Metathesis in Faroese and Lithuanian: from speech perception to Optimality Theory

Elizabeth Hume & Misun Seo

Synchronic alternations involving similar types of consonant/consonant metathesis are examined in Faroese and Lithuanian from both formal and functional perspectives. It is argued that by taking into account speech perception-based phonotactic constraints, we are able to gain insight into why metathesis occurs. The proposed formal account of the process is of particular theoretical interest given the apparent opacity involving the interaction of metathesis and place assimilation in Faroese. While straightforward in a serial-based account, this type of opacity has posed a challenge to Optimality Theory requiring the inclusion of additional formal devices into the theory. As we show, however, by modifying one assumption concerning the realization of the sequence, this additional formal machinery is rendered unnecessary. Opacity involving Faroese metathesis turns out to be an artifact of a particular phonological analysis.

Elizabeth Hume & Misun Seo, Ohio State University, Department of Linguistics, 222 Oxley Hall, Columbus, OH 43210, USA. E-mail: ehume@ling.osu.edu, mseo@ling.osu.edu

1. INTRODUCTION

Synchronic alternations involving consonant/consonant metathesis are observed in both Faroese and Lithuanian. The patterns are similar with respect to the segment types involved, the direction of change, and some conditioning environments. There are also differences, particularly as concerns the preceding context, the role of stress, and the interaction of metathesis with other phonological processes. The current study shows Lithuanian metathesis to be a more generalized version of the pattern observed in Faroese.

The account developed in this paper is both functional and formal in nature. In section 3, we consider the motivation behind metathesis in the two languages. Syllable-based accounts are shown to be unsuccessful in providing a unified and viable account of the processes. However, by drawing on speech perception-based phonotactic constraints we are able to gain insight into why metathesis occurs. In section 4, the formal part of the paper, we offer an Optimality theoretic account of metathesis in the two languages. The derivation of one class of words in Faroese is of particular theoretical interest. These involve the change of, e.g. /fransk-t/ to [frãŋst]

'French, neut.sg.', where the factors conditioning metathesis and place assimilation are hidden due to the absence of /k/, a classic case of derivational opacity. While straightforward in serial-based accounts, opacity has posed a challenge to Optimality Theory, requiring the inclusion of additional formal devices into the theory. However, as we show, by modifying one assumption concerning the realization of the sequence, this additional formal machinery is rendered unnecessary. Opacity involving Faroese metathesis turns out to be an artifact of a particular phonological analysis.

2. PATTERNS OF METATHESIS IN FAROESE AND LITHUANIAN

In both Faroese and Lithuanian, metathesis occurs across a morpheme boundary and involves a velar stop and coronal fricative. As shown in (1) for Faroese, the sequence [sk] can be observed at the end of the feminine singular form of adjectives (Lockwood 1955, Jacobsen & Matras 1961, Rischel 1972, H. Petersen, p.c.). The sounds also occur in this order in the masculine singular form, followed by a vowel-initial suffix. However, in the neuter singular form of adjectives, the segments surface instead in the order [ks]. The same pattern can be seen in verbs.

(1) Faroese

fem.sg.	*masc.sg.*	*neut.sg.*	*Gloss*
baisk	baiskʊr	baikst	'bitter'
fɛsk	fɛskʊr	fɛkst	'fresh'
rask	raskʊr	rakst	'energetic'
verb stem	*pres.sg.*	*past sg.*	
insk-	instʃɪr[1]	iŋ(k)stɪ	'to wish'

A similar pattern is observed in Lithuanian. The data is drawn from our own fieldwork, supplemented by forms from Kenstowicz (1972) and Ambrazas (1997). As shown in (2), Lithuanian metathesis also involves a coronal fricative and velar stop. The pattern can be seen by comparing the third person singular past imperfective verb forms with those of the imperative and infinitive. In the former, the order fricative + stop emerges while in the latter, the order is reversed, giving stop + fricative.

(2) Lithuanian

3sg.past imperf.	*imper.sg.*	*infinitive*	*Gloss*
plʸeske	plʸeksk	plʸeksti	'flash intensely'
tvʸeske	tvʸeksk	tvʸeksti	'flash briefly'
breʃko	brekʃk	brekʃti	'break (of dawn)'
brizɡo	briksk	briksti	'fray'

As shown, metathesis is only observed when the stop consonant is velar. Whether the process is actually limited to the velar stop or is more general in nature is difficult

to determine since there are no verbs or adjectives with a coronal fricative followed by a stem-final labial or coronal stop consonant in either language. Assuming that the process is more general is nonetheless consistent with sound patterns in both languages; restrictions on stop consonants hold over all stops, not just velars. For example, in Lithuanian, there is a prohibition against a sequence of three stop consonants within a monomorphemic word, regardless of place of articulation. Further, in Faroese, a stop consonant at any place of articulation is deleted when it would otherwise occur between a liquid and another stop consonant, e.g. /irk+tɪ/ [irtɪ] 'write poetry, past sg.'; /skarp+t/ [skart] 'sharp, shrivelled, neut.sg.'.

When it comes to the following conditioning context, Lithuanian metathesis occurs when the coronal/velar sequence is followed by any consonant. Examples in (3) illustrate metathesis occurring in the context of a following stop, fricative and liquid.

(3) Lithuanian

_ stop	bloʃke	blokʃk	blokʃti	'toss, 3sg.past; imper.sg.; infin.'
	mezge	meksk	meksti	'knit, 3sg.past; imper.sg.; infin.'
_ fric.	triʃko	trikʃta (<triʃk-sta)²		'sprout, 3sg.pres.; past'
_ liquid	tʃirʃkʸa	tʃirkʃlĭis		'chirp, 3sg.pres.; agent noun'
	nʸurzgʸa	nʸurgzlĭis		'growl, 3sg.pres.; agent noun'
	urzgʸa	urgzlĭis		'grumble, 3sg.pres.; agent noun'

In Faroese, metathesis is only observed when the sequence /sk/ occurs before a stop consonant, as shown in (4). All examples show the following stop to be coronal due to the fact that there are no suffix-initial stop consonants at other places of articulation in the language. Metathesis is not observed when an /sk/-final stem is followed by the genitive marker /-s/, e.g. *vask/vask-s* 'sink, nom./gen.sg.'. Nor is it attested when the plural genitive marker /-ra/ is added to forms ending in /-sk/, e.g. /fɛsk-ra/ [fɛskra] 'fresh, pl.fem.gen.', /frɪsk-ra/ [frɪskra] 'healthy, pl.fem.gen.' (Lockwood 1955). To our knowledge these are the only contexts with suffix-initial consonants where we would expect to find metathesis. Despite the fact that metathesis is not observed, it may well be the case that it is possible to generalize the following context to any consonant, as in Lithuanian. A reviewer points out that the genitive case is not productive in Modern Faroese, occurring almost exclusively in idioms, which are arguably unanalyzable to native speakers. For our present analyses we will continue to restrict the following context to a stop consonant but leave open the possibility that it may be more general. The choice is not crucial for the analyses that follow.

