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Icelandic Preaspiration and the Moraic Theory of Geminates

In this paper I provide an Optimality Theoretic (OT) account of Icelandic preaspiration that relies on both the moraic theory of geminates (Hayes 1986, McCarthy & Prince 1986) as well as the bisegmental theory of aspiration proposed by Steriade (1993, 1994). The main claim of the anlaysis is that preaspiration is a type of metathesis between the stop and the aspiration. Following Thráinsson (1978) and Hermans (1985) I assume that preaspiration is contingent on lengthening of consonants in stressed syllables. This restriction is captured in an OT grammar through relative ranking of constraints. The analysis is further supported by a typology of preaspiration processes.

0. Introduction

Selkirk (1990) argues that Icelandic preaspiration is a case of laryngeal fission which supports the two-root theory of geminates. Since consonant clusters and geminates are both targeted by this process the representation of both should be similar. The two-root theory captures this similarity since it states that geminates are consonant clusters at the root level. However, Selkirk's analysis rests on the assumption that post-aspirated stops are single segments. Here I argue against that assumption and for a single melody theory of geminates. Following Thráinsson (1978) and Hermans (1985) I propose that preaspiration is directly tied to lengthening of consonants in closed syllables. Furthermore, I argue (following Steriade 1993, 1994) that aspirated stops are in fact bisegmental. Rather than preaspiration targeting geminates and clusters, I analyze preaspiration as being blocked in the case of singletons. Geminates and clusters in Icelandic both shorten long vowels in stressed syllables thus enabling preaspiration.

0.1 Distribution of post and pre aspirates

Icelandic has three surface stops, postaspirated, preaspirated and unaspirated. In the North dialect of Icelandic these stops have the following distribution.

(1) *Distribution of Icelandic stops* - North Dialect

		Aspirated	Preaspirated	Unaspirated[1]
Word initial	a.	.t^{h}aa.la. 'talk'	*.htaa.la.	.taa.lʏr. 'valley'
After long vowels	b.	.aa.p^{h}i. 'monkey'	*.uu.hpi.	.ii.puð.[2] 'habitation'
	c.	.sii.t^{h}ja. 'sit'	*.sii.htja.	*.sii.tja.
	d.	.heiit^h. 'hot'	*.haahp.	*.haat.
after short vowels	e.	*.k^{h}ɔ.p^{h}ɪ.	.uh.pi. 'upstairs'	*.k^{h}ɔ.pɪ.
	f.	*.heit^h.	.hahp. 'luck'	.snökk. 'sudden'
	g.	*.ep^h.li.	.eh.pli. 'apple'	.nak.lar. 'nails'
after consonants	h.	.svun.t^{h}a. 'apron'	*.svun.hta.	.han.ta. 'for'
	i.	*.fɪs.k^{h}ʏr.	*.fɪs.hkʏr.	.fɪs.kʏr. 'fish'
	j.	*.sk^{h}ouːr.	*.shkouːr.	.skouːr. 'shoe'

[1] Einarsson (1945) describes the unaspirated stops as slightly voiced intially.

[2] This word is bimorphemic, i-, buð. A brief suvey of Einarsson's (1945) glossary revealed no monomorphemic words with intervocalic unaspirated stops that were not geminates. The same holds for final stops. This issue deserves more research.

Preaspirated and postaspirated stops are in complementary distribution. Preaspirated stops cannot occur initially, after long vowels, or after consonants, (1a-d and h-j). Given the phontactics of Icelandic, this means that preaspirated stops are not possible onsets. On the other hand, post aspirated stops cannot appear after short vowels, (1e-g). That is, they are barred from codas. In addition, there is some neutralization between aspirated and unaspirated stops. Neither pre nor post aspirated stops cannot appear after *s*, (1i,j).

Another piece of evidence that pre and post aspirated stops are related phonemically comes from geminates. Icelandic has a consonant length distinction. Unaspirated stops can be geminates. However, there are no postaspirate geminates as shown in (2).

