounding from the preceding segment does not “spread” onto any following segment.

A very concrete description of the rounding spread process in Lingít might therefore be the following.

(7) Lingít Rounding Spread (Structure Preserving Process)

Rounding spreads as far to the right as possible. However, this spreading process will not make segments which do not independently exist in the Lingít inventory. How consonantals and non-consonantals satisfy the structure-preservingness of the process differ. A consonantal (obstruent) which cannot bear rounding will not undergo the process, and will halt any further rightward spread of rounding. A vowel or glide, however, will change their value of backness in order to facilitate the rightward spread of rounding. No segment changes its height value in order to facilitate rightward rounding spread.

Again, these statements are all generalizations about the shape of Lingít nominal and verbal roots, as well as descriptions of alternations visible in the nominal and verbal suffix strings. It appears, though, that this iterating rounding spread does not occur within the verbal prefix string of Lingít². We should therefore postulate that rounding spread in Lingít is limited to a particular phonological domain which includes the root and its suffixes, but excludes the string of prefixes before the root. I'll adopt as the name for this domain "the Tail". Throughout the rest of our discussion, I'll be implicitly assuming that the phonotactics driving rounding spread are limited to the Tail.

1.3 Illustrative Data

There are several features of Lingít which motivate the generalizations in (5), (6) and (7). The first, and most striking, concerns phonological alternations that certain suffixes undergo.

1.3.1 Spreading of Rounding in the Suffix String

In Lingít, there are a number of suffixes – both nominal and verbal – with the form V(C), where after rounded segments the V is realized as "oo", and after all other segments the V is realized as "ee".

- (8) a. Haat ga-gúd-een.
 here imperf-walk-contingent
 "Whenever he comes here..." (Story 1966; p. 106)
- b. Haat gut ga-nóogw-oon.
 here walk imperf-AUX-contingent
 "Whenever he comes here..." (Story 1966; p. 106)

The most natural interpretation of these alternations is that the V of these suffixes is underlyingly "ee" and surfaces "oo" when following a rounded segment. Furthermore, there is no suffix surfacing as "ee(C)" which does not become "oo(C)" when following a rounded segment.

Similar facts show that there are in Lingít a number of verbal and nominal suffixes with the underlying form C, where C is a consonant that can bear rounding. After rounded segments, this suffix bears rounding, and after all other segments the suffix surfaces without rounding.

² This claim runs counter to previous descriptions of Lingít (Story 1966, p. 16; Leer 1991, p. 11), which describe there being a limited process of regressive rounding spread in the verbal prefix string. However, as far as I can tell, the evidence for the prefixal rounding spread is a single alternation in one prefix ("ya" + "oo" = "woo"), which fails to have the iterative character of the suffixal rounding spread. I am therefore skeptical that such a process exists in the Lingít prefix string (further reasons for skepticism will be apparent in Section 3).

Nevertheless, there is no nominal or verbal root in Lingít containing a syllable whose nucleus is rounded *and* whose coda is an unrounded consonant with a rounded “counterpart.” That is, where C_1 is a roundable consonant, there are no roots containing the syllables $(C)ooC_1$, $(C)uC_1$, $(C)ooy$, $(C)uy$ ⁵.

Despite these two constraints on the co-occurrence of rounded and unrounded segments within the syllable, the syllable in a Lingít root is not generally disallowed any combination of rounded and roundable segments. For example, it is possible for a root in Lingít to contain a syllable with a rounded nucleus and an *onset* which is a unrounded consonant with a rounded counterpart. That is, where C_1 is a roundable consonant, there are plenty of roots containing the syllables $C_1oo(C)$, $C_1u(C)$, $yoo(C)$, $yu(C)$. Furthermore, Lingít does not disallow its roots from containing syllables with high, front nuclei and rounded codas. Roots of the form $(C)eeuw$, $(C)iw$, $(C)eeC^w$, $(C)iC^w$ are widely attested.