(4) Faroese

fem.sg.	masc.sg.	neut.sg.	Gloss	
tʊsk	tʊskʊr	tʊkst	'German'	*tʊskt
nask	naskʊr	nakst	'impertinent'	*naskt

Consider now the context preceding the metathesizing segments. In Faroese, metathesis occurs when the preceding segment is a vowel or nasal, as shown in (5). Note that the nasal agrees in place of articulation with the metathesized stop, whose phonetic realization is optional. The observation that the nasal consonant is velar even if the stop consonant is not fully articulated provides a good indication that metathesis has occurred.

(5) Faroese *masc.sg.* *neut.sg.* *Gloss*
       baiskʊr   baikst   'bitter'
       franskʊr   fraŋ(k)st   'French'
       spanskʊr   spaŋ(k)st   'Spanish'

No metathesis is observed in Faroese when the preceding segment is a liquid. Instead, the medial stop deletes, as in (6). Note that an underlying /rs/ sequence is realized as [ṣ].

(6) Faroese *masc.sg.*   *neut.sg.*   *Gloss*
       falskʊr   falst   'false, spurious'   *falskt, *falkst
       nɔṣkʊr /nɔrsk-ʊr/   nɔṣt /nɔrst/   'Norwegian'   *nɔṣkt, *nɔrkst

In Lithuanian, on the other hand, metathesis is observed after liquids as well as vowels. This was seen in (2), with a preceding vowel, and is shown in (7), with a preceding liquid.[3]

(7) Lithuanian
     3sg.past imperf. *imper.sg.* *infin.* *Gloss*
      nʸurzge   nʸurksk   nʸurksti   'to growl'
      urzge   urksk   urksti   'to grumble'

While there are no alternations showing metathesis of the fricative and stop when preceded by a nasal, all surface sequences with a preceding nasal reveal the expected order of segments, consistent with that observed for other preceding sonorants where metathesis has occurred; that is, Vŋ(k)SC rather than *VnSkC, e.g. bruŋ(g)zge, bruŋ(k)sk 'grinding stone, 3sg.past, imperf./imper.sg.' (S = coronal fricative). Thus, we can state more generally that metathesis of a coronal fricative and stop consonant occurs after any sonorant. When the consonant is a nasal, metathesis is vacuous.

The role of stress in metathesis differs in the two languages. In Faroese, the context for metathesis is conditioned by stress, which typically falls on the initial (or only) syllable of a word. The sequence /sk/ is only realized as [ks] if the preceding vowel is stressed, as shown in (8a). In words with a preceding unstressed vowel, metathesis is not observed. Instead, the medial stop deletes, as in (8b). It is important to emphasize that metathesis does occur in words in which the fricative/stop sequence is preceded by a nasal consonant, even if the preceding syllable is unstressed. In such cases, as in (8c), metathesis is attested in a manner identical to the forms in (5), again with the realization of the stop being optional.[4]

(8)   Faroese

	masc. sg	neut. sg.	Gloss	
a.	ráskʊr	rákst	'energetic'	*ráskt, *rást
b.	fɸːrɪsk	fɸːrɪst	'Faroese'	*fɸːrɪskt, *fɸːrɪkst
	rósːɪsk	rósːɪst	'Russian'	*rósːɪskt,*rósːɪkst
c.	ʊ́ʃlɛnsk	ʊ́ʃlɛŋkst/ʊ́ʃlɛŋst	'Icelandic'	

In Lithuanian, on the other hand, stress plays no role in the process. Metathesis is attested regardless of whether the adjacent context is stressed or unstressed, e.g. *mézge*, *méksti*, *megzlís* 'knit, 3sg.past perf./infin./agent noun'.

Throughout this discussion it has been assumed that in both languages the sequence stop + fricative is derived from the order fricative + stop. General sound patterns in the languages support this assumption. An account of Lithuanian metathesis along these lines can be informally described as follows: a coronal fricative + stop reverse positions when preceded by a sonorant and followed by a consonant. Thus, /plʸesk-ti/ is realized as [plʸeksti] 'flash intensely, inf.', but the underlying fricative/stop sequence surfaces unchanged before a vowel in [plʸeske] 'flash intensely, 3sg.past imperf.'. The alternative account is to assume that the order stop + fricative is basic and that the sequence fricative + stop is derived. Viewed from this perspective, the context conditioning metathesis would need to be when the sequence is preceded by a sonorant and followed by a vowel. However, this account makes incorrect predictions since, for example, it incorrectly predicts that a velar stop and coronal fricative should not occur before a vowel in the language, cf. [pokʃi] 'bang, 3pres.', [pokʃeti] 'bang, inf.'; [telkʃo] 'lie, 3pres', [telkʃoti] 'lie, inf.'.

Assuming that the order stop + fricative is basic is equally problematic for Faroese. Under this account, our informal description of metathesis in the language would need to be as follows: the sequence /ks/ is realized as [sk] word-finally and before a vowel. The problem is that [ks] occurs word-finally and before a vowel in many words in Faroese, as in, for example, [aks] 'ear of corn', [bʊksʊr] 'trousers, pl.'. On the other hand, to our knowledge, there are no words in which [sk] precedes a stop consonant. Thus, while assuming that /sk/ is realized as [ks] before a stop consonant is consistent with these language-wide generalizations, the alternative account is not.

Table 1 provides a summary of the relevant observations concerning metathesis in the two languages.

3. MOTIVATION

In this section, we consider the motivation behind metathesis in the two languages. We consider two approaches: the first draws on a syllable-based explanation while the second one makes use of perceptually motivated phonotactic constraints. Our conclusion is that the latter approach is superior.

Faroese	Lithuanian
Segments involved: [coronal fric.] + [stop] ~ [stop] + [coronal fric.]	
Direction: /fric.,stop/ → [stop, fric.]	
Following context Metathesis occurs before a stop consonant (perhaps generalizable to any consonant).	*Following context* Metathesis occurs before any consonant.
Preceding context Metathesis occurs when: o /k/ is preceded by a coronal fricative, or more generally, an obstruent o the coronal fricative is preceded by • a vowel or nasal (the nasal assimilates to the metathesized stop) • but not after a liquid (/k/ deletes)	*Preceding context* Metathesis occurs when: o /k/ is preceded by a coronal fricative, or more generally, an obstruent o the coronal fricative is preceded by a sonorant
Stress Metathesis occurs when the preceding vowel is stressed. (/nsk-t/ sequences undergo metathesis regardless of stress)	*Stress* Not relevant
Phonological variation Words with the sequence /nsk-t/ are variably realized as [ŋkst] or [ŋst].	*Phonological variation* Not relevant

Table 1. Summary.