(2) *Lack of aspirated geminates*

	Unaspirated		Aspirated
k^hɔppɪ		'young seal'	*k^hɔpp^{h}ɪ
sattʏr		'sharpen'	*satt^{h}ʏr
sɪkkʏ		'Siggu'	*sɪkk^{h}ʏ

While there are unaspirated geminate stops, there are no aspirated geminate stops. The lack of aspirated geminates is accounted for if we assume that preaspirated stops are derived from underlying geminate aspirated stops. This analysis is also supported by morphological alternations like the one given in (3).

(3) *Morphological alternations*

	Fem Sg.	*Neut. Sg.*	*Gloss*		*Fem Sg.*	*Neut. Sg.*	*Gloss*
a.	sæl	sælt	'happy'	b.	feiːt^h	feiht	'fat'
	aum	aumt	'miserable'		ljouːt^h	ljouht	'ugly'
					saiːt^h	saiht	'sweet'

The examples in (3a) show that the neuter singular marker for adjectives is /-t/. When this marker combines with a stem final /t^h/, the two merge and form a geminate, which is realized as a preaspirate. Thráinsson (1978) provides more cases that support the analysis here.

0.2 Summary of Analysis

Following Steriade (1993, 1994), I assume that aspiration is not a feature of a segment, but a separate segment. I propose that preaspiration in Icelandic is metathesis in response to a markedness constraint against postaspiration. Constraints on the outcome of the metathesis determine the availability of preaspiration to alleve the markedness violation.

In (4) are the Faithfulness constraints I will be assuming for the analysis of Icelandic preaspiration.

(4) *Faithfulness Constraints*

Weight Ident **McCarthy (1995), Moren (1997)**

WEIGHT-IDENT VOWELS (HEAD) (WT-IDV(HD))	No lengthening or shortening of vowels.
WEIGHT-IDENTCONSONANT (HEAD) (WT-IDC(HD))	No lengthening or shortening of consonants.

General	**McCarthy and Prince (1995)**
MAX	No deletion of segments.
LINEARITY	No metathesis.
IDENTVOI	No devoicing or voicing.

I assume there are two versions of the WEIGHT-IDENT constraint. One version is violated by changes in the prosodic status of vowels (WT-IDV). It dislikes lengthening or shortening of vowels. The other version is violated by changes in the prosodic status of consonants (WT-IDC). It is violated by gemination or degemination of consonants. Each version of the WEIGHT-IDENT constraint also comes in a general (WT-ID) and positional version(WT-ID(HD)) (Beckman 1997). WT-ID(HD) holds over stressed syllables. A HEAD is defined as a stressed syllable. The idea is that segments in stressed syllables resist changes in their prosodic status more than segments in unstressed syllables. For example unstressed long vowels are more likely to shorten than stressed long vowels.

The general Faithfulness constraints are taken from McCarthy and Prince (1995) with positional faithfulness as propose in Beckman (1997). Since I assume that laryngeal features form an independent segment (for example h or ʔ), I assume that MAX penalizes any deletion of these features. The LINEARITY constraint penalizes metathesis of underlying segments. Finally the IDENTVOI constraint penalizes featural changes in output segments.

In (5) I introduce the Markedness constraints that are relevent for the analysis of Icelandic preaspiration.

(5) *Markedness Constraints*

NOLONGVOWEL (NLV)	Do not have long vowels.
SONORITY SEQUENCE (SONSEQ)	Onsets clusters must rise in sonority.
NO PREASPIRATE ONSETS (*[hO)	Preaspirated sequences cannot be onsets.
NOCODA	Do not have codas.
*STOP-ASP (*STOP-H)	Do not have a stop followed by an aspirated segment.