These individual constraints on the form of Lingít roots would follow from there being a more general phonotactic constraint banning all sequences S_1S_2 , where S_1 is rounded and S_2 is an unrounded segment with a rounded “counterpart.” Let us accept, then, that such a phonotactic constraint is active in Lingít. The phonological alternations described in 1.3.1 and 1.3.2 demonstrate the “repairs” which take place when an underlying form in Lingít contains sequences violating this phonotactic constraint. Such repairs are exactly those postulated in (5), (6) and (7). We therefore have strong reasons to suppose that the generalizations in (5), (6) and (7) are correct.

Now that we have established the generalizations in (5), (6) and (7), let us begin to develop an analysis of this Lingít phonotactic and its associated repairs.

2. A Basic OT System That Covers These Facts

The only framework in which phonological processes can be made to follow from surface phonotactics is Optimality Theory (OT). Let us therefore begin to develop an OT analysis of Lingít rounding spread.

Analyses of iterative rounding spread within OT typically rely on the use of Alignment constraints (McCarthy & Prince 1993, Kaun 1995). It is commonly hypothesized that the rightward spread of rounding seen in standard cases of “rounding harmony” is due to the activity of a constraint requiring that roundedness features be aligned with the right edge of some domain. Let us, for now, pursue the view that rightward rounding spread in Lingít is also due to the activity of this constraint. We will hypothesize that there is active in Lingít a constraint “Align([round],Tail,R)”, which assigns one violation star to a candidate for every syllable separating the right edge of the Tail from a roundedness feature. Moreover, we will hypothesize that this alignment constraint outranks the faithfulness constraint “Dep(Link)”, which assigns one violation

⁵ A point of clarification is necessary here. There are many words in Lingít whose orthographic representation would make them appear to be counterexamples to this claim. For example, the verbal root meaning “to soften” is written as “chook”. However, the Lingít orthography has the convention of not indicating rounding on obstruents which is the result of rounding spread. That is, Lingít orthography only indicates rounding on obstruents when it is contrastive. Ironically, it is the fact that there are no roots written as “CooCw” which indicates that rounding is not distinctive on obstruents in this environment.

star to a candidate for every autosegmental link not in correspondence with an autosegmental link in the input.

As we shall see, the ranking “Align([round],Tail,R) >> Dep(link)” derives the rightward spread of rounding in Lingít. However, in order for this spread to be “continuous”, we must posit that the constraint “NoGap” is undominated. NoGap is a constraint that is violated by candidates in which an autosegmental feature is linked to two segments, S_1 and S_3 , but not a segment S_2 appearing between them. By positing that NoGap is undominated, we capture the fact that the rightward rounding spread in Lingít never “skips” segments.

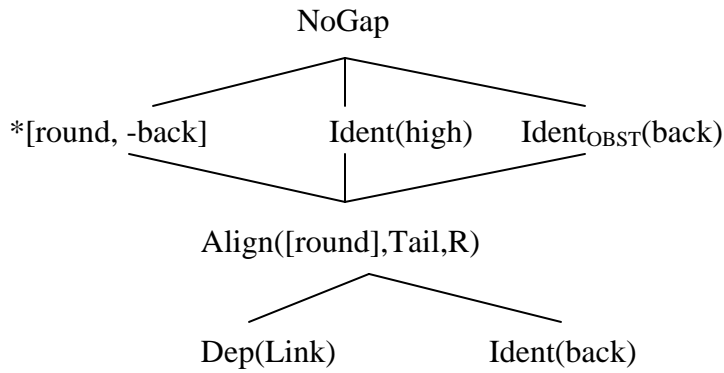
The remaining components of our constraint system will regulate which sorts of faithfulness and markedness violations may occur in order to facilitate the rightward spread of rounding in Lingít. One of the most interesting features of Lingít rounding spread is that it will not create outputs which contain sounds that are not already a part of the Lingít consonantal inventory. In particular, rounding spread will never create rounded coronal, lateral or palatal consonants, and it will never create any rounded central or front vowels. We can capture this property of Lingít rounding spread by positing that there is active in Lingít a markedness constraint “*[round, -back]”. This constraint assigns one violation star to a candidate for every rounded non-back segment it contains. If we assume that this constraint dominates Align([round],Tail,R), the “inventory sensitivity” of Lingít rounding spread naturally follows.