3.1 Syllable-based accounts

In this section, we consider syllable structure as the driving force behind metathesis. Three potential accounts are discussed; in each, metathesis could be viewed as a potential repair strategy used to satisfy a syllable-based requirement, specifically: a. syllable-internal sonority restrictions, b. restrictions on complex onsets or codas, c. syllable contact. As we show, none of these approaches is able to provide a unified account of the observed patterns.

To begin, it might be argued that metathesis occurs to improve a syllable's sonority contour. This account is problematic, however, since the contour can be better in the non-metathesized forms. For example, under the assumption that fricatives are more sonorous than stops, a change in the ordering of /sk/ to [ks] does not improve the sonority contour in Faroese words like [fɛkst] 'fresh, fem.sg.' or Lithuanian words like [meksk] 'knit, imper.sg.', among others. If anything, metathesis makes the sonority contour of the syllable worse.

Alternatively, one might suppose that metathesis occurs as a means of avoiding certain onset or coda clusters. For example, a constraint against an onset or coda made up of two stops might rule out the unmetathesized sequences in the Faroese and Lithuanian words just presented. The problem with this account is that not all words that undergo metathesis contain otherwise ill-formed onsets or codas. For example, while clusters made up of two stops are infrequent in Lithuanian, they do occur in Faroese, e.g. *gikt*, *insekt*. Moreover, in Lithuanian words like [tʃirkʃli:s] there would be no motivation to change the order of consonants since the sequences

in the unmetathesized form, /tʃirʃk+li:s/, make well-formed clusters in the language: stop + liquid and fricative + stop + liquid are possible onsets in the language, e.g. [klaida] 'mistake', [sklaidyti] 'to scatter'. Consequently, this approach is unable to account for why the unmetathesized forms with similar syllable structures such as *[tʃirʃ.kli:s] and *[tʃir.ʃkli:s] do not surface.

Syllable contact has also been used to motivate metathesis (Vennemann 1988). In this view, metathesis would serve to make a coda more sonorous than the following onset. This account is problematic, however, since metathesis applies regardless of the sonority of the sounds involved. In Lithuanian, in particular, recall that any consonant can follow the fricative/stop sequence. Furthermore, metathesis in both languages occurs even when the relevant segments belong to the same syllable.

Based on these considerations, we conclude that syllable structure does not motivate metathesis in the two languages. Sonority will play a role in ruling out possible outputs, however, it is unable to account for why metathesis occurs in the first place. We offer an alternative account drawing on perceptually motivated phonotactic constraints.

3.2 Speech perception-based account

We hypothesize that metathesis is motivated by phonotactic constraints which have their roots in speech perception. Before turning to a discussion of the specific constraints, let us first consider the perceptual factors at play. Metathesis often (though not always, see Hume 2004) occurs in contexts of low salience with the result being that the metathesized form is superior to the expected unmetathesized form in terms of the overall perceptual salience of the segments involved (Hume 1998b, 2001).

Following Wright (1996) and others, we assume that perceptual salience is determined by both segment-internal as well as contextual properties. Segment-internal properties refer to the cues that are present regardless of context, such as the frication noise of a fricative consonant. However, a sound's perceptibility cannot be defined by reference to segment-internal cues alone. Sounds are always uttered within a context and some contexts provide better perceptual cues than others.

To illustrate this point, consider the perceptual cues to place and manner of articulation for stop consonants, as listed in (9) (based on Wright 1996).

(9)   Perceptual cues to place/manner for obstruent stops

Type	Cue	Distribution
manner:	silence	internal
	release burst	contextual: consonant release
	transition duration	contextual: VC, CV transitions
place:	F2 transition	contextual: VC, CV transitions
	burst spectrum	contextual: consonant release

As (9) reveals, the cues to manner include silence, the stop's release burst and the duration of the adjacent formant transition; only silence is present regardless of context. The dependency of a stop on contextual cues is even greater when it comes to place cues since both cues for place, the F2 transition and the burst spectrum, are contextual.

As compared to stop consonants, fricatives have stronger internal cues to both place and manner of articulation, as (10) indicates.

(10)   Perceptual cues to place/manner for fricatives

Type	*Cue*	*Distribution*
manner:	frication noise	internal
	noise duration	internal
place:	frication spectrum	internal
	frication amplitude	internal
	F2 transition	contextual: VC, CV transitions

As can be seen, with the exception of the F2 transition, all cues used to identify place and manner in fricatives are internal. Thus, we can conclude that fricatives have more robust internal cues to place and manner, while stops depend more heavily on contextual cues for their identification. This means that fricatives will generally fare better in contexts of relatively poor perceptibility.

This information, we would suggest, provides insight into the observed metathesis patterns in Faroese and Lithuanian. In both languages, the underlying sequence of a fricative and a stop is reversed just in case the stop consonant would otherwise be flanked by two consonants. This context can be considered particularly poor for the identification of the stop's place and manner of articulation due to the absence of vowel formant transitions, the potential absence of a release burst, and the masking of phonetic cues by adjacent consonants.

By metathesis, the order of the fricative and stop is reversed, with the weaker stop occurring in a more optimal context, that is, after a vowel. Not only is the perceptibility of the stop improved in this new position but, in addition, contrast among sounds in the sequence is enhanced. The gain in perceptibility achieved by realizing the stop in postvocalic position outweighs any potential loss incurred by shifting the fricative to interconsonantal position.

These observations are reflected in the formal phonological account by means of perceptually-based phonotactic constraints, as discussed in the following section.

4. AN OPTIMALITY THEORETIC ACCOUNT OF METATHESIS IN FAROESE AND LITHUANIAN

With the preceding discussion as a basis, we turn now to our formal account of Faroese and Lithuanian metathesis. Drawing on recent work in phonological theory,

our analyses are cast within the framework of Optimality Theory (OT), in which a given surface form is derived from an input by means of a universal set of ranked constraints (e.g. McCarthy & Prince 1993, Prince & Smolensky 1993/2002).

Metathesis describes a process that results from a mismatch in the linear ordering of segments in an input and the corresponding segments in the output. In OT, such a mismatch is penalized and formally encoded as a violation of the faithfulness constraint, Linearity, given in (11). Informally stated, Linearity requires that the linear ordering of the string of sounds in a given representation (S_1) is identical to the ordering in the corresponding representation (S_2). For our purposes, we may consider S_1 to be a string of sounds in the underlying representation of some word, and S_2 to be those in a potential output form.

(11)   LINEARITY (McCarthy 2000, McCarthy & Prince 1995)
        S_1 is consistent with the precedence structure of S_2, and vice versa.

