

CHAPTER 5. HOCANK (WINNEBAGO)

5.1. Introduction

In chapter 4, it was argued that Scots Gaelic vowel intrusion results from the creation of a [VR]_α nucleus. The Siouan language Hocank (also known as Winnebago) has a very similar structure, except that it involves [RV]_α nuclei. This view of intrusive vowels turns out to have interesting consequences for the well-known problem of Hocank accent. The accentual pattern, which is usually analyzed with rule ordering, can be analyzed in a non-serial framework if CVRV is treated as monosyllabic.

5.1.1. Conditioning environment for vowel intrusion

Symmetrical vowel intrusion, traditionally known as “Dorsey’s Law”, is triggered by all the CR cluster types that exist in the language. Below are examples of each. Data is taken from Miner 1979, Miner 1992, Miner 1992b, Miner’s undated Grammar, Hale & White Eagle 1980, White Eagle 1982, and Susman 1943, abbreviated as M79, M92, M92b, M(n.d.), HWE, WE, and S.

(214)	kr	karáire	‘they departed returning’	M79:29
	kn	kānák	‘put s.th. not having length’	M79:26
	kw	hokewé	‘enter’	M79:30
	pr	parás	‘flat’	M79:27
	pn	bo:púnūs	‘hit at random’	M92:30
	sr	serétʃ	‘long, tall’	M79:27
	sn	wasúnú	‘spit, roast’	M79:27
	sw	gisewé	‘calm down’	M92:30
	ʃr	ʃuruʃgé	‘you (sg.) untie it’	M79:30
	ʃn	ʃíní	‘cold’	M92:30
	ʃw	ʃawaʒók	‘mash’	HWE 124
	tʃw	tʃiwítʃiwĩ	‘reverberating’	M79:26
	xr	ʃuruxúruk	‘you (sg.) are able’	M79:30
	xn	ũ:xĩnĩ	‘ashes’	M92b
	xw	xuwuxúwu	‘brittle’	M79:29

These clusters all consist of voiceless obstruents and sonorants. Homorganic combinations involving plosives ([pw, tʃn, tʃr]) are absent, but the homorganic fricative – sonorant combinations [sn, sr] do occur. Susman 1943:15 describes [r] as a single-flap tongue tip alveolar trill.

In the following chart, clusters that trigger vowel intrusion are shaded, and clusters that surface at the beginning of a phrase are unshaded²¹. (S20)

(215)

	p	t	k	g	tʃ	dʒ	s	ʃ	x	m	n	r	w	j	h	ʔ
p							ps	pʃ			pn	pr				pʔ
t																tʔ
k						kdʒ	ks	kʃ			kn	kr	kw			kʔ
tʃ				tʃg									tʃw			
s		st		sg							sn	sr	sw			sʔ
ʃ				ʃg		ʃdʒ					ʃn	ʃr	ʃw			ʃʔ
x				xg		xdʒ					xn	xr	xw			xʔ

In native words, CR clusters predictably undergo vowel intrusion. Borrowings, however, like [črá:k] *truck* and [sná:p] *snuff* (M92b), sometimes lack intrusive vowels where they would be expected, as pointed out by John Koontz (p.c.). This may be a case of incomplete nativization of loanwords, but even so, it shows something important about Hocank vowel intrusion: that it is unlike the highly automatic and unconscious timing patterns that produce vowel intrusion in most languages. For example, Wiik 1965:28 reports that Finns who have vowel intrusion don't perceive the difference between English *scalloping* and *scalping*, so presumably these speakers couldn't refrain from adding intrusive vowels to borrowings even if they wanted to.

I have argued in chapter 4 that symmetrical vowel intrusion in Scots Gaelic can be indirectly lexically specified. Timing itself is not contrastive, but vowel intrusion is caused by a structure “α” whose presence is contrastive. The loanwords above suggest that lexical specification might play a role in Hocank vowel intrusion as well, and this would be fully consistent the theory of symmetrical vowel intrusion developed in chapter 4. However, two loans are limited data. Lacking more extensive evidence that vowel intrusion requires lexical specification, I will assume in the analysis below that intrusion is synchronically motivated and enforced in Hocank.

5.2. Evidence for monosyllabicity, monosegmentality

In Hocank, there is less of a tradition of describing intrusive vowel sequences as monosyllabic than there is in Scots Gaelic. The fieldworkers Susman and Miner describe them as disyllabic, although Susman 1943:13 notes that they may be the “functional

²¹ Miner's Lexicon contains one root that may involve vowel intrusion in a different cluster: [kʔorokʔoros] ‘be hollow’. This root behaves like a vowel intrusion sequence in that it reduplicates in its entirety; I do not know whether it has the “fast” phonetic realization of vowel intrusion sequences. There are apparently no other examples of underlying /kʔr/ in the language. The Lexicon also contains one word, [tʃwe:k] ‘snipe’, which lacks vowel intrusion in a cluster that usually produces it (tʃw/). Miner writes ‘sic’ after this entry, perhaps indicating uncertainty about its accuracy.

equivalent” of one long syllable or “be regarded...as playing the part of one long syllable”. Only Alderete 1995 and Clements 1991 (who follows Steriade 1990’s gestural analysis) explicitly claim that Hocank intrusive vowel sequences are monosyllabic.

Fieldworkers do not report having tried to discern speakers’ intuitions about syllabification with segmentation tasks or direct questions the way Borgstrøm 1940 and Oftedal 1956 did for Scots Gaelic. White Eagle, who is a native speaker, has published a study of Hocank accent (Hale and White Eagle 1980), but she does not explicitly discuss her own intuitions about syllable structure. Hale & White Eagle treat intrusive vowel sequences as disyllabic, but they also treat what others describe as long vowels and diphthongs as disyllabic, so by “syllable” they apparently mean what others call a mora.

However, intrusive vowel syllables phonologically pattern like single syllables, and the two vowels together act like a single segment. Miner 1992 points out three ways in which CVRV does not behave like an ordinary disyllable: reduplication, contextual nasalization, and ablaut. Restrictions on root size may be added to this list. As in Scots Gaelic, linguists report that intrusive vowel sequences sound different than normal CV.CV sequences, although instrumental confirmation is lacking for Hocank.

5.2.1. Reduplication

Hocank reduplicants are normally monosyllabic, taking the form of an infix when the root is CV:C, or a suffix otherwise. The reduplicants are in bold below.

(216) Reduplication

gihú	‘swing’	gihuhú	‘wag tail’	M92:29
hit’ é	‘speak, talk’	hit’et’ é	also ‘speak, talk’	M92:29
ratʃgǎ	‘drink’	ratʃgǎtʃgǎ	‘drink repeatedly’	M92:29
mā:nǐ	‘walk’	mā:nǐnǐ	‘walk a little’	S33
wafǐ	‘dance’	wafǐfǐ	‘dance a little, stop, dance again’	S33
wa:zǐ	‘to suckle’	wa:zǐzǐ	‘to suckle a little at a time’	S34
		sga:sgáp	‘sticky’	M79:29
		ʒo:ʒók	‘slippery’	M79:29

In intrusive vowel sequences, however, not only the final CV but the entire sequence is copied. They are the only sequences longer than C(C)V that may reduplicate.

(217)	Reduplication of intrusive vowel syllables			
	-kereʃ	‘make designs’	kerekéreʃ	‘spotted’ / ‘colorful’
	tʃiwi	‘reverberating’	tʃiwitʃiwi	also ‘reverberating’
	ʃará	‘bald’ / ‘bare’	ʃaraʃára	‘bald in spots’ M92:29
	parás	‘flat’	parapáras	‘wide’ M79:29
	(root glosses not given for rest)		kirikiris	‘striped’ S33
			poropóro	‘spherical’ M79:26
			xaraxára	‘in slices or leaves’
			xuwuxúwu	‘brittle’
			kūnūkúnūs	‘cartilaginous’ M79:29

If intrusive vowel sequences are monosyllabic, we can maintain the generalization that the reduplicant is maximally one syllable, without exceptions.

(218) /ʃra + REDUPLICANT/ → ʃara.ʃára

Non-intrusive CV₁CV₁ sequences do not show this special reduplication pattern. Words like [howó] ‘swollen’, [xeté] ‘big’, and [heré] ‘to be’ reduplicate only their final CV, like other disyllables. Therefore, the reduplication pattern cannot be analyzed as simply having a special provision for identical vowels.

5.2.2. Root Size

Another way in which Hocank morphology counts syllables is in its restriction on root size. According to Miner (n.d.:37), “Verb roots in Winnebago are normally (in those cases where analysis is possible) monosyllables or Dorsey’s Law sequences. Typical roots are *xée* ‘buy’; *šgáac* ‘play’; *keré* ‘return’.” Dorsey’s Law is the traditional term for vowel intrusion. In other words, an ordinary two syllable sequence cannot be a root, but a vowel intrusion sequence can. If intrusive vowel sequences are regarded as monosyllabic, then the pattern is simply that all roots are one syllable.

5.2.3. Nasalization

Contextual nasalization provides evidence that the intrusive vowel and following vowel are actually the same segment and same gesture. When one of the two vowel portions in an intrusive vowel sequence undergoes contextual nasalization, the other must also. [i, a, u] nasalize after a nasal consonant, as in the following words.

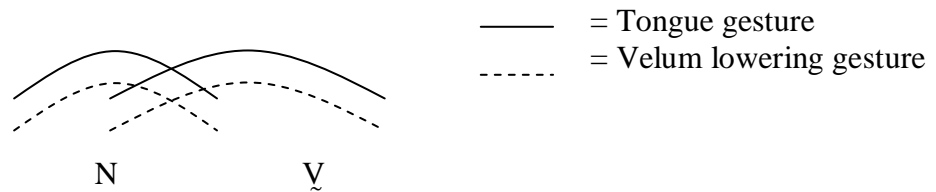
(219)	Contextual nasalization		M92:30
a.	mã:	‘earth, ground’	
b.	ní:	‘water’	
c.	wamãnúke	‘thief’	

Nasalization is also contrastive in Hocank, as in the following words.