We have seen that the rightward spread of rounding in Lingít induces place changes in certain segments. In particular, the high front vowels (ee, i) will become back vowels (oo, u) in order to facilitate rounding spread. Similarly, the palatal glide “y” will harmonize to the ‘back’ labio-velar glide “w”. Thus, non-obstruents will change their backness value at the demands of roundedness alignment. However, we never see analogous alternations in the obstruents; alveolar “t” never becomes rounded velar “kw” as a result of rounding spread. It seems, then, that *only* the non-obstruents change their backness in order to harmonize. We might capture this more “malleable” nature of the Lingít vowels and semi-vowels by postulating the existence of two Ident faithfulness constraints: Ident_{OBS}(back) and Ident (back). The former Ident constraint only evaluates obstruents; the latter constraint evaluates segments of all types. If we rank the more specific Ident_{OBS}(back) constraint over Align([round],Tail,R), the resulting system will not allow rounding spread to induce a backness change in obstruents. However, if we also rank the more general Ident(back) constraint below Align([round],Tail,R), the system *will* allow rounding spread to induce a backness change in all other segments. Thus, the pattern of rounding spread this constraint system generates will be one in which only non-obstruents – the vowels and the glides – change their backness value in order to facilitate rounding spread.

Although Lingít rounding spread sometimes forces the backness of a segment to change, height is never altered as a result of rounding spread. The rightward alignment of roundedness never forces the vowels “ei” and “aa” to raise and become “oo”. Indeed, it is only the high vowels which ever ‘harmonize’ in Lingít, and it is probably no coincidence that the only rounded vowels in the language are high. We might easily capture this relative stability of the vocalic height feature by ranking the faithfulness constraint “Ident(high)” above the spread-driving constraint “Align([round],Tail,R)”.

Our initial, alignment-based analysis of Lingít rounding spread is thus the constraint system represented in (14).

(14) Initial OT System for Lingít Rounding Spread



Let us now examine some tableaux in order to verify the empirical adequacy of this system. The tableau in (15) demonstrates that this system captures many characteristics of Lingít rounding spread.

(15)

rd kweeyeek	NoGap	*[rd, -bk]	Id(high)	Id_OBST(back)	Align (rd, Ta, R)	Dep(Link)	Id(back)
rd kweeyeek					*! * * *		
rd \ / kweeyeekw	*!					*	
rd \ / kwüüyeek		*!			* * *	*	
rd \ / kwooyeek					*! * * *	*	*
rd \ / \ / \ / kwoowookw						* * * * *	* * * *

Ident_{OBS}T(back). The undominated status of NoGap entails that rounding spread in Lingít can never skip any intermediate segments. Therefore, if rounding is to spread past a segment such as “t”, it must somehow associate with that segment. As we see in the second candidate, rounding cannot simply associate directly with a faithfully surfacing “t”. Such a form would violate the highly ranked constraint banning rounded non-back sounds. However, neither can “t” be changed to a back sound in order to provide a host to the spreading roundedness feature. Such a form would violate the highly ranked Ident_{OBS}T(back). Since all these constraints dominate Align([round],Tail,R), the result is that any rightward spread of rounding is sacrificed in order to satisfy them. Thus, within this constraint system, any obstruent which cannot bear rounding will serve to block spread of any segments to its right.

Finally, the ability of non-high vowels to block rounding spread is illustrated in tableau (17).