For metathesis to occur at all, as opposed to deletion, epenthesis, segment merger, etc., Linearity must be ranked below other relevant faithfulness constraints, such as Max (don't delete), Dep (don't epenthesize), etc. Further, metathesis only occurs as a means of repairing some ill-formed structure. In OT terms, this means that a violation of Linearity must be forced in order to satisfy some higher ranked constraint. Otherwise, there is no justification for reordering segments in an output and the candidate most similar to the input in this regard will be selected.

We propose that the higher ranked constraint which forces a reordering of segments in the two languages is a contextual, or phonotactic, constraint (see, e.g. Jun 1995; Steriade 1995, 1997; Hume 1998b). Contextual constraints, referred to here as Avoid X/Y constraints (Hume 1998b), simply penalize the occurrence of a particular segment type in a particular context. For example, the constraint *stop/C_C penalizes the occurrence of a stop consonant between two consonants. We assume that Avoid X/Y represents a family of constraints comprised of all segments in all observed contexts.

(12)   AVOID X/Y (*x/y)
        Avoid positioning a segment type X in context Y.

Independent evidence for contextual constraints comes from, for example, patterns of laryngeal neutralization (Steriade 1997), the distribution of retroflex consonants (Steriade 1995), consonant/consonant metathesis more generally (Hume 1998b), and asymmetrical patterns of dissimilation in Greek (Tserdanelis 2001) and /h/-deletion in Turkish (Mielke 2001). In each case, not only do speech perception factors provide insight into the observed patterns, but the ranking of contextual constraints employed to describe the patterns reflects the scale of perceptibility of

the segments involved. A similar approach is adopted in the present case. Avoid X/Y constraints are thus assumed to force metathesis in Lithuanian and Faroese.

The crucial ranking of constraints from the family of Avoid X/Y above Linearity can force a change in the ordering of sounds, as shown in tableau (13). Since the ordering of segments in candidate (a) does not satisfy the contextual constraint, a violation is incurred. Switching the order, as in (b), violates Linearity but given the constraint ranking, this candidate is selected as the correct output.

(13)

		/VCtC/	*stop/C_C	Linearity
	a.	VCTC	*!	
☞	b.	VTCC		*

Contextual constraints may be ranked with respect to one another. For example, as discussed further below, in order to account for the observed patterns of metathesis, the following ranking is required: *stop/C_C ≫ * fricative /C_C. Informally stated, it is worse for a stop (T) to occur between consonants than it is for a fricative (S) to occur in this position. As illustrated in tableau (14), the crucial ranking of *stop/C_C above Linearity selects the metathesis candidate in (b) as the optimal surface form.

(14)

		/VSTC/	*stop/C_C	*fricative/C_C	Linearity
	a.	VSTC	*!		
☞	b.	VTSC		*	*

We assume that contextual constraint rankings are informed by our understanding of the perceptual salience of speech sounds (contextual and inherent factors) as reflected through language sound patterns. Phonetic factors are not, however, represented directly in the synchronic grammar. Yet, although phonetic factors are considered to be external to the formal theory and description of a particular language, their influence is reflected in both the constraints and the constraint rankings (for related discussion, see Hume & Johnson 2001).

4.1 Lithuanian metathesis

We begin with Lithuanian metathesis. Recall that in Lithuanian, a velar stop and coronal fricative metathesize just in case the stop is followed by another consonant. The stop shifts from a position between two consonants to a context in which it is preceded by a sonorant (vowel or consonant). We would suggest that this pattern reflects the view that place cues to the identification of a stop are less robust
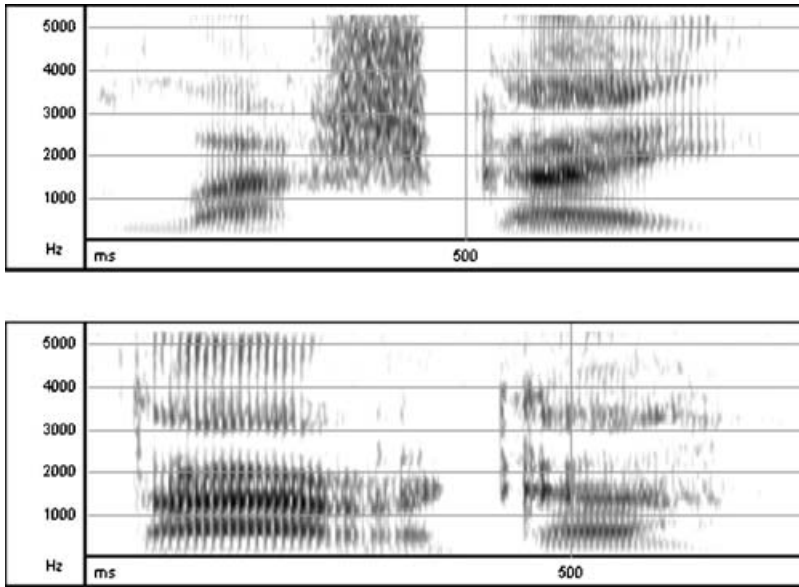
Figure 1. Lithuanian blaʃkai (first spectogram) and tarka (second spectogram).

perceptually when first, the stop is flanked by consonants rather than being preceded by a vowel, and second, the stop occurs after an obstruent rather than after a sonorant. (Note that generalizing the context preceding the stop to the class of obstruents is consistent with observed sound patterns of the language.) The spectrograms in Figure 1 illustrate this latter point; in the first, [blaʃkai] 'throw, 2pres.sg.', we see the velar stop following the fricative [ʃ], and in the second, [tarka] 'greater' illustrates a stop following the liquid [r]. We hypothesize that the more pronounced formant transitions present in the liquid provide stronger cues to place identification in the stop.

These observations, in conjunction with the observed pattern of metathesis in Lithuanian, motivate the contextual constraint in (15).[5,6] We assume that the constraint in (15) is part of the more general family of constraints represented as *stop/C_C (Avoid positioning a stop between two consonants).

(15)   *stop/obstruent_C: Avoid positioning a stop between an obstruent and a consonant.

The contextual constraint in (15) provides the motivation for metathesis, expressed formally as the crucial ranking of *stop/obst_C over Linearity, in (16).

(16)   *stop/obstruent _C ≫ Linearity

As shown in (17), this ranking correctly selects the optimal metathesized outputs of underlying forms such as /breʃk-k/ 'break (of dawn), imper.sg.', /tʃirʃk-li:s/ 'chirp, 3rd pres./agent noun', and /ursk-ti/ 'to grumble, infin.'.[7]

(17)

(i)		/breʃk-k/	*stop/obst _C	Linearity
	a.	breʃkk	*!	
☞	b.	brekʃk		*
(ii)		/tʃirʃk-li:s/		
	a.	tʃirʃkli:s	*!	
☞	b.	tʃirkʃli:s		*
(iii)		/ursk-ti/		
	a.	urskti	*!	
☞	b.	urksti		*

The ordering of consonants for each of the (a) candidates in (17) is faithful to the ordering in the relevant input. However, each violates the high ranking contextual constraint. In each of the (b) candidates the ordering fricative/stop has been changed to stop/fricative, violating Linearity. Given the proposed ranking, the second candidate is correctly selected in each case.