The constraint NOLONGVOWEL (Rosenthall 1994) reflects the marked status of long vowels. It is violated by any long vowel in the output. Research in phonotactics has shown a general preference accross languages for onset clusters to rise in sonority as they approach the nucleus of the syllable (Clements 1990) . I assume that the general constraint SONORITYSEQUENCE is responsible for this preference. SONORITYSEQUENCE is violated by any onset cluster which does not rise in sonority. The constraint NOPREASPIRATEONSETS is violated by any preaspirated stop parsed as an onset cluster. The constraint NOCODA (Itô 1987, Prince & Smolensky 1993) should be familiar to readers. Finally, I propose that there is a markedness constraint against post aspirated stops, *STOP-ASP. This assumption is warranted since many languages lack postaspirated stops entirely or restrict there distribution in some way. The constraint *STOP-ASP is further supported by cross-linguistic evidence below in section 4. The *STOP-ASP constraint is stated as a sequencing constraint which is blind to the syllabification of the segments involved. Note this constraint is violated by the surface strings *.thV.* and *t.hV.*

In (6) I show the mapping I assume for preaspiration.

(6) *Mapping for preaspiration*

/ph/ ↦ hp

The preaspiration mapping violates the Faithfulness constraint LINEARITY. However, it satisfies the markedness constraint *STOP-ASP. Ranking the constraints *STOP-ASP and MAX above LINEARITY makes this mapping optimal. The result is demonstrated in tableau (7).

(7) *STOP-ASP, MAX » LINEARITY - ranking needed for preaspiration

/ph/	MAX	*STOP-ASP	LIN
a. ☞ hp			*
b. ph		*!	
c. p	*!		

LINEARITY is forced to be violated in (7) by higher ranked MAX and *STOP-ASP. Deletion of the aspirate segment (candidate c) is blocked by MAX. This is the core ranking of my analysis of

Icelandic preaspiration. However, as seen in (1) above, preaspiration does not occur everywhere in Icelandic. Other constraints conspire to block preaspiration initially, following stressed long vowels, and following voiced sonorants.

0.3 Summary of Paper

In section 1 I show how the preaspiration mapping in (6) is blocked initially, following stressed vowels, and following voiced sonorants. There are three constraints (*[hO, WT-IDV(HD), and IDVOI) that dominate the preaspiraiton ranking resulting in blocking. In section 2 I show how the preaspiration ranking is enabled in Icelandic. The ranking is enabled by syllable structure constraints whose ranking is independently motivated in Icelandic. These constraints mitigate the effects of WT-IDV(HD), allowing the preaspiration ranking to have an effect. In section 3 I discuss the cases where post-aspirates and unaspirated stops neutralize. I analyze these cases as preaspiration, but with the aspirate merging with a preceding segment. In section 4 I conclude the paper with a brief survey of preaspiration in other languages. Here I offer cross-linguistic evidence for the constraint *STOP-ASP.

1. Postaspirates

The surface distribution of postaspirates is word initially, following long vowels and following voiced sonorants. Word initially and following consonants the language demands that stop-aspirate sequence be parsed as an onset. The fact that preaspirates are blocked from this environment indicates that *[hO must dominate *STOP-ASP, restricting preaspiration from creating an illicit onset. I will argue that following long vowels Icelandic demands that the stop-aspirate sequence be parsed as an onset. This argument relies on the distribution of length in stressed syllables, which I adress here.

1.1 Length Stressed syllables

In this section I will give an analysis of the distribution of length in stressed syllables. This analysis is crucial for the anlaysis of preaspiration since the restrictions on length in stressed syllables constrains the general preaspiration mapping in (6).

Icelandic, as other Scandinavian languages, requires stressed syllables to be heavy. All stressed syllables are either closed by a consonant (the first half of a geminate or consonant cluster) or contain a long vowel. I propose the following mappings in Icelandic.

(8) *Mappings in stressed syllables*:

a. VVCV ↦ VV.CV Underlying stressed long vowels are retained

b. VCCV ↦ VC.CV Underlying short vowels before clusters are retained

c. VVCCV ↦ VC.CV Underlying long vowels before clusters are shortened

d. VCV ↦ VC.CV Underlying short consonants are geminated after short vowels.

The most interesting mappings are those that are shown in (8c and d). In (8c) an underlying long vowel is shortened before a consonant cluster. Shortening only occurs when the consonant cluster cannot be parsed as a legitimate onset (subject to SONSEQ). In that case, vowel shortening and concommitent parsing of the the first consonant as a coda occurs. Morphological evidence favors this mapping. In (8d) the underlying form does not have enough material to create the surface target of a heavy syllable. The traditional analyisis of this case is that vowel lengthening occurs (Vennemann 1972, Kiparsky 1984). However, I argue that preaspiration requires that gemination is the result.