(17)

rd kwaayeeek	No Gap	*[rd, -bk]	Id(high)	Id _{OBS} T(back)	Align (rd, Ta, R)	Dep(Link)	Id(back)
rd kwaayeeek					* * * *		
rd / \ / \ / \ kwääwookw		*!				* * * *	* *
rd / \ / \ / \ kwoowookw			*!			* * * *	* *
rd / \ / \ / \ kwaawookw	*!					* * *	* *

Again, the undominated status of NoGap requires that a rounding feature spreading past a non-high vowel also associate with that non-high vowel. However, any such association either violates the highly ranked “inventory constraint” or the equally high-ranked Ident(high) constraint. Therefore, non-high vowels are correctly predicted to block rounding spread in Lingít.

We have shown, then, that the constraint system in (14) is at least empirically adequate. It does derive the rounding spread generalizations in (5), (6) and (7). In the next section, however, we will consider some rather decisive arguments against an alignment-based account of this sort.

3. Problems With this Basic OT System

Although it can derive the targeted pattern, the basic, alignment-driven OT system developed in the previous section suffers from some insuperable conceptual deficiencies. The account is simply too descriptive in a number of regards.

First of all, the account fails to provide us with any deep understanding of why Lingít rounding spread possesses its apparent “inventory sensitivity.” In no other known language is rounding spread prevented from rounding a segment which does not bear rounding phonemically.⁶ After all, if a segment doesn’t bear rounding phonemically, then rounding on that segment simply isn’t contrastive. Thus, if such a segment were to become rounded in order to facilitate the rightward spread of rounding, there would be no loss of a contrast otherwise present in the language. In fact, one would rather expect those segments on which rounding is *contrastive* to resist rounding spread. Given that both “yook” and “yookw” are inputs constructible from the sound inventory of Lingít, one might naturally expect there to be some pressure *against* rendering them both homophonous at the surface. Clearly, Lingít doesn’t mind sacrificing this contrast in order to spread rounding further to the right. In itself, this fact may not be too surprising. What is surprising, however, is that this phonological process should be halted exactly when it creates a segment that *couldn’t* be confused with another phoneme in the language.

The analysis put forth in section 2 claims that this puzzling “structure preservation” is the result of a markedness constraint, *[round, -back], dominating the alignment constraint forcing rounding spread. Presumably, one would want to claim that this markedness constraint also determines the segmental inventory of Lingít. The idea would be, roughly, that Lingít has a general ban on rounded non-back segments, and this ban also applies to the output of the rounding spread process. However, the existence of such ‘inventory constraints’ has been seriously challenged by the work of Flemming (2001). After all, front rounded sounds are in no sense inherently “marked”; they occur in many of the world’s languages. It would therefore be preferable to view the “inventory sensitivity” of Lingít rounding spread as some sort of epiphenomenon deriving from deeper properties of the process.

Two other questionable constraints which the system in (14) relies upon are Ident_{OBS}T(back) and NoGap. The existence of the NoGap constraint is highly dubious on typological grounds. If NoGap were ever dominated by a featural alignment constraint, the consequent phonological system would be one in which a feature would seem to “jump” to the end of the word, skipping all intervening segments. No such phenomenon has ever been reported to exist, and so we should opt for a system which can avoid appeal to such a constraint. Furthermore, the existence of the highly specific Ident_{OBS}T(back) constraint is rather dubious on language-internal grounds. The intuition behind this constraint is that obstruents in Lingít are “less plastic” and undergo fewer phonological alternations than non-obstruents. It seems, though, that such a difference between obstruents and non-obstruents only arises in the case of rounding spread. With respect to all the other phonological rules of Lingít, there is no interesting “obstruent/non-obstruent” split. Therefore, we should also seek an analysis which avoids appeal to the Ident_{OBS}T(back) constraint.

⁶ This is especially clear if one considers rounding harmony to be one instance of rounding spread.