- (220) Contrastive nasalization M92:29
- | | | | | |
|----|------|-----|------|--------------------------|
| a. | ha:k | vs. | hã:k | ‘rear part’, ‘woodchuck’ |
| b. | gisú | vs. | gisũ | ‘(de)husk’, ‘upset’ |

These contrasts show that the language allows a vowel to be associated with its own velum lowering gesture. I will assume that even contextually nasalized vowels have a separate velum lowering gesture; contextual nasalization is not merely an extension of the consonant’s velum gesture over the vowel.

- (221) Contextual nasalization



When vowel intrusion is triggered by a C[n] sequence, both vowel portions surface as nasal, even though the first one is not after a nasal segment on the surface.

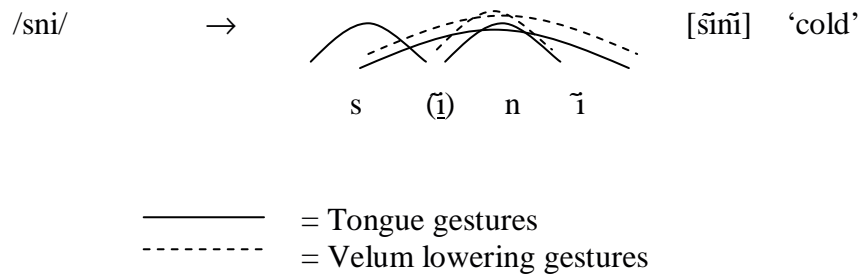
- (222) Nasalization with vowel intrusion M92:30
- | | | | | |
|----|----------|-----|------|-----------------|
| a. | kãnãk | vs. | krãk | ‘marry’ |
| b. | šĩnĩ | | | ‘cold’ |
| c. | bo:pũnũs | | | ‘hit at random’ |

Under the theory that the two vocalic sections are the same segment, it is natural that both have the same nasality in the output. The segmental string is /CnV/. Since the vowel’s velum lowering gesture (dotted below) is attached to the entire vowel segment, the part of the vowel that is phonetically realized before the [n] is nasalized as well.²²

²² John Koontz points out (p.c.) that historically, the nasality may originate with the vowel in some cases. For example, the word [kãnãk] ‘marry’ has been reconstructed as historical *krãk. [r] changed to [n] before nasal vowels. If the synchronic grammar also treats [kãnãk] as underlyingly /krak/, this would mean that the vowels are underlyingly, not contextually, nasal. If so, their featural identity is unremarkable under any account.

However, this historical explanation does not seem to apply to all C[n] clusters. According to Wolff 1950, Proto-Siouan *[sn] is realized as sV₁nV₁ in Hocank, so presumably a word like [šĩnĩ] ‘cold’ comes from an original *[sn] cluster with a vowel that could have been underlyingly oral or nasal. In this case, the predictable nasality of the intrusive vowel must be contextual, not underlying.

(223) Nasalization with vowel intrusion



Contextual nasalization shows that the intrusive vowel cannot have different gestural specifications than the following vowel, as predicted if they are in fact one gesture and one segment. A similar pattern occurs with ablaut, discussed below.

5.2.4. Ablaut

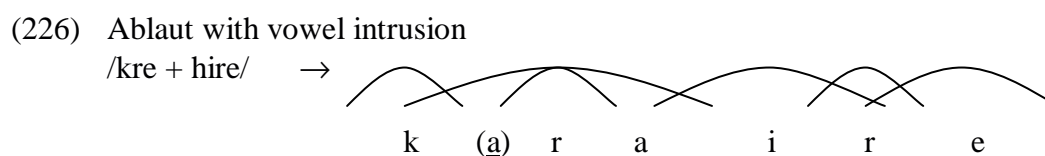
Many Hocank stems change their final [e] to [a] before certain suffixes. Below, the segments that have undergone ablaut are shown in bold in the second column.

(224) Ablaut		M92:30, Miner n.d.:42
waré	wararé	‘work / imperative’
mā:tǰé	mā:tǰ aire	‘cut a piece off / 3pl.’
té:	tá:nā	‘I go / I could go’
hīxé	hīxawi	‘he buries me / he buries us’

In the words above, only the final vowel of a stem undergoes ablaut. But if a stem ends in an intrusive vowel sequence involving the vowel [e], both [e] portions change to [a].

(225) Ablaut with vowel intrusion		M92:30
keré	karáire	‘leave returning / 3pl.’
mā:pére	mā:páranā	‘slice thin / could slice thin’
gisewé	gisawánák	‘calm down / calm down sitting’

Under the hypothesis that the vowels are really one segment and one gesture, the ablaut actually affects only the final stem vowel as usual.



Ablaut and contextual nasalization are alike in that they are segmental changes that affect both vowels in an intrusive vowel sequence, although only the second appears to be in the correct position.

In non-Optimality Theoretic frameworks, all of the patterns described above (reduplication, root size restrictions, ablaut, nasalization) must be analyzed with rule ordering. Miner 1992 analyzes vowel intrusion as a rule of Epenthesis, which applies after Nasalization, Reduplication and Ablaut. This type of analysis is successful in modeling the interaction of these processes, but as argued in chapter 2, it is not necessarily explanatory from a cross-linguistic perspective. A rule ordering analysis doesn't explain why this particular kind of "epenthesis" (insertion of a copy vowel into CR or RC clusters) is, across languages, virtually always ordered last, while other types of epenthesis and even copy vowel epenthesis are not. Rule ordering also does not explain why such sequences have different phonetic characteristics than ordinary CVCV sequences, as discussed in the next section.

5.2.5. Phonetics

Only impressionistic phonetic descriptions are available for Hocank, but they are consistent with the claim that intrusive vowel groups are heavy monosyllables. Miner 1979:26 calls them "fast sequences", because "the sequences are spoken (and apparently, sung) faster than other CVCV sequences." Susman 1943:10, who refers to such sequences as "CVCV morphemes" (although vowel intrusion can also happen between morphemes), comments that "in most surroundings, CVCV is intermediate in length between one long and two short syllables." She also observes: "In a "CVCV" morpheme which constitutes a phrase, the first vowel is shorter than normal. After a short unstressed syllable and before a stressed syllable, CVCV takes about the time of one long syllable" (S8). Thus, CVRV apparently has a shorter duration than a disyllable.

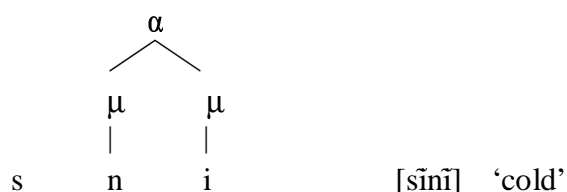
There is also evidence, discussed further in section 4, that CVRV syllables have different pitch patterns than disyllables. Susman 1943:13 claims that "secondary stress seems to attach equally to both syllables" of CVRV. This is strikingly similar to Borgström's and Oftedal's descriptions of stress being "shared" among the vowels of CVRV in Scots Gaelic.

5.3. Vowel intrusion as [RV]_α

5.3.1. Bimoraicity

I propose that Hocank vowel intrusion results from the same subsyllabic structure as Scots Gaelic vowel intrusion, discussed in chapter 4. A moraic sonorant and a vowel are united under an "α node", creating a bimoraic structure that is similar to the traditional notion of a nucleus. The only difference from Scots Gaelic is that V and R are in a different order in the input.

(227)



The symmetrical phasing of segments within the α structure is caused by the same constraint ranking as in Scots Gaelic. I do not repeat this part of the analysis here.

Like Scots Gaelic, Hocank syllables with symmetrical vowel intrusion are bimoraic. Evidence for their bimoracity comes primarily from the accentual system, which is analyzed in section 4. Also, as noted in section 2.1, the intrusive vowel sequence reduplicates as an infix, which bimoraic but not monomoraic syllables do. In addition, a minimal word pattern treats these syllables as heavy. Hocank does not allow monomoraic words. Only the nucleus determines syllable weight: CV(C) is light and CV:(C) or CVV(C) heavy. Therefore, monosyllables always have a long vowel (HWE130, M92:39).

(228)	Predictable V: in monosyllables		HWE 130
	tʃi:	‘house’	ra:p ‘beaver’
	na:	‘wood’	zi:k ‘squirrel’
	wā:k	‘man’	sḍʒa:k ‘be warm’ (Miner 1992b)

Intrusive vowel sequences can stand alone as words without lengthening of the vowel, as in [s̃iṁ] ‘cold’. This indicates that they are bimoraic, with the \underline{VRV} sequence equivalent to a long vowel in weight. If the sonorant were not moraic, we would expect lengthening to *[s̃iṁ:].

5.3.2. Nasality restrictions

In chapter 4, I pointed out that intrusive vowel sequences in one dialect of Scots Gaelic show restrictions on the distribution of nasal vowels that are unique within the language. An intrusive vowel sequence containing a non-nasal sonorant cannot have a nasal vowel, although in ordinary syllables nasal vowels can follow or precede non-nasal consonants. I proposed that constraints limit the licensing of nasality within $[VR]_{\alpha}$.

- (229) Licensing of nasality (Barra Gaelic)
 Complex α structures do not license independent nasality unless both of their constituent segments are segments that can be independently nasal.

Hocank $[VR]_{\alpha}$ show evidence of a similar restriction. Susman 1043:26 observes that “Only the nasal vowels may follow m and n, and e and o, which have no nasal equivalents, may follow these nasal consonants in ordinary syllables, but not CVCV.” (CVCV is her term for intrusive vowel sequences). In other words, a nasal consonant may not co-occur with a vowel that is incapable of being nasal. Hocank thus provides additional evidence that segments within $[VR]_{\alpha}$ structures are subject to special co-occurrence restrictions that do not apply to ordinary adjacent consonants and vowels.