In addition to the mappings given in (8) for stressed vowels, Icelandic also has only short vowels in unstressed syllables. Yet, geminates are allowed in all syllables. The constraint rankings in (9) account for the distribution of weight in Icelandic.

(9) *Weight Related Constraint Rankings*
SONSEQ » WT-IDV(HD) » NLV » WT-IDV
SONSEQ » WT-IDC(HD), WT-IDC » NOCODA

The ranking of WEIGHT-IDENTV(HD) above NOLONGVOWEL, which in turn dominates WEIGHT-IDENTV, causes underlying long vowels to be shortened in unstressed syllables but retained in stressed syllables. However, (8c) shows that even stressed long vowels will shorten if a following consonant cluster cannot form a complex onset to the following syllable. Therefore SONORITYSEQUENCE must dominate WEIGHT-IDENTV(HD). Also SONORIOTYSEQUENCE must dominate both WEIGHT-IDENTC constraints and NOCODA since it can push a consonant into the coda of a stressed or unstressed syllable. Since Icelandic allows geminates in both stressed and unstressed syllables, we know that WEIGHT-IDENTC(HD) and WEIGHT-IDENTC must dominate NOCODA, assuming that geminates violate NOCODA since they are parsed as coda and onset.

1.2 Blocking Preaspiration

Word initially aspirated stops are postaspirated not preaspirated. Any preaspirate initially would necessarily be parsed as a complex onset due to the lack of a preceding syllable. This parsing violates the *[hO constraint. Ranking *[hO above *STOP-ASP blocks the preaspiration ranking.

(10) *Post-aspiration Initially* - *[hO » *STOP-H

/thaala/	*[hO	*STOP-H	LIN
a. ☞ thaala		*	
b. htaala	*!		*

Preaspiration in candidate (b) violates *[hO since the *ht* sequence must necessarily be parsed as an onset. There is no preceding syllable that can host *h* as a coda. Therefore the preaspiration mapping is blocked and we get a surface post-aspirate (candidate a).

Long vowels only occur in stressed syllables as stated above in section 1.1. Recall this restriction resulted from the ranking in (11).

(11) WT-IDV(HD) » NOLONGVOWEL » WT-IDV

Since faithfulness to stressed vowels is ranked above the markedness constraint (NOLONGVOWEL) stressed vowels contrast length. However, with general faithfulness ranked below NOLONGVOWEL unstressed vowels neutralize to short vowels. Recall that a following consonant cluster could force shortening of even a stressed long vowel. Shortening in this case results from SONORITYSEQUENCE dominating WEIGHT-IDENTV(HD). The fact that preaspiration does not occur following stressed long vowels indicates that it is better to preserve the long vowel than to avoid the marked stop-aspirate sequence.

(12) After Long Vowels - *[hO, WT-IDV(HD) » *STOP-H

/aaphi/	*[hO	WT-IDV(HD)	*STOP-H	LIN
a. ☞ .aa.phi.			*	
b. .aa.hpi.	*!			*
c. .ah.pi.		*!		*

Preaspirated stops cannot be a single onset as in candidate (b) due to the high ranking of *[hO. This is consistent with what we know from word initial aspirates. Furthermore, the preaspirated stops cannot straddle the syllable boundary in this environment because it would require shortening the long vowel. WEIGHT-IDENTV(HD) blocks this shortening and so blocks the preaspiration mapping.

After voiced consonants aspirated stops are also postaspirated. We know from the previous two cases that *[hO would block preaspiration if it created a complex onset as in *.svun.hta*. Another possibility is for the aspiration to merge with the sonorant in the coda of the preceding syllable. I propose that IDENTVOICE blocks merger with a preceding voiced stop.

(13) Merger between [n] and [h] is blocked - they disagree in voicing.