The most worrisome of the constraints in (14), however, is $\text{Align}([\text{round}],\text{Tail},\text{R})$. As an explanation of the existence in many languages of rounding harmony and other types of rounding spread, it seems far too ham-fisted. Why is there such an alignment constraint for the roundedness feature? Why should there be a tendency for *rounding* to spread towards the right and not other features, such as aspiration?

If the $\text{Align}([\text{round}],\text{X},\text{R})$ constraint could be provided some sort phonetic grounding, then it might be easier to accept a phonological analysis that makes use of it. Kaun (1995) proposes a phonetic account of rounding spread in which the $\text{Align}([\text{round}],\text{X},\text{R})$ constraint acts to improve the audibility of rounding. Kaun's proposal is that rounding spread serves to make salient an otherwise difficulty perceived (or distinguished) rounding feature. Accepting this as the phonetic motivation for rounding spread, we would then predict that rounding spread should be triggered most often by segments upon whom rounding is most difficulty perceived. As Kaun 1995 demonstrates, this typological prediction is indeed met out, at least if one considers most systems of rounding harmony.

So, could the need to make rounding more salient be what ultimately underlies Lingít rounding spread? Although Kaun 1995's analysis nicely accounts for features of rounding harmony in the Altaic languages, some difficult questions arise when we attempt to apply it to Lingít. The foremost is "what independent evidence is there that rounding is difficult to perceive in Lingít?" In particular, if rounding spread exists to make a roundedness feature more salient, why is rounding spread in Lingít triggered by "oo" ([u:])? After all, it's in the context of high, long, back vowels that the roundedness feature is *most* salient. Moreover, it's not at all clear which vowels Lingít speakers might otherwise confuse "oo" and "u" with if not for the presence of rounding spread. As the inventory in section 1 shows, there are simply no vowels in the Lingít inventory that share with "oo" and "u" more than one distinctive feature. The segments "oo" and "u" are the only back vowels, they are the only rounded vowels, and the only other high vowels are front and unrounded. Furthermore, recall that Lingít rounding spread will not occur if the rounded vowel of the root is followed by a non-back obstruent. There are *many* roots in Lingít of this form ("gut" = walk / come / go), and there is no sign that the rounded vowel is being lost from this environment. In short, there is no independent evidence that the rounding on Lingít vowels is difficult to perceive; in fact, all the evidence points in the opposite direction.

Now, one might venture the guess that Lingít rounding spread actually began as a process triggered solely by the rounded consonants, as rounding is difficult to perceive in this environment. After a while, this phonetically based rounding spread was "grammaticalized" and generalized to all rounded segments in Lingít, including the vowels. Although sensible, this account is wholly speculative (given that our documentation of Lingít only extends as far back as the 1880s). Also, it divorces the current Lingít phenomenon from any phonetic basis, returning it to the status of an arbitrary formal rule.

However, the strongest motivation against applying the Kaunian story to Lingít resides in the existence of a separate process which seems closely related to rounding spread. In the verbal prefix string, progressive rounding spread seems not to occur. In its place, we instead have a process of "regressive palatalization" (Story 1966; p. 17). In a certain subdomain of the prefix string, a rounded segment cannot precede an unrounded

A second special hypothesis the imagined account rests upon is that Lingít’s palatal glide “y” is pronounced with distinctly wide lip spread, wider lip spread than what “y” in English receives. This articulatory gesture is most likely an inheritance from an earlier period. According to the descriptions of Boas 1917 and Swanton 1911, Lingít had at the time of their studies only one glide, the back-glide /ɥ/. Like all back C’s in Lingít, this segment could bear rounding, in which case it became the labio-velar /w/. When this segment did not bear rounding, we might suppose that it was also pronounced with a wide lip spread, to distinguish it from its rounded cousin. One might suppose that when unrounded /ɥ/ transformed into unrounded “y” over the last century, the lip gesture of the glide was retained. In fact, a pronunciation with a wide lip spread might be the reason why unrounded /ɥ/ eventually became “y” in present day Lingít.