5.3.3. Motivating vowel intrusion

The motivation for creating α structures appears to be different in Hocank than in Scots Gaelic. I have argued that in Scots Gaelic, creating α is a way of avoiding overlap

between certain kinds of consonants, whether they are tautosyllabic or heterosyllabic. Minimizing overlap in RC clusters helps to make contrasts among the nine coronal sonorants more acoustically salient. The creation of $[VR]_{\alpha}$ does not seem to be conditioned by syllable structure in Gaelic. In Hocank, however, I will argue that syllable structure does matter. Only tautosyllabic clusters have intrusion, and the motivation for creating $[RV]_{\alpha}$ structures is to avoid complex onsets. Preserving contrasts is less of a problem in Hocank, which has only five sonorants in total.

An onset segment can be defined as a segment preceding an α structure within a syllable. The prohibition on complex onsets is actually inherent in some of the C-V phasing constraints already proposed. As discussed in chapter 4, Browman & Goldstein 2001 propose that, within a syllable, every consonant before the vowel wants to have the same phasing relation with respect to the vowel. This was captured with the following constraint:

- (230) ALIGN (C, LANDMARK¹, V, LANDMARK²)
 If C and V belong to the same syllable, and C precedes V (not necessarily directly), landmark¹ of C is simultaneous with the landmark² of V.

In a C_1C_2V sequence, this constraint applies to both C_1 and C_2 . It is impossible to give both consonants the desired phasing, without having them fully overlap. Hence, the constraint above automatically penalizes complex onsets: it can only be fully satisfied when there is no more than one prevocalic consonant in the syllable.

I propose that incorporating the R of a CRV sequence into α is a way of eliminating the complex onset and better satisfying the constraint above. To capture this formally, it will be necessary to adjust the constraint to refer to α structures.

- (231) ALIGN (C, LANDMARK¹, α , LANDMARK²)
 If C and α belong to the same syllable, and C precedes α (not necessarily directly), landmark¹ of C is simultaneous with the landmark² of α .

This constraint assumes that the entire α structure has gestural landmarks that can be referred to for phasing, and that flanking consonants are phased with respect to the α complex as a whole.

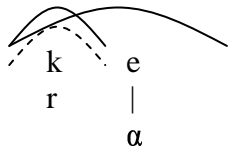
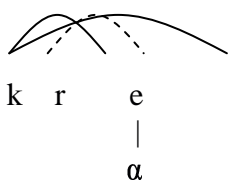
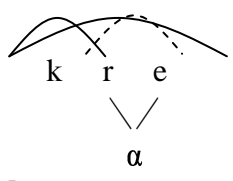
As stated in chapter 4, I assume that all vowels are dominated by α . For simplicity, vowels are shown as underlyingly dominated by α . The constraint DEP- α prohibits placing additional segments under α .

- (232) DEP- α
 A segment that is dominated by α in the output is dominated by α in the input.

The following tableau shows the options for realizing a CRV sequence. If the C and R fully overlap, as in a), this satisfies the alignment constraints but violates the higher-ranked *C IN C. If C and R are left in the onset but do not fully overlap, as in b), then at least one of the onset consonants must violate ALIGN (C, ONSET, α , ONSET). If R is incorporated into the nucleus α , as in c), this allows full satisfaction of the phasing constraints, but violates faithfulness. The ranking *C IN C >> ALIGN (C, ONSET, α , ONSET)

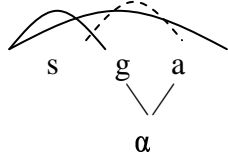
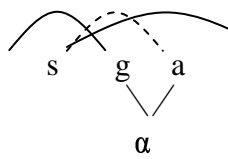
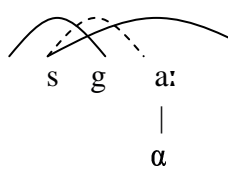
>> DEP- α produces chooses candidate c), where R is under α . Other phasing constraints, given in chapter 4, will cause candidate c) to have symmetrical vowel intrusion.

(233) [kere] ‘leave returning’

/kre/ α	*C IN C	ALIGN (C, ONSET, α , ONSET)	DEP- α
a.  [kʳe]	*!		
b.  [kre]		*!	
c.  → [kere]			*

This repair for complex onsets is not available when the onset consists of two obstruents. Putting an obstruent into an α structure would require it to have heavy overlap with the vowel. As established in chapter 1, such overlap is more marked for obstruents than sonorants: *OBSTRUENT IN V is universally higher ranked than *SONORANT IN V. The tableau below shows how *OBSTRUENT IN V blocks vowel intrusion in /sga:/ ‘white’. Candidate a) adopts the repair of placing [g] under α . It is eliminated because this requires heavy overlap between [g] and [a], violating *OBSTRUENT IN V.

(234) [sga:] ‘white’

/sga/ α	*OBSTRUENT IN V	CONSTRAINTS CAUSING CENTERING WITHIN α	ALIGN (C, ONSET, α , ONSET)	DEP- α
a.  [saga]	*!			*
b.  [sga]		*!	*	*
c. →  [sga:]			*	

In short, the creation of α structures is a strategy for removing complex onsets in Hocank. This strategy can only be used for CR clusters, because non-sonorant consonants can't be in α structures in Hocank. Hence, CC clusters consisting of two obstruents surface intact.

5.3.4. Syllable structure effects, and a second type of vowel intrusion

In the analysis above, vowel intrusion is conditioned directly by syllable structure. Many descriptions, however, claim that vowel intrusion is conditioned by morphological factors. There are, in fact, generalizations about where vowel intrusion occurs that can be stated in terms of morphological boundaries. In most cases, an intervocalic CR cluster triggers symmetrical vowel intrusion if the consonants are tautomorphemic, but a different, short intrusive vowel appears if the consonants are heteromorphemic. There is evidence, however, that morphology plays a role only in so far as it determines syllable boundaries.

If an intervocalic CR cluster is tautomorphemic, it always has symmetrical vowel intrusion. Tautomorphemic CR clusters occur in many roots and in at least two suffixes--the declarative [-ʃānā], and [-ʃūnū] meaning ‘customarily’ (M92:43)²³. But if an

²³ Miner's Grammar also contains the suffixes [ʃāwāk] ‘you (sg)’ and [aʃāwāk] ‘you (pl)’, which appear to contain vowel intrusion.

intervocalic CR cluster is heteromorphemic, it has a different intrusive vowel: a schwa that Miner 1979 describes as having “more or less the quality of a short version of the following full vowel” (i.e. the vowel adjacent to the sonorant, as is typical in vowel intrusion.) It is usually not transcribed. Examples of this schwa at different morpheme boundaries are given below.

(235)	[ə] intrusion		M92:31
	Before suffixes:		
	a.	wańík	‘bird’
	b.	wańig ^ə ńík	‘little bird’
	c.	wańig ^ə ńig ^ə ra	‘the little bird’
	Between roots in a compound:		
	d.	pe:tʃ̆	‘fire’
	e.	wa:tʃ̆	‘boat’
	f.	pé:dʒ ^ə wá:tʃ̆	‘locomotive’

This intrusive schwa appears to consist of just a short, variable release between consonants. Like the cases discussed in chapters 1 and 2, it can be produced by C-C phasing constraints. It does not involve an [RV]_α structure. Syllables containing intrusive schwa do not count as bimoraic in the accentual system, the way syllables with long intrusive vowels do. Another difference between the two intrusive vowels is that obstruents that precede an intrusive [ə] are always voiced, while obstruents that precede a long intrusive vowel are not.

I propose that the reason symmetrical vowel intrusion does not occur in heteromorphemic CR is that these clusters are also heterosyllabic. There is no complex onset, so there is no reason to build a [RV]_α structure. Evidence for syllabification comes from pausing. In describing the pre-sonorant voicing pattern, Susman 1943:18 notes that “if the slightest pause occurs, the sonant and glide vowel is replaced by the corresponding surd (hã:brá ‘the day’, resolves into hã:p-ra).” Speakers generally prefer to pause between syllables, not within onset clusters, so the placement of the pause between the C and the R suggests they are heterosyllabic²⁴. Incidentally, speakers do not need to pronounce the [p] with the preceding syllable in order to make that syllable a minimal word, a consideration which has been proposed to affect pausing patterns in English. CV: words are well-formed in Hocank.

The following constraint prefers to align syllable and morpheme boundaries.

²⁴ Susman draws the opposite conclusion from the same data. She apparently reasons that the pre-sonorant voicing seen in [hã:bra] happens only in onsets, and hence is disrupted when the two consonants are separately syllabified as speakers pause. I assume that pausing is ordinarily determined by, and respects, syllable affiliation. Voicing is conditioned by gestural overlap between consonants, and for this reason is blocked by pausing.

(239)	/k/ prefixation			M92:31
	uu	k'uu	'make, wear / one's own'	
But:	ruʃíp	ku <u>ru</u> ʃíp	'pull down / one's own'	
	ratʃgǎ́	ka <u>rat</u> ʃgǎ́	'drink one's / own'	
		ka <u>ra</u> péres	'one's-own-know'	S138

These word-initial clusters are the only situation where it is not possible to make a heteromorphemic C and R heterosyllabic. From the morphological-conditioning view, they are an exception, but from the syllable-conditioning view, they are unsurprising.

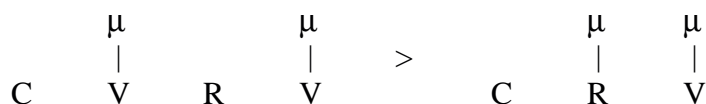
Relating Hocank vowel intrusion to syllable structure is also more consistent with the general typological characteristics of vowel intrusion, which are discussed in chapter 2. There are definitely cases where syllabification affects phasing, but none where it is clear that morphemic affiliation matters—for example, I have not found any non-derived environment blocking (NDEB) effects involving vowel intrusion. Pending such evidence, it is better to keep the more restrictive hypothesis that morphemic boundaries affect phasing only insofar as they affect syllable boundaries. No constraints refer directly to the phasing of segments belonging to different morphemes.²⁵

5.3.5. Historical source of moraic sonorants

While synchronically, Hocank $[RV]_{\alpha}$ structures and the resulting vowel intrusion can be analyzed as a way of avoiding complex onsets, this is probably not how they arose historically. The sonorant likely became moraic in order to preserve the mora of an elided syllable.