The constraints posited thus far are not sufficient to rule out all non-optimal metathesis candidates, as can be seen in the tableau just below. The same observation holds for ill-formed candidate *[tʃiʃrkli:s], cf. [tʃirkʃli:s] in (17ii).

(18)

		/ursk-ti/	*stop/obst_C	Linearity
	a.	urskti	*!	
☞	b.	urksti		*
*☞	c.	usrkti		*

Two candidates incorrectly emerge as winners. Candidate (b), the actual surface form, satisfies the high ranking constraint *stop/obst_C by switching the order of /s/ and /k/. In candidate (c), on the other hand, the constraint is satisfied by switching the order of /r/ and /s/ and it too is selected as optimal, though incorrectly.

Both ill-formed *[usrkti] and *[tʃiʃrkli:s] can be ruled out straightforwardly by drawing on the Sonority Principle (Sievers 1881, Jespersen 1904). As stated in (19a), the Sonority Principle (SP) expresses the observation that as you move

out from the syllable peak, sonority cannot increase. It may, on the other hand, decrease or alternatively, remain relatively constant. We assume the sonority ranking in (19b).

(19) a. Sonority Principle (Jespersen 1950:131)
          Between a given sound and the peak are only found sounds
          of the same, or a higher, sonority class.
      b. Sonority ranking (from most sonorous to least sonorous)
          vowels > liquids > nasals > fricatives > stops

A revised tableau (17) is provided in (20). SP must be crucially ranked below the phonotactic constraint *stop/obst _C in order to correctly generate forms like [brekʃk] in (20ib). Despite being worse than its competitor in terms of sonority sequencing, it satisfies the high ranking phonotactic constraint and is thus correctly selected. While SP is not crucial to predicting the correct output in (20i), it is in (20ii) and (20iii). The (b) candidate in each is properly ruled out by SP (a period between consonants indicates a hypothesized syllable boundary). For simplicity, we have included only one ill-formed candidate to illustrate the role played by SP though it is worth noting that placing the syllable boundary in other positions would also result in violations of SP, e.g. *[tʃiʃrk.li:s], *[tʃiʃ.rkli:s], *[usr.kti], *[us.rkti]. No crucial ranking appears to be required between Linearity and SP.

(20)

(i)		/breʃk-k/	*stop/obst _C	SP	Linearity
	a.	breʃkk	*!		
☞	b.	brekʃk		*	*
(ii)		/tʃirʃk-li:s/			
	a.	tʃirʃ.kli:s	*!		
	b.	tʃiʃr.kli:s		*!	*
☞	c.	tʃirk.ʃli:s			*
(iii)		/ursk-ti/			
	a.	ursk.ti	*!		
	b.	usrk.ti		*!	*
☞	c.	urk.sti			*

Given the proposed constraints and ranking, summarized in (21), accounting for metathesis in Lithuanian is straightforward.

(21) *stop/obst_C ≫ Sonority Principle, Linearity

4.2 Faroese metathesis

We turn now to our formal account of Faroese metathesis. As was shown above, Faroese displays a similar metathesis pattern as Lithuanian in that a pre-consonantal velar stop shifts away from a post-obstruent context to a position after a vowel or nasal. However, we also saw that there are differences between the two patterns. First, in Faroese, the preceding segment cannot be a liquid, as it can be in Lithuanian. If it is, /k/ deletes, as in /falskt/ → [falst] 'false, spurious, neut.sg.'. In cases involving /rsk/, not only does the velar stop delete, the /rs/ sequence is realized as the retroflex [ʂ], a general process in the language. When the metathesizing segments are preceded by a nasal, the realization of the metathesized velar stop is optional, e.g. /fransk-t/ → [fraŋkst] ~ [fraŋst] 'French, neut.sg.'. Finally, the velar stop does not surface after an unstressed vowel; instead, deletion occurs, e.g. /fø:rɪsk+t/ → [fø:rɪst] 'Faroese, neut.sg.'.

Similar to our account above, we assume that the contextual constraint *stop/obst_stop motivates metathesis in Faroese. Obviously, the difference between Lithuanian and Faroese in this regard is that for Faroese we limit the specification of the following context to stops (though see section 2 above for relevant discussion), while in Lithuanian, there is no restriction on the quality of the following consonant. The analysis of words such as [fɛkst] is straightforward given the ranking of *stop/obst_stop above Linearity, as shown in (22). Similar to Lithuanian, the ordering of consonants in candidate (a) is ruled out due to a violation of *stop/obst_stop. Candidate (b) satisfies the high ranking contextual constraint by reversing the order of /s/ and /k/ and so is selected. Also like Lithuanian, we must assume that SP is ranked below the phonotactic constraint which motivates metathesis. For simplicity, we will omit SP from the following tableaux.

(22)

		/fɛskt/	*stop/obst_stop	SP	Linearity
	a.	fɛskt	*!		
☞	b.	fɛkst		*	*

When stress is taken into account, metathesis is in competition with segment deletion. Recall that the velar stop does not surface after an unstressed vowel; instead, the stop deletes. From a phonetic perspective, the maintenance of the stop in a stressed context as opposed to an unstressed context is not surprising; perceptual cues to a consonant's identification are typically more robust in the context of a stressed vowel given the potential for increased duration and/or amplitude of cues resulting from prosodic prominence.

The stress-dependent nature of the observed metathesis pattern in Faroese can be accounted for by means of the two constraints in (23).

(23) *stop/v̆_c: Avoid positioning a pre-consonantal stop after an unstressed vowel.
  *stop/v́_c: Avoid positioning a pre-consonantal stop after a stressed vowel.

The ranking of the first constraint over the second captures the observation that a stop is worse after an unstressed vowel than after a stressed one.

(24) *stop/v̆_c: ≫ *stop/v́_c

Consider the derivation of /fø:rɪsk-t/ 'Faroese' in tableau (25). In this case, the stop /k/ does not surface, formally expressed as a violation of the correspondence constraint Max-C (informally defined as: 'Don't delete a consonant that occurs in the input.').[8]

(25)

		/fø:rɪsk-t/	*stop/ obst_stop	*stop/v̆_c	Max-C	*stop/ v́_c	Linearity
	a.	fǿrɪskt	*!				
	b.	fǿ:rɪkst		*!			*
☞	c.	fǿ:rɪst			*		

As usual, candidate (a) is ruled out by high ranking *stop/obst_stop. Candidate (b) is the expected output in Lithuanian where stress is not relevant. Here, the velar stop is preserved by reversing the order of /s/ and /k/ to satisfy the highest ranking constraint even though it is preceded by an unstressed vowel. Yet, with Max-C ranked below the *stop/v̆_c constraint, it is better for the velar stop to delete in an unstressed context, as in (c), than to remain, as in (b). Tableau (26) illustrates the crucial ranking of Max-C above *stop/v́_c and Linearity.