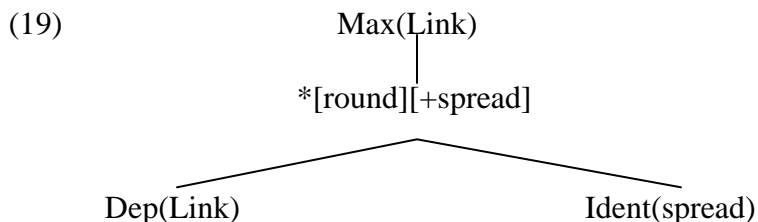
A more secure guess – though nevertheless a guess – regarding the phonetics of Lingít is that the high vowels “ee” and “i” ([i:] and [ɪ], respectively) are pronounced with much more lip spread than the non-high vowels. This special lip gesture would simply be a primitive feature of their articulation, as we observe that it also seems to be true of their correlates in English.

Let us now make one final hypothesis. Let us suppose that it takes a comparatively strong articulatory effort to follow a rounded segment, which has a protruded lip gesture, with a segment that has widely spread lip gesture. The “distance” between the two target positions is, in fact, so great that there exists a constraint banning sequences of this type. That is, let us postulate the existence of a phonological constraint “*[round][+spread]”, which is violated by sequences in which a rounded segment is directly followed by a segment with widely spread lip gesture. We hypothesize that this constraint has a grounding in articulatory phonetics, in the fact that because of the distance between the target positions, [round][+spread] sequences are inherently difficult to produce⁷.

As we shall see in the next section, these hypotheses can be combined together into an empirically adequate, but conceptually superior, OT analysis of Lingít rounding spread.

5. The Articulation-Based OT Model of Lingít Rounding Spread

Even if they are ultimately wrong, the special hypotheses in section 4 permit a rather simple analysis of rounding spread in Lingít. Consider the following constraint system.



⁷ As regards the existence of a *[+spread][round] constraint, I remain agnostic at this point. Perhaps something else mitigates the badness of [+spread][round] sequences, with the result that either such a constraint doesn’t exist or it is universally outranked by *[round][+spread]. Or, it could be that *[+spread][round] does exist, is freely rankable with respect to *[round][+spread], and we simply have yet to find a language in which this constraint is active.

last candidate in (20) illustrates that “regressive palatalization” cannot be used in the Tail to eliminate “round-spread” sequences. However, if we were to reverse the rankings of “Max(Link)” and “Dep(Link)”, the resulting system would one employing such a repair. This analysis therefore links together the processes of progressive rounding spread and regressive palatalization. We might within this system represent the phonological difference between the Tail and the prefix string in Lingít as simple differences in the relative ranking of Max(Link) and Dep(Link).

Other characteristic properties of Lingít rounding spread are illustrated in (21).

(21)

	Max(Link)	*[round][+spread]	Dep(Link)	Ident(spread)
			*! * *	* * *
			*!	*

The failure of the second candidate demonstrates how this analysis views the apparent “structure preservation” of Lingít rounding spread. The reason why segments without rounded “counterparts” are not subject to rounding spread is because there is simply no motivation for spreading rounding onto them. Recall that such segments are assumed *not* to be pronounced with wide lip spread. It follows that there is no markedness violation when they follow rounded segments. In other words, the ultimate reason why Lingít rounding spread seems not to create rounded segments absent from its segmental inventory is that such sounds would just not have any surface phonotactic purpose.

We have shown, then, that the constraint system in (19) also derives the rounding spread generalizations in (5), (6) and (7). Let us now discuss some of the strengths and weaknesses of this new proposal.

6. Discussion: Benefits of and Challenges to The Contrast-Based Analysis

The primary benefit of the proposals in sections 4 and 5 is that they provide answers to the questions raised in section 3 against the purely descriptive, alignment-based analysis.