Miner 1979 suggests that CR clusters result from an earlier syncope, adding that “there may be a bit of evidence for this in Mandan”. An ancient syncope could explain why $[RV]_{\alpha}$ arose in the first place in this language family: as a strategy for preserving a mora originally associated with a deleted vowel.

(240) Hypothetical historical mora transfer



Thus, $[RV]_{\alpha}$ could historically be the outcome of a type of compensatory weight phenomenon. In this it would be like the “RV diphthongs” that Kaye 1995 proposes for some African languages: they also arose historically from CVRV. However, it does not

²⁵ It is possible, of course, that syllable structure and phasing relations are redundant structures: that the definition of being an onset, for example, is having a particular kind of phasing relationship to a following vowel. In a theory like this, morphological structure could be seen as directly affecting phasing, rather than determining syllable boundaries which in turn determine phasing. The important point remains the same: that there are not two separate factors, morphemic boundaries and syllable boundaries, that affect phasing.

seem necessary or illuminating to give a synchronic analysis that recapitulates this history.

The closely related language Chiwere may have bimoraic [RV]_α without the gestural timing that produces vowel intrusion. Chiwere words that are cognate to Hocank words with symmetrical vowel intrusion have a special accentual pattern. Normally, accent can fall either on the first or second syllable. But Miner notes that if a word contains a CRV syllable that is cognate to Hocank CVRV, accent falls predictably on that syllable, as shown by the examples below.

(241)			Whitman 1947, Miner 1979
	Chiwere	Hocank	
a.	ugwé	hoikéwe	‘enter’
b.	waθlú	wasūnú	‘spit, roast’
c.	d̄ʒiglé	d̄ʒikeré	‘become’
d.	labláðe	raparás	‘tear with the mouth’
e.	lublíye	rupiríʃ	‘curl’
f.	gléblā	kerepána	‘ten’
g.	bláθge	parás	‘flat’
h.	θléd̄ʒe	serétʃ	‘long, tall’

The Chiwere pattern can be explained if these CRV syllables are counted as heavy, and thus attract accent. Since the vowel is short, the second mora in a syllable like [gwe] or [θlu] could only be associated with the sonorant. This suggests that Chiwere, too, has [RV]_α, but without the symmetrical phasing of Hocank (and Scots Gaelic) ones. Instead, these would be like the “RV diphthongs” discussed in chapter 4.

5.4. Accent

The accentual system of Hocank is consistent with the view that intrusive vowel syllables are a kind of heavy syllable, as Hayes 1995:362 has also noted. In several ways, a CVRV sequence doesn’t behave like a sequence of light syllables: it can form the head of an iamb, and it cannot be split between two feet. However, CVRV does not behave exactly like other heavy syllables. Hocank associates a high tone with each foot head, and this tone is realized later after CVRV than after other heavy syllables. I will link this difference to the fact that such syllables have RV nuclei, and R doesn’t license tone.

A basic Optimality Theoretic analysis of Hocank accent is laid out in section 5.4.1–5.4.4, while 5.4.5 shows how intrusive vowels fit into the pattern. The following abbreviations are used throughout this section: L = light syllable, H = heavy syllable, H = a syllable with an intrusive vowel (which is a kind of heavy syllable), T or an acute accent = high tone, μ = mora, **μ** = prominent mora.

5.4.1. Late realization of tone

My analysis of Hocank accent assumes the basic iambic foot structure proposed by Hayes 1995. Hayes' analysis, made in the context of a typological survey of stress systems, is guided partly by the goal of describing Hocank in terms of theoretical apparatus whose existence is supported by other languages. Other studies have concluded that Hocank has patterns that are unknown elsewhere, such as initial extrametrical syllables, or foot boundaries that fall within syllables. I will not review here all the arguments against alternative analyses of Hocank footing, but refer the reader to Hayes 1995 for discussion.

Hayes proposes that Hocank is a pitch accent language that has iambic feet, and that often realizes accent on the syllable after the head of a foot. The following rules (simplified) apply:

- (242) Foot Construction: Form iambs left to right, optionally skipping a single light syllable between feet.
Tone Assignment: Assign high tone to the sonority peak of a syllable that is the head of its foot.
Tone Shift: From an initial or light syllable, shift tone one syllable to the right.

Below is an example of how this system places accent on [hokiwároké] 'swing' (M79:28).

- | | |
|-------------------|--------------------|
| (243) | /hokiwaroke/ |
| Foot Construction | (ho.ki).(wa.ro).ke |
| Tone Assignment | (ho.kí).(wa.ró).ke |
| Tone Shift | (ho.ki).(wá.ro).ké |

A shifting operation requires multiple stages of derivation, as in the ordered rules above. However, the insight that tone falls after the foot head can also be captured by aligning the beginning of the tone to the end of the prominent mora, and this does not require serial derivation.

It is cross-linguistically common for tones to be realized late. In Greek, for example, the F0 peak that is associated with a prominent syllable falls outside of the syllable altogether. It is consistently aligned just after the beginning of the following vowel (Arvaniti et al. 1998). In Japanese, there is also a tendency to realize the F0 peak in the following syllable, although less consistently (Sugito 1968, Hasegawa & Hata 1988). Other languages that realize tone late in or after the prominent syllable include Navajo (De Jong & McDonough 1993) and Mandarin (Xu 1997, 1998, 1999).

There is evidence that tones may be aligned with respect to moraic segments. For Dutch, Ladd et al. 2000 show that the high tone of a Low-High sequence is realized during the second half of a long vowel, but on the consonant following a short vowel. This difference holds even when a phonologically bimoraic vowel and a phonologically monomoraic vowel have the same physical duration. This is consistent with an analysis in which the high tone falls one mora after the low tone. Plausibly, a consonant following a

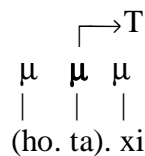
short stressed vowel is syllabified as a coda (perhaps ambisyllabic) in Dutch. Hence, it bears a mora, since coda consonants contribute to syllable weight in Dutch.

(244) Dutch *Low High* tone realization



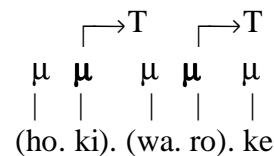
I suggest that Hocank, like Dutch, places high tone one mora after the first mora of the syllable that licenses it. Below, a tone is horizontally positioned over the mora that it is realized on. Iambic footing is shown with parentheses.

(245) a.



hotaxí ‘expose to smoke’

b.



hokiwároké ‘swing (n.)’

The reason Hocank, unlike Dutch, realizes tone as late as on the vowel of the next syllable is linked to the fact that in Hocank, only vowels are moraic. Hocank coda consonants never contribute to syllable weight: CV and CVC are light, while CV: and CV:C are heavy. If an accented syllable is monomoraic, and tone is to be realized one mora late, it must be realized on the following vowel.

5.4.2. Constraints on accent

A few markedness constraints suffice to regulate the introduction of tone. First, there is a constraint demanding that the right edge of each prominent position (defined below) be aligned with the left edge of a high tone.

(246) ALIGN (PROMINENCE, RIGHT; TONE, LEFT)

Every prominent position P licenses a single high tone T, and the left edge of T is aligned with the right edge of P.

Prominent positions are themselves determined by prosodic constraints which are not discussed here. In Hocank, I propose that prominent positions include the head syllable of the head foot (the main stressed syllable), and the first mora of the head of a non-head foot (a secondarily stressed syllable). The first foot is the head foot. Data discussed below will demonstrate that these are the positions that tone seems to associate with.

- (247) Prosodically prominent positions, Hocank (preliminary, revised in (260))
- a. The whole head syllable of the head foot of a word. Head feet are initial.
 - b. The first mora of the head syllable of a non-head foot.

ALIGN (PROMINENCE, RIGHT; TONE, LEFT) competes with a constraint that wants to align a tone to the beginning of every prominent position.

- (248) ALIGN (PROMINENCE, LEFT; TONE, LEFT)
Every prominent position P licenses a single high tone T, such that the left edge of T is aligned with the left edge of P.

Note that it is not possible to satisfy both (PROMINENCE, RIGHT; TONE, LEFT) and (PROMINENCE, LEFT; TONE, LEFT), because each refers to a *single* tone. If two tones are introduced for a single prominent mora, one in each position, then neither constraint is satisfied. Both constraints want there to be only one tone; the ranking of the two constraints determines the first and second choices of where to place this tone.

The tonal alignment constraints compete with a faithfulness constraint against tonal epenthesis:

- (249) DEP-TONE
A tone in the output has a correspondent in the input.

The following tableau shows a constraint ranking that produces late realization of tone in a string of light syllables. For this and following tableaux, candidates are shown in moraic structure, with prominent moras in bold.

Candidate a) has a tone on the mora after each prominent position, satisfying ALIGN (PROMINENCE, R; TONE, L). Candidate b) has a tone directly on each prominent mora, satisfying ALIGN (PROMINENCE, L; TONE, L). Candidate c) has no tone, which violates both the alignment constraints but satisfies faithfulness. Since ALIGN (PROMINENCE, R; TONE, L) is highest ranked, candidate a) wins.

(250) [hokiwároké] ‘swing (n.)’

/hokiwaroke/	ALIGN (PROMINENCE, R; TONE, L)	ALIGN (PROMINENCE, L; TONE, L)	DEP-TONE
a. → ┌→T ┌→T (μ μ) (μ μ) μ [hokiwároké]		**	**
b. T T (μ μ)(μ μ) μ [hokíwaróke]	*!*		**
c. (μ μ)(μ μ) μ [hokiwaroke]	*!*	**	

ALIGN (PROMINENCE, L; TONE, L) does play a role in determining the output in cases when the higher-ranked ALIGN (PROMINENCE, R; TONE, L) cannot be satisfied for some other reason. For example, late realization of tone is not possible when the prominent syllable is word-final: there is no following mora for tone to fall on.