(26)

		/fɛsk-t/	*stop/ obst_stop	*stop/v̆_c	Max-C	*stop/v́_c	Linearity
	a.	féskt	*!				
☞	b.	fékst				*	*
	c.	fést			*!		

Metathesis is also in competition with deletion when a liquid precedes the /sk/ sequence. Recall that in Lithuanian, in this context, the order of /sk/ in the input is

reversed in the output, e.g. /nʸursk + t/ → [nʸurkst] 'to growl, imp.sg.'. In Faroese, on the other hand, no reordering of segments in observed; rather, the velar stop is not realized, e.g., /falsk-t/ → [falst] *[falkst] 'false'. However, as can be seen in (27), the ranking posited thus far is unable to correctly select candidate (c) where the stop deletes. Rather, candidate (b), with the stop following the liquid, is incorrectly predicted.

(27)

		/falsk-t/	*stop/ obst_stop	*stop/v̆_c	Max-C	*stop/v́_c	Linearity
	a.	fálskt	*!				
*☞	b.	fálkst					*
(☞)	c.	fálst			*!		

The reason why the stop deletes, we would suggest, is due to the heterorganicity of the sonorant consonant and interconsonantal stop in ill-formed words such as *[falkst]. When the stop agrees in place of articulation with the preceding consonant, as in e.g. /fransk-t/ → [fraŋkst] 'French', stop deletion is not obligatory (see section 4.2.1 below for detailed discussion of these forms). Thus, the difference between the two types of words has to do with the place of articulation of the sonorant consonant and /k/. Stop deletion is mandatory when the metathesized stop would be flanked by two consonants of which the first is non-homorganic with the stop. Reference to a following consonant is also required since a stop is otherwise well-formed after [l], e.g. [kɔlk] 'lime', [alt] 'all' (n.sg.). Informally stated, a stop is prohibited between a heterorganic sonorant consonant and another consonant.

(28)   *stop$_{[\alpha pl]}$/sonorant C$_{[\beta pl]}$_C (where [αplace] ≠ [βplace])

Tableau (29i) illustrates the correct derivation of the word [falst]. For comparison, we repeat the derivation of Lithuanian [urksti] from (20). Crucially for Faroese, constraint (28) is ranked above Max-C, thus forcing out candidate (ib), containing the heterorganic sequence [lk]. Instead, candidate (c), where no /k/ appears, is selected. In Lithuanian, ranking Max-C above Linearity predicts metathesis above deletion as a means of satisfying the phonotactic constraint. Further, under the assumption that constraints are universal (Prince & Smolensky 1993/2002), ranking constraint (28) below both Max-C and the high ranking phonotactic constraint predicts that in Lithuanian, candidate (iib) with the four-consonant sequence will surface, contrary to the observed pattern in Faroese.

(29) i.   Faroese

		/falsk-t/	*stop/ obst _ stop	*stop[αpl]/ sonC[βpl] _ C	Max-C	Linearity
	a.	falskt	*!			
	b.	falkst		*!		*
	c.	falkt		*!	*	
☞	d.	falst			*	

      ii. Lithuanian

		/ursk-ti/	Max-C	*stop/ obst _ stop	Linearity	*stop[αpl]/ sonC[βpl] _ C
	a.	urskti		*!		
☞	b.	urksti			*	*
	c.	ursti	*!			

4.2.1 An apparent case of opacity

In this final section, we address an interesting issue relating to Faroese metathesis. This concerns forms in which the /sk/ sequence is preceded by a nasal consonant, as in [fransk] 'French'. As noted above, there are two acceptable metathesis outputs: [fraŋkst] and [fraŋst]. In both instances, the nasal agrees in place of articulation with the metathesized velar stop; the realization of the oral stop is optional. Deriving [fraŋst] from /fransk-t/ would appear to be a classic case of derivational opacity where the effects of one or more processes are hidden by the effect of another. In the case at hand, the motivation for place agreement and metathesis are hidden due to the absence of the velar stop. In serial rule-based accounts, such cases of opacity are easily handled by the appropriate ordering of rules. For example, as shown in (30), we might assume three rules: metathesis, place assimilation and consonant deletion. By ordering metathesis and assimilation before deletion, the correct form is obtained.

(30) /fransk-t/ → frankst → fraŋkst → [fraŋst]
              Metathesis   Assimilation   Deletion

The inherent serial nature of this type of analysis poses a challenge to Optimality theoretic accounts, given the assumed parallel evaluation of candidates. To resolve this potential problem, a variety of formal strategies have been proposed, including harmonic serialism (Prince & Smolensky 1993/2002), Sympathy Theory (McCarthy, to appear), OT-Lexical Phonology (Kiparsky, to appear), cyclic constraint evaluation

(e.g. Kenstowicz 1995, Booij 1996), among others (see McCarthy 2002 for an overview of these and other approaches). While the mechanics of the various approaches differ, they all share at least one thing in common: in each case, additional formal machinery must be incorporated into the theory to account for cases of opacity.

While the Faroese pattern appears to typify phonological opacity, we suggest that by changing a single assumption regarding the processes involved, not only is the account straightforward, it does not require the opaque interaction of processes. In other words, opacity turns out to be an artifact of a particular formal analysis.

Consider how this alternative approach handles words with a nasal consonant preceding /sk/, e.g. franskʊr, fraŋkst ~ fraŋst 'French, masc.sg., neut.sg.'. The form of particular interest at this point is [fraŋst], in which the nasal consonant is realized as velar even though the velar stop is absent. But is it absent? An alternative to viewing [ŋ] as the result of place assimilation and stop deletion, as above, is to treat it instead as coalescence, the approach we adopt.[9] In this light, the merged consonant [ŋ] is comprised of the manner of the first consonant and the place of articulation of the second. From a phonetic perspective, the velar nasal resulting from *nk* is simply the consequence of a high degree of articulatory overlap (Byrd 1994). In OT terms, the merging of two consonants results in a violation of the constraint Uniformity, given in (31).

(31)   UNIFORMITY 'No Coalescence' (McCarthy & Prince 1993)
        No element of S_2 (the output) has multiple correspondents in S_1 (the input).