First, the puzzling “inventory sensitivity” of Lingít rounding spread is, under the contrast-based analysis, only apparent. Rounding fails to spread onto certain segments

not because the result would be a segment not found in the inventory, but because such rounding spread simply isn't motivated in those environments. Because front obstruents, such as “t”, do not minimally contrast in rounding with another segment, they are assumed not to be produced with distinctly wide lip spread. Therefore, when such front segments are preceded by a rounded segment, the most faithful candidate incurs no violation of the constraint *[round][+spread]. Since it is violations of this constraint that are assumed to motivate Lingít rounding spread, no rounding spread is motivated in cases where front obstruents follow rounded segments.

This analysis also provides a principled explanation of the apparent difference between consonantal and non-consonantal segments with respect to how the “inventory sensitivity” of rounding spread is observed. Recall that it seemed, under the alignment-based analysis, that non-consonantal segments change their backness in order to facilitate rightward rounding spread, while consonantal segments do not. This difference between obstruents, vowels and glides had simply to be stipulated under the alignment-driven account by means of the constraint $\text{Ident}_{\text{OSBT}}(\text{back})$. Under the contrast-based account, however, such a stipulation need not be made. By reasoning that should by now be familiar, the resistance of “t” to change its backness value is due simply to the fact that rightward rounding spread is not motivated when it follows rounded segments. Thus, one can do away with the constraint $\text{Ident}_{\text{OSBT}}(\text{back})$ in one's analysis of Lingít, and simply rank the constraint *[round][+spread] above the single constraint $\text{Ident}(\text{back})$.

Happily, the contrast-based analysis allows one to also dispense with the dubious constraint ‘NoGap’. Under the contrast-based analysis, there is simply no motivation for the feature [round] to “skip” segments. Rounding spreads not to ‘reach a destination’; rather, it is in all cases motivated by the purely local need to ease pronunciation of certain otherwise stressful consonantal sequences.

Another benefit of the contrast-based analysis is, as has already been mentioned, that it conceptually links the processes of progressive rounding spread and regressive palatalization. Unlike the alignment-based theory, this account can view the processes of regressive palatalization and progressive rounding spread as deriving from the same phonotactic constraint. Different phonological domains may employ either of these repair strategies, the decision being based upon the relative ranking of $\text{Dep}(\text{Link})$ and $\text{Max}(\text{Link})$. Under the contrast-based analysis, it is therefore no coincidence that Lingít possesses both these processes and that they apply in complementary domains.

Perhaps the greatest advantage of the constraint system in (19) is, however, that it provides a sensible account of why rounding in Lingít should iteratively spread rightwards. Recall that under the alignment-based account, the existence of Lingít rounding spread rests ultimately in the activity of the constraint $\text{Align}(\text{round}, \text{X}, \text{R})$. As compared to the constraint *[round][+spread], there is little phonetic motivation for the activity of $\text{Align}(\text{round}, \text{X}, \text{R})$ within Lingít. Although rounding may be difficult to perceive on Lingít consonants, it is quite perceptible on Lingít vowels. Thus, the alignment-based analysis is rather hard-pressed to account for the fact that vowels in Lingít are robustly triggers of rounding spread. According to the contrast-based analysis, however, the rightward spread of rounding in Lingít is motivated not to make rounding more salient, but to avoid illicit sequences of articulatory gestures, ones that could be created by *any* rounded segment.

Despite these advantages of the contrast-based analysis, there are still some challenges it faces. Perhaps the most difficult is that there is reason to doubt the existence of the hypothesized ‘wide lip spread’ gesture which the analysis rests upon. Although Lingít is not a widely studied language, it has been investigated by several highly talented scholars. Within such works as Story (1966), Naish (1966), Story & Naish (1973) and Leer (1991), numerous fine details regarding the language’s phonology are recorded. Nowhere in these works, however, is there any suggestion that this hypothesized enhancement lip spread occurs on any segments of the language. Neither is there any mention of such a gesture in Maddieson et al. (2001), a work that studies in detail the articulation of Lingít consonants. Furthermore, Ian Maddieson reports (p.c.) that he does not recall witnessing such a gesture in the course of his research, and does not recall any facts which would support the existence of such a gesture.