As shown in the tableau below, the options for a word-final foot are to not realize the tone at all, as in candidate b), or to realize it on the prominent mora, as in candidate a). The choice between these two options is determined by the ranking of ALIGN (PROMINENCE, L; TONE, L) and DEP-TONE. In Hocank, the first is higher-ranked, so candidate a) wins.

(251) [wasgé] ‘dish, plate’

/wasge/	ALIGN (PROMINENCE, R; TONE, L)	ALIGN (PROMINENCE, L; TONE, L)	DEP-TONE
a. → T (μ μ) [was.gé]	*		*
b. (μ μ) [was.ge]	*	*!	

Hence, a word-final (LL) foot has tone on the last syllable.

5.4.3. Initial feet

As stated in (247), the main stressed syllable is considered one prominent position. This captures the fact that tone is never realized on an initial, non-final sequence of (LL), (H), or (LH), but is always realized on the syllable immediately following one of these. In other words, the tone licensed by an initial foot is always realized late, when possible.

(252) Tone after initial feet

Initial LL

a.	(LL) \acute{L}	ho. ta. xí	‘expose to smoke’	M79:28
b.	(LL) $\acute{L}L$	ha. ra. tʃáb. ra	‘the taste’	M79:28

Initial H

c.	(H) \acute{H}	nā: wá:k	‘he (moving) was singing’	S10
d.	(H) \acute{L}	ho: tʃák	‘Hocank’	M79:27

Initial LH

e.	(LH) $\acute{H}L$	xe. tea. rái. re	‘they got big’	S29
f.	(LH) \acute{L}	hi. nā:. nák	‘we (sitting) slept’	S11

This pattern is fully parallel to that demonstrated in tableau (250); the only difference is that some of the prominent positions are whole bimoraic syllables.

Incidentally, the words in (257)e-f) differ from the description of the data in Alderete 1995:29 and Hayes 1995. Both claim that an LHL word is accented $L\acute{H}L$, both citing the same example, [kírí:nā] ‘returned’. But this word appears to be part of a pattern of exceptional accent before certain suffixes. According to S47 and M92:52, the declarative suffix [nā] regularly causes the preceding vowel to become long and accented regardless of its position in the word, as shown below.

(253) [nā] causing preceding V:

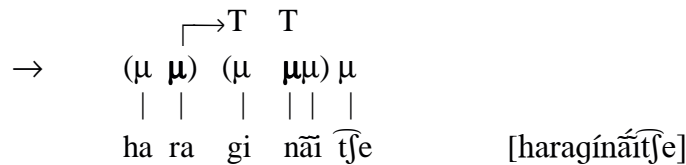
ha. pé:. nā	‘he waited for him’	S12
pí:. nā	‘it is good’	S47
nī. gi. gí:. nā	‘I did to you’	S47
hā:ké kīri. nī:. nā	‘he did not go back’	S47
(hā:ke...nī ‘not’; kīrí ‘to return’)		

I assume that some morphological factor independent of the basic accentual system is at work in [kírí:nā]. Examples (252) e)–f) suggest that $L\acute{H}L$ is the normal pattern.

5.4.4. Heavy syllables (without intrusion)

In non-initial feet, heavy syllables appear with falling accent unless they contain opening diphthongs. Falling pitch presumably reflects tone on the first mora, rather than the second.

(254)



This is not expected according to the constraints proposed so far: we would expect tone to fall on the second mora, since the first mora of each foot head is considered a prominent position. However, rising tone within a syllable is avoided in many languages, including Hocank.

The constraint NORISE, which Gussenhoven 1997:15 proposes based on Roermond Dutch, penalizes a rise in pitch within a single syllable.

(255) NORISE * T (adapted from Gussenhoven 1997)
(μ μ)_σ

The effects of this constraint are seen in other languages, according to Gussenhoven. For example, Hausa allows falling but not rising tones within single syllables (Leben 1978:206). Toura allows four level tones and six falling tone patterns within syllables, but no rising tones (Bearth 1971). Possible phonetic grounding for NORISE is the fact that F0 rises take longer to produce than F0 falls (Ohala 1978). The durational confines of a single syllable may be small enough to make the realization of a rise difficult. Thus, this deviation from the usual tonal alignment in Hocank can be attributed to an independently motivated pressure.

The tableau below demonstrates how the constraints choose this pattern. Heavy syllables are shown as “**μμ**”, with the first mora bold to show its prominence. The location of tone within the syllable is indicated by placing T above the first or second mora. All the candidates realize tone late from the first foot, but differ on the treatment of the heavy syllable. Candidate b) realizes tone one mora after the prominent mora, according to the usual pattern. This results in rising tone in the syllable, violating high-ranked NORISE. Candidate c) avoids rising tone by realizing tone on the following syllable, but this makes the tone two moras late and fails to satisfy either alignment constraint. Candidate a) avoids rising tone by realizing the tone directly on the prominent element. This satisfies ALIGN (PROMINENCE, L; TONE, L), so candidate a) wins.

(256) [haragínáitʃe]

/haragínáitʃe/	NORISE	ALIGN (PROMINENCE, R; TONE, L)	ALIGN (PROMINENCE, L; TONE, L)
a. $\rightarrow (\mu \mu) \begin{array}{c} \lrcorner \rightarrow T \\ (\mu \mu\mu) \mu \end{array} T$ haragínáitʃe		*	*
b. $(\mu \mu) \begin{array}{c} \lrcorner \rightarrow T \\ (\mu \mu\mu) \mu \end{array} \rightarrow T$ haragínáitʃe	*!		**
c. $(\mu \mu) \begin{array}{c} \lrcorner \rightarrow T \\ (\mu \mu\mu) \mu \end{array} \begin{array}{c} \lrcorner \rightarrow T \\ (\mu \mu\mu) \mu \end{array}$ haragínáitʃé		*	**!

In this way, heavy syllables in non-initial feet are assigned tone on their first mora, which is heard as falling tone. There is one further detail to the pattern, not treated here: opening diphthongs do have rising tone rather than falling tone. This can be produced by a higher-ranked constraint demanding that the tonal profile match the sonority profile, but it is tangential to the main point here.

In summary, the normal accentual pattern in Hocank is to place tone one mora after initial feet and after light syllables that are heads of feet. Heavy syllables realize their own tone, normally on their first mora. The following section discusses the patterning of intrusive vowel syllables within this system.

5.4.5. Intrusive vowel syllables

As argued in section 3, syllables with symmetrical vowel intrusion are bimoraic, but contain an unusual type of nucleus: RV rather than VV or V:. In the accentual system, intrusive vowel syllables (H) behave like heavy syllables in that they always license a tone, but unlike normal heavy syllables, they realize this tone late. I attribute this to the fact that the first mora of (H) is associated with a consonant, which does not license tone. Tone is licensed by the second mora of (H), and hence realized later.

5.4.5.1. Initial feet

Word-initial feet provide evidence that an intrusive vowel syllable is not a sequence of two light syllables (S43:13). An initial (LL)L has tone on its third mora, while initial (LH) places its tone on the following mora. Thus, if a word like [hakaraxe] is (LL)LL, we expect tone on [ra]; if the structure is (LH)L, we expect tone on [xe]. The latter is what happens, as seen below.

(257) High tone after initial (LH) feet

(LH) \acute{L}	ha. <u>ka</u> . ra. xé	‘I buried my own’	S13
(LH) \acute{L}	hi. <u>ko</u> ro. hó	‘prepare, dress’	M79:30
(LH) \acute{L}	gi. <u>sa</u> wa. nák	‘calm down sitting’	M92:30
(LH) \acute{H}	wi. <u>ki</u> ri. páras	‘cockroach’,	M79:30
(LH) $\acute{H}\acute{H}$	gi. <u>ka</u> nā. <u>ka</u> nāp. <u>ʃ</u> ānā	‘it is shiny’	M89:170
(LH) $\acute{H}\acute{H}$	wa. <u>ki</u> ri. <u>po</u> ro. <u>po</u> ro	‘spherical bug’	HWE 131

This pattern is expected under the theory developed so far: an intrusive vowel syllable is a single heavy syllable, and like other heavy syllables it realizes its tone late when it is the head of the initial foot. If intrusive vowel sequences were LL sequences, then their behavior in the above words would be exceptional. This is shown by the comparison between an LHL word and a LLL word below.

(258) Hypothetical LL interpretation of intrusive vowel words

	(LL) $\underline{L}\acute{L}$	ha. <u>ka</u> . ra. xé
vs.	(LL) $\acute{L}L$	ha. ra. tʃáb. ra

Unaccented initial LLL sequences are unknown. If intrusive vowel sequences were two syllables, they would break the generalization about accentual patterns at the beginnings of words.

5.4.5.2. Non-initial feet

In non-initial feet, both normal heavy syllables and intrusive vowel syllables always license tone—but while tone is realized on the first mora of a normal heavy syllable, it is realized on the mora following an intrusive vowel syllable.

A heavy syllable outside the initial foot always has a tone, since it is always a foot head and does not realize its tone late. The mora following it never carries tone. (Non-initial HH does not occur in the reported data). Some examples of heavy syllables in various contexts are given below.

(259)	Heavy syllables outside the initial foot always bear accent		
	(L L) (H́) L	hit. ʔet. ʔéi. re	M79:29
	(H) (H́) L	mā:. tʃái. re	M79:29
	(L L) (H́) (L L) (H́) (L Ĺ)	hi. zã. kí. tʃãf. gu. nã. nã. gá	M79:25 ²⁶
	(L L) Ĺ (L L) (H́) (L H́) (L Ĺ)	wa. ỹi. ỹí. giʃ. gap. ʔú. ze. ré	M79:25
	(L L) (Ĺ H́) L	ha. ra. gí. nã. tʃe	S49

glosses:

‘they speak’, ‘they cut a piece off’, ‘nine and’, ‘baseball player’, ‘you will suffer for it’

An intrusive vowel sequence is also a heavy syllable, hence always the head of a foot, and always licenses tone. But unlike H, it prefers to realize its tone late. A non-final (H) is always followed by a tone. In this way, heavy CRV differs from heavy CVV.