Uniformity is independently motivated in Faroese, as it is also relevant to the analysis of forms in which the sequence *rs* is systematically realized as ʂ, e.g. /nɔrsk-t/ → [nɔʂt] 'Norwegian'. For our present purposes we will assume that the constraint forcing a violation of Uniformity is simply characterized as *rs although further research may reveal a more insightful formulation of the constraint. The derivation of [nɔʂt] is illustrated in tableau (32). Candidates (a) and (d) are ruled out by at least high ranking *rs. Although the sequences in (b) and (c) satisfy this constraint, they are ungrammatical due to violations of the phonotactic constraints motivated above. Finally, although the surface form (e) incurs violations of Max-C (due to the absence of /k/) and Uniformity (due to coalescence of /rs/), it is nonetheless selected as optimal.[10]

(32)

	/nɔrsk-t/	*rs	*stop/ obst_stop	*stop[apl]/ son[βpl]_C	Max-C	Uniformity	Linearity
a.	nɔrskt	*!	*				
b.	nɔskt		*!			*	
c.	nɔrkst			*!			*
d.	nɔrst	*!			*		
☞ e.	nɔʂt				*	*	

But what forces coalescence in the case of [fraŋst] from underlying /franskt/? For this, we draw on the constraint *Nstop, which prohibits a nasal consonant followed by a stop (see Hyman 2001 on *NT and *ND, and Pater 1997 and Hayes 1999 on *NT, where T, D represent voiceless and voiced stops).

(33)   *NStop: A nasal followed by a stop is prohibited.

Incorporating *NStop into the constraint ranking provides a straightforward account of [fraŋst], shown in tableau (34). Of the four candidates considered, (a) is most faithful to the input yet ungrammatical, given the interconsonantal velar stop. Candidate (b), a metathesis candidate and well-formed alternate realization of the input, fails since the occurrence of [nk] creates violations of *Nstop and the heterorganic stop/sonorant constraint. Candidate (c) differs from (b) only in that the homorganicity of the nasal and stop eliminates one violation. Two means of satisfying *NStop are illustrated: deletion of /k/, resulting in candidate (d), and coalescence of /nk/, giving (e). Given the crucial ranking of Max-C over Uniformity, the latter candidate is correctly selected as the output. Naturally, candidate (e) also incurs a violation of Linearity since the linear position of the velar in the output is not faithful to that in the input.[11,12]

(34)

		/fransk-t/	*stop/ obst_stop	*stop$_{[\alpha pl]}$/ sonC$_{[\beta pl]}$_C	Max-C	*NStop	Uniformity	Linearity
	a.	franskt	*!					
	b.	frankst		*!		*		*
	c.	fraŋkst				*!		*
	d.	franst			*!			
☞	e.	fraŋst					*	*

Consider now the realization of [fraŋkst], the alternate pronunciation of /fransk-t/. In this case, both the nasal and the stop are pronounced and, importantly, they share the same place of articulation. This cannot be due to coalescence since both consonants are present in input and output and thus the output satisfies Uniformity. Rather, we see shared place as a response to the high ranking constraint, Agree-Place (35). As the name suggests, Agree-Place requires a nasal consonant and following stop to agree in place of articulation.[13]

(35)   AGREE-PLACE: A nasal agrees in place of articulation with a following stop.

Before illustrating the derivation of [fraŋkst], however, one more issue must be addressed: forms with an /nsk/ sequence have two possible realizations, e.g. [fraŋkst]/[fraŋst]. Phonological variation of this sort has received a variety of different

formal accounts in Optimality Theory; the choice of formal method is not crucial to our analysis. For our purposes we make use of VARIABLE CONSTRAINT RANKING (see, e.g. Reynolds 1994, Kang 1997). In this approach it is assumed that the variable realization of an input results from different rankings of a set of constraints. For example, given two constraints, A and B, the ranking A ≫ B would predict variant X, while the ranking B ≫ A would predict variant Y. Both rankings co-occur within a single grammar.

For variable constraint ranking to successfully account for the Faroese pattern, we may assume that the markedness constraint *NStop is variably ranked with the faithfulness constraint Uniformity. When *NStop is ranked below Uniformity, it is more important for the faithfulness constraint to be satisfied and thus the metathesized candidate [fraŋkst] emerges as optimal, as shown in (36i). When *NStop is ranked above the faithfulness constraint, coalescence occurs as a means of satisfying the prohibition against a nasal/voiceless stop sequence. This is illustrated in (36ii), based on tableau (34). Tableau (36i) also illustrates the crucial ranking of Uniformity above Linearity. Were the ranking reversed, we would incorrectly predict candidate (d) as the winner in this tableau as well as in the next.

(36) i. Uniformity ≫ *Nstop

	/fransk-t/	Agree-Place	*stop/ obst _ stop	*stop_{[αpl]}/ sonC_{[βpl]}_ C	Max-C	Uniformity	*NStop	Linearity
a.	franskt		*!					
☞ b.	fraŋkst						*	*
c.	frankst	*!		*!			*	*
c.	franst				*!			
d.	fraŋst					*!		*

ii. *NStop ≫ Uniformity

	/fransk-t/	Agree-Place	*stop/ obst _ stop	*stop_{[αpl]}/ sonC_{[βpl]}_ C	Max-C	*NStop	Uniformity	Linearity
a.	franskt		*!					
b.	fraŋkst					*!		*
c.	frankst	*!		*!		*		*
c.	franst				*!			
☞ d.	fraŋst						*	*

An important consequence of this analysis is that the realization of input forms like /fransk-t/ is handled straightforwardly, without assuming the opaque interaction

of constraints or processes. The surface form [fraŋst] involves both metathesis and coalescence of the nasal and velar stop; that is, the output is unfaithful to the input in terms of Uniformity and Linearity. Linearity is also violated by the alternate pronunciation [fraŋkst]. The crucial difference between the two variants has to do with the degree to which the nasal and velar stop have merged. In [fraŋkst] both segments share the same place, thus satisfying Agree-Place, yet maintain distinct manners of articulation. In [fraŋst], on the other hand, merger is complete; they share not only the same place but the same manner as well. The two realizations can be seen as the phonological reflex of different stages of the phonetically natural phenomenon of articulatory overlap.

This analysis of the Faroese pattern seems to be on the right track for a number of reasons. First, the formal analysis itself is straightforward, making use of independently motivated constraints. Second, viewing the variable realizations as reflecting different stages of segment merger is phonetically motivated. Third, and equally important, accounting for the observed patterns does not require recourse to derivational opacity and, thus, no special formal machinery is needed to account for the facts. Interestingly, opacity turns out to be an artifact of a particular phonological analysis. The extent to which other putative cases of opacity can be reanalyzed is an important research question, yet one that will be left for future exploration (see Mielke, Armstrong & Hume 2003 for related discussion).

4.2.2 Summary

In our account of Faroese metathesis, the *stop/obst_stop constraint is treated as the motivating factor in all cases and, thus, is crucially ranked above Linearity. Faroese is similar to Lithuanian in this regard. However, unlike Lithuanian, two contextual constraints are required to account for the stress-dependent nature of process; metathesis is not predicted to occur when the preceding vowel is unstressed. Reference to the segment type 'vowel' in the constraints necessarily excludes cases in which a stop metathesizes to postnasal position, regardless of stress.