/svuun$_1$t$_2$h$_3$a/	SONSEQ	WT-IDV(HD)	IDVOI	*STOP-H	LIN
a. .svuu.n$_1$t$_2$h$_3$a.	*!			*	
b. ☞ .svun$_1$.t$_2$h$_3$a.		*		*	
c. .svuN$_{1,3}$.t$_2$a.		*	*!		*

(14)

/svun$_1$t$_2$h$_3$a/	SONSEQ	WT-IDV(HD)	IDVOI	*STOP-H	LIN
a. .svuu.n$_1$t$_2$h$_3$a.	*!	*		*	
b. ☞ .svun$_1$.t$_2$h$_3$a.				*	
c. .svuN$_{1,3}$.t$_2$a.			*!		*

Candidate (c) in both tableaux represents the merger candidate. Note that merger violates IDENTVOICE since underlying *n* and *h* disagree for voicing. Any segment which is a correspondent of both of these segments will necessarily disagree with one of them for voicing. IDENTVOI CE ranked above *STOP-ASP blocks preaspiration mapping.

2. Enabling Preaspiration

Recall that in Icelandic vowels are short in stressed syllables when the syllable is followed by a consonant cluster. I proposed above that underlying long vowels are shortened before consonant clusters as in (15).

(15) /naaklar/ ↦ [naklar]

This mapping results from SONORITYSEQUENCE, which dislikes parsing *kl* as an onset, dominating WEIGHT-IDENTV(HD). This ranking is restated in (16).

(16) SONSEQ » WT-IDV(HD)

I will argue that vowel shortening enables preaspiration.

When an input contains the sequence stop - aspirate - sonorant the result is metathesis of the aspirate and the stop (preaspiration). Key to this result is that parsing all three segments as a complex onset violates the SONORITYSEQUENCE constraint worse than parsing only two segments in the onset and one in the coda of the preceding syllable. The tableau (17) shows how presapiration is enabled by SONORITYSEQUENCE.

(17) Preaspiration following long vowel enabled by SONSEQ.

/eephli/	SONSEQ	WT-IDV(HD)	*STOP-H	WT-IDC(HD)	LIN
a. .ee.phli.	**!		*		
b. .ep.hli.	*	*	*!	*	
c. ☞ .eh.pli.	*	*		*	*

Since SONORITYSEQUENCE rules out candidate (a), WEIGHT-IDENTV(HD) must be violated. Therefore the constraint is not active on the remaining candidates. The decision is passed onto *STOP-ASP which chooses in favor of preaspiration (candidate c). Also note that preaspiration must be able to create a coda in the stressed syllable, therefore WEIGHT-IDENTC(HD) must be subordinate to *STOP-ASP.

When the same sequence of segments follows an underlying short vowel the result is the same, since again WEIGHT-IDENTV(HD) is inactive. The tableau (18) shows this result.

(18) Preaspiration following short vowel follows from previous ranking.

/ephli/	SONSEQ	WT-IDV(HD)	*STOP-H	WT-IDV(HD)	LIN
a. .ee.phli.	**!		*		
b. .ep.hli.	*		*!	*	
c. ☞ .eh.pli.	*			*	*

WEIGHT-IDENTV(HD) is rendered inactive by the lack of a long vowel in the input, thus enabling the preaspiration mapping as in (18).

We know from above that WEIGHT-IDENTV(HD) dominates *STOP-ASP since the postaspirated stop occurs after underlying long vowels. Furthermore, we know that *STOP-ASP dominates IDENTWTC(HD) because preaspiration can create a coda consonant in the stressed syllable. Therefore IDENTWTV(HD) must dominate IDENTWTC(HD). Since all stressed syllables must be heavy, the result of an undominated constraint, underlying /cvcv/ will surface as cvccv with gemination of the medial consonant, not lengthening of the vowel. This result is contrary to the general claim made by previous researchers that short vowels are lengthened in stressed syllables (Vennemann 1972, Kiparsky 1984). However, the preaspiration ranking demands this result.