To explain this, I propose that consonants, even if moraic, do not license tone in Hocank. Gordon 1999 shows that this to be a common situation. Many languages permit a CVV but not a CVC syllable to carry a contour tone (i.e. two tones), even if CVC counts as a heavy syllable for other purposes. This suggests that in some languages only vocalic moras license tone.

Accordingly, I amend the definition of prominent moras in Hocank to exclude consonants. In a bimoraic syllable where the first mora is associated with a sonorant, the second mora counts as prominent.

(260) Prosodically prominent positions, Hocank (revised)

- a. The whole head syllable of the head foot of a word. Head feet are initial.
- b. The first *vocalic* mora of the head syllable of a non-head foot.

If R in CRV is not a prominent mora, it is predicted that tone should be realized late after (H). Tone is realized one mora after the prominent mora that licenses it, and in an intrusive vowel syllable, this prominent mora is the second one. In the tableau below, candidate a) wins because it places tone one mora after the prominent mora, as preferred by ALIGN (PROMINENCE, R; TONE, L). Candidate b) places tone directly on the prominent mora, while candidate c) places it early, so neither of these has the preferred alignment.

²⁶ The syllable [nã] has accent on the second mora because of a general pattern, not analyzed here, in which T falls on the most sonorous vowel in a diphthong.

(261) [ra:. gá. kãnáʃ. gé]

/ ra:gaknaʃge/	ALIGN (PROMINENCE, R; TONE, L)	ALIGN (PROMINENCE, L; TONE, L)
a. $\begin{array}{c} \lrcorner \rightarrow T \quad \lrcorner \rightarrow T \\ \rightarrow (\mu\mu) (\mu \mu\mu) \mu \end{array}$ ra:. gá. kãnáʃ. gé		**
b. $\begin{array}{c} \lrcorner \rightarrow T \quad T \\ (\mu\mu) (\mu \mu\mu) \mu \end{array}$ ra:. gá. kãnáʃ. ge	*!	*
c. $\begin{array}{c} \lrcorner \rightarrow T \quad T \\ (\mu\mu) (\mu \mu\mu) \mu \end{array}$ ra:. gá. kãnáʃ. ge	*	**

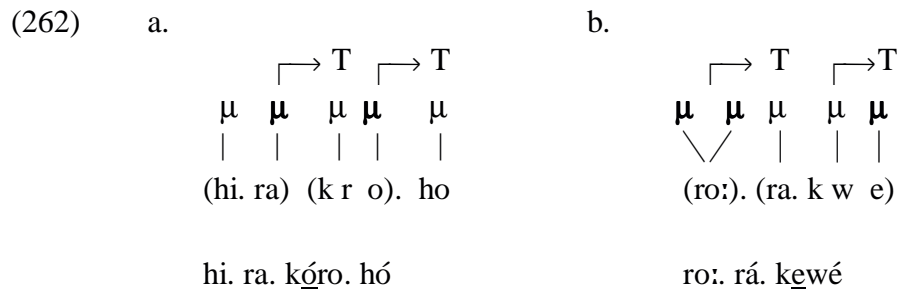
Thus, an intrusive vowel syllable will always realize its tone on the following syllable when possible. This is the basic difference in behavior between intrusive vowel syllables and other heavy syllables, and it results from the fact that the former contain moraic consonants.

5.4.5.3. First mora tone; second mora tone; no tone

In this section I describe the distributions of three types of intrusive vowel syllables: those heard with tone on the first mora, those heard with tone on the second mora, and those heard without tone. Each of these realizations corresponds to a particular environment, and is explained under the theory proposed here.

There are two circumstances under which tone is realized *on* an intrusive vowel syllable. First, the tone of a preceding foot can be realized late on the first mora of an intrusive vowel syllable. Not being a prominent position, the R of CRV doesn't license a tone, but a tone licensed by a preceding syllable can be realized on it. Secondly, a word-final intrusive vowel syllable realizes its own tone on its second mora, because there is no following syllable for tone to fall on.

The accents heard on intrusive vowel syllables are described as having two distinct phonetic realizations that correspond to the two environments described above. In the first situation, tone is heard on the first vowel as in a) below; in the second situation, tone is heard on the second vowel as in b) below. I assume that this reflects association with the first and second mora, respectively; a theory of the physical realization of tone on intrusive vowel syllables is presented in section 4.5.



The following examples demonstrate that intrusive vowel syllables have a first-mora accent only when they follow a foot of the kind that realizes its tone late—i.e., any initial foot, or a non-initial LL or H foot. The tone heard on the intrusive vowel syllable is licensed by the previous foot, not by the intrusive vowel syllable itself.

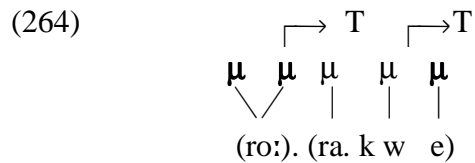
(263) Intrusive vowel sequences with first-mora accent

- a. Following an initial LL foot:
- | | | | |
|----------------------------------|---------------------------|--------------------------|-----------|
| (LL) (<u>H</u>) | ha. nĩp. ʃǎnǎ | ‘I swam (declar.)’ | WE 82:314 |
| (LL) (<u>H</u>) [́] L | hi. ra. k <u>ó</u> ro. hó | ‘prepare, dress (2 sg.)’ | HWE 128 |
- b. Following an initial H foot:
- | | | | |
|---------------------------------|-----------------------------------|--------------------------|---------|
| (H) (<u>H</u>) | ro:. k <u>e</u> wé | ‘dress, paint face’ | M79:30 |
| (H) (<u>H</u>) | mǎ:. ʃáratʃ | ‘promise (2 sg.)’ | HWE 127 |
| (H) (<u>H</u>) (<u>H</u>) | wa:. p <u>ó</u> ro. p <u>ó</u> ro | ‘snowball’ | M79:30 |
| (H) (<u>H</u>) [́] L | ya:. k <u>ó</u> ro. hó | ‘prepare, dress (1 sg.)’ | HWE 128 |
- c. Following an initial H foot:
- | | | | |
|------------------|-------------------------------|-----------------|--------|
| (H) (<u>H</u>) | k <u>e</u> re. k <u>e</u> ref | ‘colorful’ | M30 |
| (H) (<u>H</u>) | ʃ <u>a</u> ra. ʃ <u>a</u> ra | ‘bald in spots’ | M92:29 |
- d. Following a non-initial LL foot:
- | | | | |
|-------------------------------------|-------------------------|---|---------|
| (LL) ([́] L) (<u>H</u>) | ha. ki. rú. d̥ʒik. ʃǎnǎ | ‘pull taut (3 rd sg- declar.)’ | HWE 126 |
|-------------------------------------|-------------------------|---|---------|
- e. Following a non-initial H or LH foot:
- | | | | |
|--|---|-------------------|---------|
| (LL) [́] L (L <u>H</u>) (<u>H</u>) | hi. rat. ʔát. ʔa. ʃǎnǎk. ʃǎnǎ | ‘you are talking’ | HWE130 |
| (L <u>H</u>) (<u>H</u>) (<u>H</u>) | wa. k <u>i</u> ri. p <u>ó</u> ro. p <u>ó</u> ro | ‘spherical bug’ | HWE 131 |

Intrusive vowel syllables realized with second mora accent are always word-final, meaning they have no place to realize their tone late. Also, they are always preceded by something that does not place a tone on following moras: by an L that is not a foot head; or by an (H) or (LH) foot, which realizes its own tone. (If a word-final (H) is preceded something that does realize tone late, (H) does not have two tones; instead, it does not

license its own tone. This is part of a system of tonal clash avoidance, which is not treated here.)

For example, in [ro:rákewé] the intrusive vowel is preceded by H L. The heavy syllable forms a foot by itself, and realizes its tone late on the following L. The L cannot form a foot, so it becomes the first syllable of an LH iamb. It does not license any tone. The vowel of the intrusive vowel syllable does license tone, and must realize its own tone since there is no following syllable to place it on.



ro:. rá. kewé

The following examples show that the distribution of intrusive vowel syllables with second mora accent is that predicted by this analysis. They are always word-final and preceded by something that does not realize tone late: either a light syllable that is not a foot head, or a heavy syllable (which is not in the initial syllable), which realizes its own tone.

(265) Intrusive vowel syllables with second-mora accent

After L

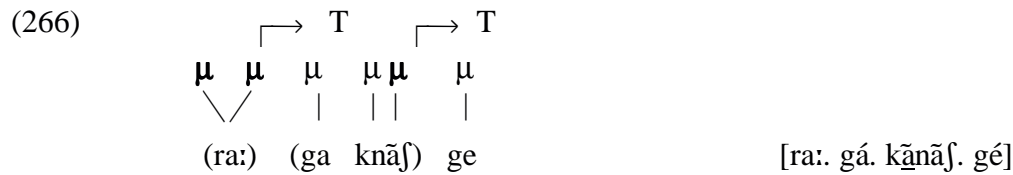
(L L)(<u>L</u> H) (<u>L</u> H)	ha. ra. kí. <u>ʃuru</u> . <u>dʒík</u> . <u>ʃǎná</u>	‘pull taut- 2sg.’ HWE126
(H) (<u>L</u> H)	ro:. rá. <u>ke</u> wé	‘you dressed him’ S13
(H) <u>L</u> (L H)	wi:. pá. mā. <u>ke</u> ré	‘rainbow’ M81:342

After non-initial H

(L L) (H) (<u>H</u>)	ha. ke. weák. <u>ʃǎná</u>	‘he is entering (moving)’ M79:29
------------------------	---------------------------	----------------------------------

There are also cases where an intrusive vowel syllable is realized without any accent. These cases always fulfill two conditions. First, the intrusive vowel syllable is not preceded by anything that would place a tone on the following mora. Second, the intrusive vowel syllable is followed by at least one syllable so that its own tone has a place to be realized late.