(37)   *stop/v̆_c $\gg$ Max-C $\gg$ *stop/v́_c, Linearity

Deletion of the stop after a liquid is expressed through the interaction of the place-sensitive contextual constraint *stop$_{[\alpha\text{pl}]}$/sonC$_{[\beta\text{pl}]}$_C and the faithfulness constraints, Max-C and Linearity, shown in (38).

(38)   *stop$_{[\alpha\text{pl}]}$/sonC$_{[\beta\text{pl}]}$_C $\gg$ Max-C $\gg$ Linearity

Finally, coalescence of two sequences, nasal-voiceless stop and r-s, receives a formal account through the outranking of the faithfulness constraint Uniformity by both *NStop (variably) and *rs.

(39)   *rs, *NStop ≫ Uniformity

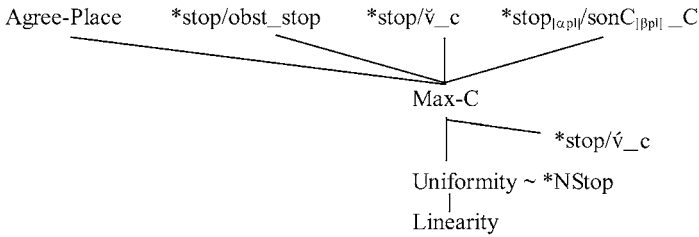A summary of constraint rankings for Faroese is illustrated in Figure 2.

Figure 2. Faroese constraint hierarchy.

5. CONCLUSION

As we have shown in this paper, metathesis in Lithuanian and Faroese share much in common: a stop and fricative are involved in both; metathesis applies in the same direction (fricative + stop → stop + fricative); and both patterns are perceptually motivated. There are also a number of differences with respect to the preceding context, possibly the following context, the role of stress, and the interaction of metathesis with other phonological processes. By comparing the analyses of the two languages it can be seen that the pattern in Lithuanian is essentially a more general version of the one in Faroese, the latter requiring more constraints, less general environments in the constraints, and additional conditions. Whether or not the differences in complexity impact the learnability of the processes remains an empirical question.

Of particular theoretical interest in the paper is the finding that derivational opacity is simply an artifact of a particular phonological analysis of the Faroese patterns. By modifying the assumption that the realization of *nk* as [ŋ] is due to coalescence rather than place assimilation plus stop deletion, it becomes unnecessary to introduce additional formal machinery into the analysis in order to account for the apparent opaque interaction of processes. As noted above, the extent to which other putative cases of opacity can be reanalyzed is an important research question and one that merits further investigation.

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NOTES

1. Note that sonorant consonants are always voiceless before a voiceless obstruent. Thus, a more phonetically faithful transcription of [instʃɪr] would be [in̥stʃɪr]. Note also that palatalization has changed the velar stop to an alveopalatal affricate before the front vowel.

2. Adjacent sibilants are simplified to a single palato-alveolar fricative by an independent process in the language.

3. No words could be found with a preceding [l] which we interpret as an accidental gap.

4. We are grateful to a reviewer for bringing this pattern to our attention.

5. Classificatory terms such as OBSTRUENT and STOP used in the formulation of constraints should be interpreted as abbreviations for the distinctive features needed to characterize the relevant class of sounds. The term STOP is used to refer to obstruent stops only, nasal consonants excluded.

6. Further study may reveal that each of the proposed contextual constraints is, in fact, the conjunction of two individual constraints. In this view, *stop/obstruent_C, for example, would be divided into the constraints *stop/obstruent_ and *stop/_C. The present data do not require this analysis, however, and so we have opted for the simpler formulation, with a single constraint.

7. As aptly pointed out by a reviewer, in OT analyses there are always failed candidates left out of tableaux and the present paper is no different in this regard; clearly, not all candidates can be included. We assume, however, that these absent candidates are ruled out by constraints ranked at least higher than Linearity. Consider, for example, the ill-formed candidate *[urskit] (/ursk-ti/ → [urksti]), where the high ranking phonotactic constraint is satisfied by metathesizing the consonant and vowel of the suffix rather than the final two consonants of the stem. A similar pattern occurs in Leti and many other cases of metathesis, where it is consistently stem-final segments that are affected (see Hume 1998a). The preference for segments at the end as opposed to the beginning of a morpheme to undergo change is consistent with the findings of Beckman (1998), who posits positional faithfulness constraints to account for the observation that certain positions in the word, for example, are more prone to modification than others. We refer the reader to the works cited for more detailed discussion.

   An additional class of candidates that needs to be ruled out involves those in which the stop consonant metathesizes with the initial consonant of the following suffix. This would

give, for example, *[tʃirʃlkiːs] from /tʃirʃk-liːs/, instead of well-formed [tʃirʃkliːs]. There are a variety of ways to rule out such forms. For example, one might draw on the constraint Contiguity, to prohibit the insertion of a segment between two tautomorphemic segments (see Kenstowicz 1994, Hume 1998a for related discussion).

8. The candidate *[førɪsk] ties with the optimal candidate [føːrɪst] in (25). In the former, the suffixal consonant /t/ deletes, while in the latter, the final consonant of the root is deleted. To account for the failure of /-t/ to delete, it is reasonable to assume a constraint which penalizes deletion of a segment which alone carries the meaning of a morpheme, as is the case with the suffixal consonant /-t/ (neut.sg.).

9. We are grateful to a reviewer for suggesting a coalescence approach.

10. An additional failed candidate *[nɔkʂt] can be easily ruled out given that the sequence [kʂt] is non-occurring in the language; the retroflex sibilant never occurs between stop consonants. We can then assume an undominated phonotactic constraint to this effect.

11. Non-optimal candidate *[fransk] would presumably be ruled out for the same reason as discussed in note 8, that is, by a constraint which penalizes deletion of a segment which alone carries the meaning of a morpheme.

12. As a brief aside, note that this analysis also provides a straightforward account of forms in which the /nsk/ sequence occurs after an unstressed vowel, e.g. /ʋislɛnsk-t/ → [óʃleŋkst] ∼ [óʃleŋst] 'Icelandic', cf. e.g. /føːrɪsk-t/ → føːrɪst (see (25)). The realization of /ʋislɛnsk-t/ is identical to that observed for all other /nsk/ sequences, e.g. fraŋkst ∼ fraŋst. Note that, unlike other forms in which /sk/ is preceded by in an unstressed syllable, the stress constraints are not relevant in the case of /ʋislɛnsk-t/ since the stop is preceded by a nasal consonant, not a vowel.

13. Discussion of the Agree constraint can be found in, for example, Gnanadesikan (1997) and Beckman (1998).

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