In addition the relative ranking of WEIGHT-IDENTV(HD) and WEIGHT-IDENTC(HD) means that preaspiration will occur following an underlying short vowel whether the medial consonant is a geminate or not. The tableaux (19) and (20) show this result.

(19) An underlying geminate following a short vowel becomes preaspirated.

/upphi/	WT-IDV(HD)	*STOP-H	WT-IDC(HD)	LIN
a. ☞ .uh.pi.			*	*
b. .up.phi.		*!		
c. .uu.phi.	*!	*	*	

(20) An underlying sigleton following an underlying short vowel preaspirates.

/uphi/	WT-IDV(HD)	*STOP-H	WT-IDC(HD)	LIN
a. ☞ .uh.pi.			*	*
b. .up.phi.		*!	*	
c. .uu.phi.	*!	*		

These tableaux show that WEIGHT-IDENTC(HD) is forced to be violated under pressure from the higher ranked *STOP-H and WEIGHT-IDENTV(HD). The preaspiration candidate (a) violates WEIGHT-IDENTC(HD) since it forces the *h* into a coda of the stressed syllable. The general WEIGHT-IDENTC must also be subordinate to *STOP-ASP since candidate (19a) also degeminates the underlying geminate. Since the degeminated segment is parsed in the second syllable in the output it does not violate WEIGHT-IDENTC(HD).

3. Deaspiration

Following voiceless fricatives, aspirated stops are deaspirated. I analyse deaspiration as the merger of aspiration with the voiceless fricative. Merger is allowed when the two segments agree in voicing since IDENTVOICE is not violated. Tableaux (21) and (22) show how merger between *s* and *h* is optimal regardless of the length of the underlying initial vowel.

(21) Merger between [s] and [h] is allowed - they agree in voicing.

/fiis$_1$k$_2$h$_3$yr/	SonSeq	IdentVoi	IdentWtV(Hd)	*Stop-H	Lin
a. .fii.s$_1$k$_2$h$_3$yr.	*!			*	
b. .fis$_1$.k$_2$h$_3$yr.			*	*!	
c. ☞ .fis$_{1,3}$.k$_2$yr.			*		*

(22)

/fis$_1$k$_2$h$_3$yr/	SonSeq	IdentVoi	IdentWtV(Hd)	*Stop-H	Lin
a. .fii.s$_1$k$_2$h$_3$yr.	*!		*	*	
b. .fis$_1$.k$_2$h$_3$yr.				*!	
c. ☞ .fis$_{1,3}$.k$_2$yr.					*

In contrast to when a voiced sonorant precedes the aspirated stop IdentVoi is inactive, thus enabling preaspiration. IdentWtV(Hd) is also inactive due to higher ranking of SonSeq as in (16) above.

4. Conclusion

The particularly complex set of Icelandic facts with respect to preaspiration results from the following ranking of the proposed constraints.

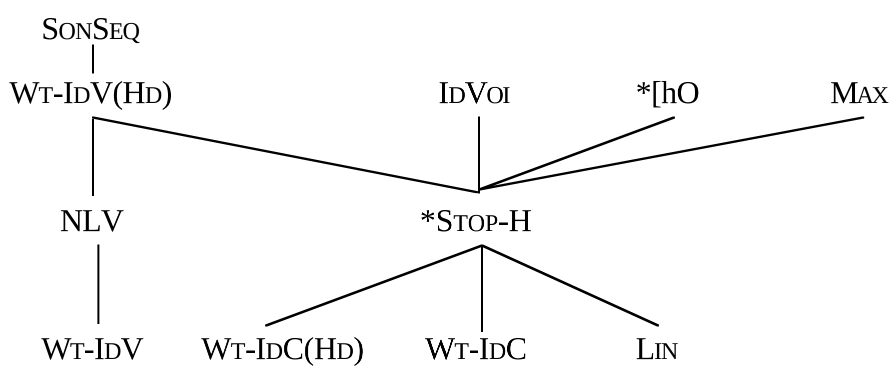

Figure 1 Icelandic Preaspiration Ranking

The core ranking is that between *Stop-Asp and Linearity and the two Wt-IdC constraints. This ranking prefers preaspiration to alleviate a *Stop-Asp violation. Furthermore ranking Max above *Stop-Asp prevents deletion of aspirates when preaspiration cannot occur. The other three constraints that directly dominate *Stop-Asp block preaspiration in certain environments. With *[hO above *Stop-Asp, preaspiration is blocked from creating a complex onset. With IdentVoice above *Stop-Asp, preaspiration cannot merge aspiration with a preceding voiced sonorant. Finally with Weight-IdentV(Hd) above *Stop-Asp, preaspiration cannot shorten a long vowel in a stressd syllable.