In [ra:gákkānǎʃgé], for example, the intrusive vowel syllable [kānǎʃ] places a tone on the following syllable [ge]. The single light syllable [ga] which precedes [kānǎʃ] cannot form a foot, so it does not license tone and [kānǎʃ] appears without any tone.



The penultimate (H) feet below are other examples of intrusive vowel syllables that don't realize any tone. It can be seen that all meet the two conditions given above.

- (267) Intrusive vowel syllables without accent
- | | | | |
|----|---------------------------|-------------------------------|----------------------------------|
| a. | H (<u>H</u>) (L) L | tʃu: . giá. ʃãñãp. ké | 'kingbird', M81:342 |
| b. | (L L) L (L <u>H</u>) (H) | hi. rat. ʔát. ʔa. ʃãñãk. ʃãñã | 'you are talking', HWE130 |
| c. | (H) (L <u>H</u>) L | ra: . gá. kãñãʃ. gé | 'ant', M81:342 |
| d. | (L L) L (L <u>H</u>) L | hi. ro. kí. ya. porok. ʃé | 'he rolled them up together' S29 |

In short, distributional facts support the theory that an intrusive vowel syllable is a heavy syllable that realizes its accent late. Like other heavy syllables, it is always associated with a tone, but unlike other heavy syllables, this tone is normally realized to the right of the syllable.

5.4.5.4. Weak local parsing

In some respects, an (H) syllable outside of the initial foot acts like an (LL) sequence. Each places a tone on a following syllable, and each realizes a tone on its first mora only when it follows a foot. This similarity follows from the fact that in both (LL) and CRV, the tone is licensed by the second mora—in the case of LL, because the second mora is the head of the foot; in the case of CRV, because the first mora is non-prominent due to being consonantal.

But intrusive vowel sequences do not pattern like LL sequences in other respects. One difference between the two relates to the possibility of weak local parsing. Hocank can optionally leave one L syllable unparsed between two feet, as seen in (267) b) and d) and in the following examples.

- (268)
- | | | |
|-----------------|------------------------|----------------------------|
| (L L) L (L L) L | ho. ki. wá. ro. ro. ké | 'swing (v. intr.)' M81:342 |
| (H) L (L L) L | wi: rá. gũʃ. ge. rá | 'the stars' M79:28 |

Only one L in a row can be left unparsed. But if an intrusive CYRV sequence consisted of two light syllables, it would be necessary to posit cases in which more than one L in a row is left unparsed, as in the hypothetical alternative representations below.

(269) (L L) \acute{L} (L \underline{H}) (\acute{H}) hi. rat. $\text{?át. ?a. } \underline{\text{?ánāk. } \text{?ánā}}$ ‘you are talking’, HWE130
 Hypothetical: (L L) \acute{L} L (L L) \acute{L} L

(L L) \acute{L} (L \underline{H}) \acute{L} hi. ro. kí. ya. $\underline{\text{porok. } \text{?é}}$ ‘he rolled them up together’ S29
 Hypothetical: (L L) \acute{L} L (L L) \acute{L}

Treating (\underline{H}) as monosyllabic allows us to maintain a simple generalization about weak local parsing: only one light syllable is left between feet.

Also, weak local parsing cannot skip one of the putative “syllables” of $\text{CV}\underline{\text{R}}\text{V}$. This is seen in words like [hirakórohónirá] (“the fact that you do not dress”, Halle 1990:149). If the intrusive vowel syllable were a sequence of two light syllables, it would be possible to leave the first one unparsed. This would cause tone to fall on [ni], as shown below. Such a parse is possible in a word that really consists of a string of light syllables, like [hokiwároroké] “swing” (M81:342). If this kind of parse were possible, then it would not be predicted that (\underline{H}) should always be followed by a tone.

(270) Hypothetical weak parsing of /hirakronira/

$\begin{array}{c} \lrcorner \rightarrow T \\ (\mu \ \mu) \ \mu \ (\mu \ \mu) \ (\mu \ \mu) \\ \ \ \ \ \ \ \\ \text{hi} \ \text{ra} \ \underline{\text{ko}} \ \text{ro} \ \text{ho} \ \text{ni} \ \text{ra} \end{array}$	* [hirakórohóníra]
---	-----------------------

Cf. (ho ki) wa (ro ro) ke [hokiwároroké]

There are no examples of intrusive vowel syllables being parsed like this. $\text{CV}\underline{\text{R}}\text{V}$ is always treated like a foot, and hence always followed by a tone, as shown below.

(271) Real parsing of /hirakronira/

$\begin{array}{c} \lrcorner \rightarrow T \ \lrcorner \rightarrow T \ \lrcorner \rightarrow T \\ (\mu \ \mu) \ (\mu\mu) \ (\mu \ \mu) \ \mu \\ \ \ \ \ \ \\ \text{hi} \ \text{ra} \ \text{kro} \ \text{ho} \ \text{ni} \ \text{ra} \end{array}$	[hirakórohónirá]
--	------------------

In this respect, $\text{CV}\underline{\text{R}}\text{V}$ acts as a unit in a way that other CVCV sequences don’t. In the theory of Hayes 1995, this unity is captured by splitting / CRV / into two syllables after most of the accent rules have applied; in the $[\text{RV}]_\alpha$ theory, it is captured by representing $\text{CV}\underline{\text{R}}\text{V}$ as monosyllabic on the surface.

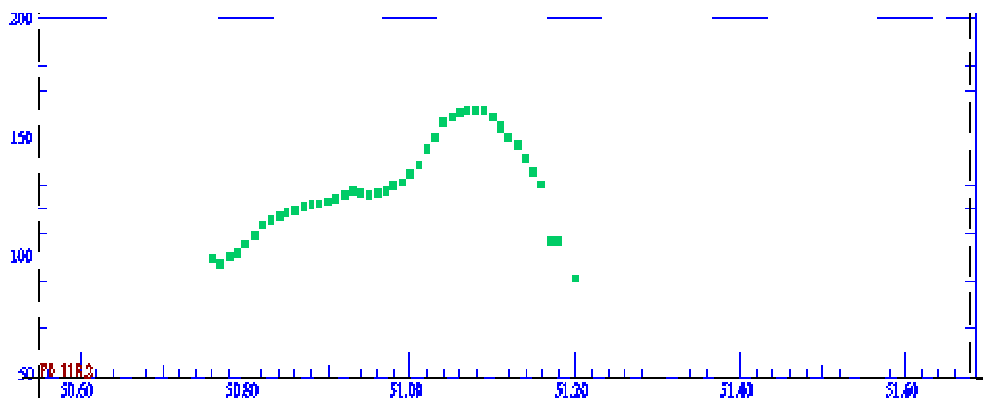
5.4.6. Physical realization of tone on intrusive vowels

I have been assuming that a word-final intrusive vowel syllable has a single tone associated with its second mora. In this way, it is like an LL foot, which also has tone on its second mora word-finally. But not all descriptive accounts agree that (LL) and (H) have an identical accentual structure.

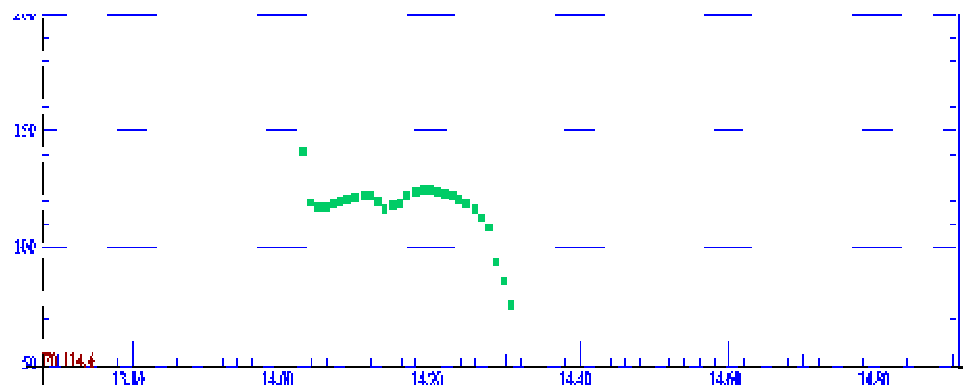
In early work, Miner transcribes intrusive vowel syllables with secondary accent on the first vowel and primary accent on the second, as in [kèré] ‘depart returning’. He transcribes ordinary disyllables, such as [wasgé] ‘dish, plate’, with only one accent. He notes, however, that others disagree: “perceptually, in the nonreduplicated fast sequences, it sometimes happens that the secondarily accented syllable has almost as much accent as, or even as much as (but never more than) the primarily accented one. It may be this that caused Lipkind to write stress only on the C₁V₁ portion of fast sequences, an error which persists through Wolff to Matthews and beyond” (M79: 26-7). In later studies, Miner omits the secondary accents on the intrusive vowels, changing the transcription of accent to [keré]. Thus, fieldworkers give at least three different transcriptions of accent on words like ‘depart returning’: [kére], [kèré], and [keré].

Using tapes of Gerd Fraenkel’s fieldwork on Hocank, stored in Indiana University’s Archives of the World’s Languages, I made pitch tracks of an intrusive vowel syllable, [sɛretʃ] ‘long’, and similar two-syllable words like [warutʃ] ‘eat’. These words were spoken in isolation in the context of a Swadesh word list. [sɛretʃ] is the only word in the list consisting of a single intrusive vowel syllable, so of course conclusions based on the two tokens of this word must be very tentative. However, the pitch contours do not support Miner’s later transcriptions of purely second-vowel accent. The disyllabic [warutʃ] has a clearly rising pitch, as seen in (272), while [sɛretʃ] has a fairly steady pitch, as seen in (273). A heavy monosyllable like [se:p], as in (274), has a clear fall. This supports Miner’s early transcription convention, in which these three foot types were distinguished accentually.