Of course, doubts alone do not falsify the crucial articulatory hypothesis of the contrast-based analysis. Nevertheless, this articulatory hypothesis must be substantiated in some way before the contrast-based analysis can stand as a serious proposal. It is, however, not a trivial task to test this hypothesis without having direct, personal contact with a native speaker of the language. Although there exist publicly available video and audio tape recordings of Lingít, it is not clear how one could from such materials argue either for or against the crucial articulatory hypothesis. This is especially the case with respect to audio recordings, though video recordings present unique problems of their own.¹⁰

Even if corroborating evidence can be found to support the crucial articulatory hypothesis, there are still other, conceptual criticisms that face the contrast-based analysis. One of the most challenging is that the analysis relies upon a rather strange stipulation regarding the feature [spread]. It is clear from the tableaux in (20) and (21) that the contrast-based analysis must treat the feature [round] as privative and the feature [+spread] as a bi-valued. If this distinction is not maintained, then one loses the difference between the process of *progressive rounding* and that of *regressive palatalization*. Without the stipulated difference between [round] and [spread], the two processes are fully equivalent in their faithfulness violations, and so the proposed constraint system would not be able to distinguish them. This, of course, begs the question of whether this crucial distinction has any independent motivation. As of yet the answer is not clear.

In closing, let us note that the benefits of the contrast-based analysis are extremely encouraging, and should motivate a serious investigation regarding the presence of the hypothesized wide lip spread gesture. Such an investigation may require nothing less than direct face-to-face interaction with a native speaker informant.

¹⁰ One immediate challenge with respect to argumentation from video recordings of naturally occurring speech is how one determines from these recordings what is a ‘neutral’ lip posture for the speaker in question.

References

Boas, Franz. 1917. "Grammatical Notes on the Language of the Tlingit Indians." University of Pennsylvania University Museum Anthropological Publications 8:1.

Dauenhauer, Nora Mars and Richard Dauenhauer. 2000. *Beginning Tlingit*. 4th Edition. Sealaska Heritage Foundation Press. Juneau.

Flemming, Edward. 2001. "Contrast and Perceptual Distinctiveness." Hayes, B., R. Kirchner & D. Steriade (eds.) *Phonetically-Based Phonology*. Cambridge University Press.

Kaun, Abigail R. 1995. *The Typology of Rounding Harmony: An Optimality Theoretic Approach*. PhD Dissertation. UCLA.

Leer, Jeff. 1991. *The Schetic Categories of the Tlingit Verb*. PhD Dissertation. University of Chicago.

Maddieson, Ian, Caroline L. Smith and Nicola Bessell. 2001. "Aspects of the Phonetics of Tlingit." *Anthropological Linguistics* 43, p. 135 – 176.

McCarthy, John & Alan Prince. 1993. *Generalized Alignment*. Technical Report 3 of the Rutgers Center for Cognitive Science. Rutgers, New Jersey.

Naish, Constance. 1966. *A Syntactic Study of Tlingit*. Language Data; Amerindian Series 6. Summer Institute of Linguistics.

Naish Constance, Gillian Story, Henry Davis & Jeff Leer. 1996. *English – Tlingit Noun Dictionary*. Sheldon Jackson College. Fairbanks.

Stevens, K. N. and S. J. Keyser. 1989. "Primary Features and their Enhancement in Consonants." *Language* 65. p. 81 – 106.

Story, Gillian. 1966. *A Morphological Study of Tlingit*. Language Data; Amerindian Series 7. Summer Institute of Linguistics.

Story, Gillian and Constance Naish. 1973. *Tlingit Verb Dictionary*. Summer Institute of Linguistics.

Swanton, J.R. 1911. "Tlingit." Boas, Franz (ed.) *Handbook of American Indian Languages*. Bureau of American Ethnology; Bulletin 40. Washington, DC