As we have seen, Icelandic has a complicated pattern of preaspiration and blocking effects. Other languages have very similar patterns, some less complex than Icelandic. I have done some preliminary research of languages which have preaspiration and have found the cases in (23).

(23) *Other languages with preaspiration*

Faroese — Werner (1963), Thráinsson, et al. (to appear)
Similar distribution to South Icelandic, however, preaspiration can shorten long mid and low vowels.

Goarijo	Holmer (1949) Preaspiration '... can neither be seperated syllabically from the following consonant ... nor have any effect on syllable length.' (46)
Hopi	Whorf (1946) 'The preaspirates occur only syllable initially after a firm stressed vowel...'()
Quileute	Andrade (1933), Hoard (1978) Preaspiration of voiceless stops following stressed vowels.
Tarascan	Foster (1969) Aspirated stops are postaspirated initially, preaspirated following vowels and deaspirated after consonants.

This brief and incomplete survey shows some of the types of variation found with preaspiration. The pattern in Tarascan provides evidence for the *STOP-ASP constraint.

Tarascan has a simpler pattern of preaspiration than Icelandic. Aspirated stops are postaspirated initially, preaspirated following vowels and deaspirated after consonants. Preaspiration in Tarascan does not interact with vowel length. Furthermore, it is free to create a coda consonant. The fact that postaspirates survive in the initial syllable shows the effect of a positional variant of MAX, which is sensitive to deletion in the intial syllable - MAXINTIAL. Otherwise no new constraints are needed. The constriant ranking for Tarascan is given in).

(24) *Rough analysis of Tarascan preaspiration.*
IDAP, IDENTVOI, MAXINIT, *[hO, » *STOP-ASP » MAX » LIN, WT-IDC

Unlike Icelandic, preaspiration in Tarascan does not interact with stress and syllable weight. Therefore I have left the WEIGHT-IDENT constraints out of the ranking. They must be ranked below *STOP-ASP in Tarascan to be inactive. Also, Tarascan does not have devoicing as the result of preaspiration. Therefore IDENTVOICE must be ranked above MAX in this language. Another difference between the two languages is that when preaspiration is blocked in Tarascan, deletion occurs while in Icelandic post-aspirated stops are tolerated. This means that MAX must be ranked below *STOP-ASP in Tarascan, but still above LINEARITY. This ranking ensures that preaspiration is preferred to deletion but that when preaspiration is blocked deletion will occur.

Tarascan provides evidence for the context free markedness constraint *STOP-ASP over a coda specific markedness constraint (Moren & Viglio 1998, Ringen 1998) since preaspiration/deaspiration occurs with potential onsets, unlike in North Icelandic. This point is echoed in South Icelandic. In the southern dialect of Icelandic postaspirate stops are deaspirated in onsets. Deaspiration and preaspiration in the South dialect can be accounted for using the general *STOP-ASP constraint.

The analysis presented here maintains a single melody analysis of geminates. LINEARITY is violated under compulsion of *STOP-ASP. However, metathesis can only take place when syllable structure allows it. That is, when the preceding syllable is forced to be closed for independant reasons. By comparison, a two-root theory of preaspiration must lengthen coda consonants, for example in /ɛp^{h}li/, to feed preaspiration. Unfortunately coda consonants which are not post aspirates must then be shortened since there are no overlong consonants on the surface (see Hermans 1985). The effect of consonant lengthening in clusters is then opaque. It only serves to trigger preaspiration. This is a serious problem for the two-root theory of Icelandic preaspiration.

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