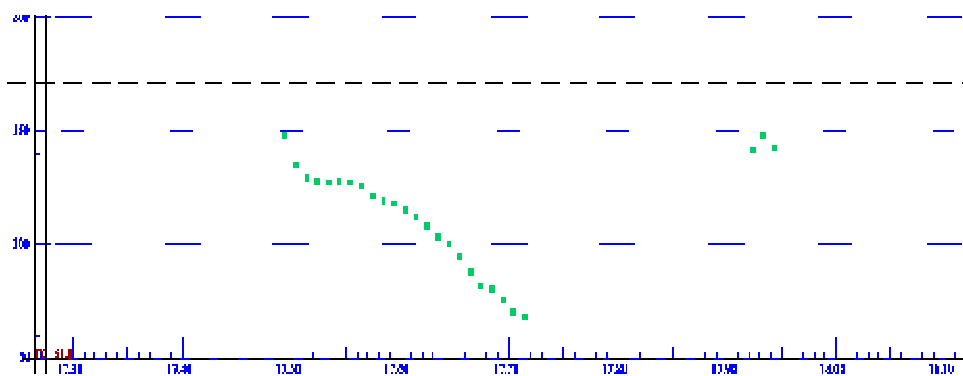
(272) Pitch track of [warutʃ]



(273) Pitch track of [sɛrɛtʃ]



(274) Pitch track of [sɛ:p]



I propose that [sɛrɛtʃ]'s unique pitch pattern results from the fact that the physical realization of tones is linked to that of segments. In a CRV sequence where tone is linked to the same mora as V, the high pitch is linked to the vowel gesture, which stretches across the syllable. If the vowel intrusion were perfectly symmetrical, with the sonorant exactly in the middle of the vowel, high pitch would be heard more or less evenly across the syllable. Some of Susman 1943:13's observations agree with this: she states that "secondary stress seems to attach equally to both syllables" in CVRV.

But Hocank vowel intrusion is not always perfectly symmetrical. Susman observes that "in a "CVCV" morpheme which constitutes a phrase, the first vowel is shorter than normal." This suggests a slightly skewed alignment as below. (Capturing the slight non-symmetricality of Hocank vowel intrusion is possible with modifications to the alignment constraints. I do not do so here, given the lack of evidence about what the exact alignment is.)

(275)



If a vertical line is imagined in the center of this sequence, more of the R is heard on the left side of the line and more of the V is heard on the right side. Therefore, tone realized on the R will be heard more on the beginning of the syllable, and tone realized on the V will be perceived more on the end. But since the V gesture does spread completely across the syllable, there will be some perception of high pitch in the beginning as well. This may explain why Miner transcribed a secondary accent in [kèré]. Lipkind's transcription [kére] may reflect a dialect or idiolect where the sonorant is timed later in the vowel, so that more of the vowel and its tone are heard near the beginning of the syllable. The mistaken assumption that [kere] has two syllables imposes an artificial choice on the fieldworker, to assign accent to the first or second, when in fact the two vocalic periods are a single segment, with a single accent.

5.4.7. Summary of accent

There are more details to the accentual system that are not treated here (such as deletion of tones in clash, the accenting of opening diphthongs, and the placement of tone when a syllable elides in “syllable merger”), but the essential point is that intrusive vowel syllables act like single heavy syllables rather than LL sequences, and that the differences between intrusive vowel syllables and other heavy syllables all derive from the fact that a consonantal mora cannot license tone in this language. Preliminary phonetic evidence also indicates differences in the realization of accent on LL, H, and H.

Furthermore, it is possible to give a principled analysis of the accentual pattern that depends only on output constraints, without rule ordering. The placement of pitch accents in Hocank is guided by constraints that are operative in many other languages, such as prohibiting consonants from licensing accent, and prohibiting rising tone within a syllable.

5.5. Conclusion

Hocank intrusive vowels share the unusual characteristics of those in Scots Gaelic. The overlap between vowel and sonorant is relatively dramatic compared to vowel intrusion in other languages, and the resulting syllable is bimoraic. In Hocank, this bimoraicity is proven primarily by the accentual system, but also by minimal word requirements and by the reduplication pattern, in which intrusive vowels are infixed like heavy syllables rather than suffixed like light syllables. Patterns of ablaut and contextual nasalization demonstrate that the intrusive vowel has no ability to take a different quality than the non-intrusive vowel, as expected if they are one gesture.

Such vowel intrusion cannot be analyzed as only an effect only of C-C phasing; rather, it reflects a particular structure within the syllable. I have proposed that the sonorant is adjoined to the vowel, and they together function as a single α unit. Hence, a CVRV sequence behaves like a heavy monosyllable. The accentual system supports the view that one of the moras of an intrusive vowel syllable is associated with the sonorant, because this mora shows an aversion to licensing tone, which is typical of consonants. Scots Gaelic and Hocank demonstrate that intrusive vowels- that is, vocalic periods that do not correspond to an independent segment- do not have to be short and fleeting. An intrusive vowel can be as long as an ordinary short vowel, and stable in quality and duration, yet not behave like a separate syllable for phonology or for speaker intuitions.

APPENDIX: LIST OF CONSTRAINTS

Markedness constraints

Constraints on total overlap

General form:

*GESTURE_x IN GESTURE_y

A gesture of type *x* does not fully surround a gesture of type *y* (extending on both sides of it).

Specific constraints:

*V IN V

A vowel gesture does not fully surround another vowel gesture.

*C IN V

A vowel articulation does not extend on both sides of a consonant articulation (fully surrounding it).

*OBSTRUENT IN V

A vowel gesture does not completely surround the gesture of an obstruent consonant (where gutturals are not considered obstruent).

Also: *NASAL IN V, *GLIDE IN V, *[r] IN V, *[l] IN V, *[ɹ] IN V, *[ɸ] IN V,

*GUTTURAL IN V

Constraints on CC phasing

*C_xC_y OVERLAP

In a C₁C₂ sequence, C₁ belonging to the class C_x and C₂ belonging to the class C_y, there is no overlap between the gestures of C₁ and C₂.

OCP- GESTURE

Overlapping identical oral gestures are prohibited.

General form:

ALIGN (G¹, LANDMARK¹, G², LANDMARK²) Gafos 2002:278, 292
Align landmark¹ of gesture¹ to landmark² of gesture².

Landmarkⁱ takes values from the set {onset, target, c-center, release, offset}

Specific constraints:

ALIGN (C₁, CENTER, C₂, ONSET)

In a C₁ C₂ sequence, the center of C₁ is aligned with the onset of C₂.

ALIGN (C₁, RELEASE, C₂, TARGET)

In a C₁ C₂ sequence, the release of C₁ is aligned with the target of C₂.

ALIGN (C:, CENTER, C, ONSET)

In a C₁ C₂ sequence, where C₁ is a geminate, the center of C₁ is aligned with the onset of C₂.

ALIGN (C, CENTER, C:, ONSET)

In a C₁ C₂ sequence, where C₂ is a geminate, the center of C₁ is aligned with the onset of C₂.

ALIGN (C, CENTER, R, ONSET)

In a C₁ C₂ sequence, where C₂ is a sonorant, the center of C₁ is aligned with the onset of C₂.

ALIGN (R, CENTER; C, ONSET)

In a C₁ C₂ sequence, where C₁ is a sonorant, the center of C₁ is aligned with the onset of C₂.

ALIGN (R, RELEASE, C, TARGET)

In a C₁ C₂ sequence, where C₁ is a sonorant, the release of C₁ is aligned with the target of C₂.

ALIGN (R, CENTER; C, ONSET) IN σ

In a C₁ C₂ sequence, where C₁ is a sonorant, and where C₁ and C₂ belong to the same syllable, the center of C₁ is aligned with the onset of C₂.

ALIGN (R, RELEASE; C, TARGET) IN σ

In a C₁ C₂ sequence, where C₁ is a sonorant, and where C₁ and C₂ belong to the same syllable, the release of C₁ is aligned with the target of C₂.

Alignment constraints referring to the nucleus

ALIGN (V, OFFSET, SYLL, OFFSET)

The offset of every vowel is aligned with the offset of the rightmost segment that belongs to the same syllable as that vowel.

superseded by ALIGN ([SEG]_α, OFFSET, SYLL, OFFSET)

ALIGN (V, ONSET, SYLL, ONSET)

The onset of every vowel is aligned with the onset of the rightmost segment that belongs to the same syllable as that vowel.

superseded by ALIGN ([SEG]_α, ONSET, SYLL, ONSET)

ALIGN ([SEG]_α, OFFSET, SYLL, OFFSET)

The offset of every segment dominated by an α node is aligned with the offset of the rightmost segment that belongs to the same syllable as that segment.

ALIGN ([SEG]_α, ONSET, SYLL, ONSET)

The onset of every segment dominated by an α node is aligned with the onset of the leftmost segment that belongs to the same syllable as that segment.

ALIGN ([SEG]_α, ONSET, SYLL, ONSET)²

If C and V belong to the same syllable, and C precedes V, the onset of V is not more than one “displacement” from the onset of C.

ALIGN ([SEG]_α, OFFSET, SYLL, OFFSET)²

If V and C belong to the same syllable, and V precedes C, the offset of V is not more than one “displacement” from the offset of C.

ALIGN (C, LANDMARK¹, V, LANDMARK²)

If C and V belong to the same syllable, and C precedes V (not necessarily directly), landmark¹ of C is simultaneous with the landmark² of V.
(**superseded** by ALIGN (C, LANDMARK¹, α, LANDMARK²))

ALIGN (C, LANDMARK¹, α, LANDMARK²)

If C and α belong to the same syllable, and C precedes α (not necessarily directly), landmark¹ of C is simultaneous with the landmark² of α.

Constraints on “gesture sharing”

*MULTIPLE LINKING

A single gesture is not associated with more than one segment.

*MULTIPLE LINKING: STOP-C

A single head gesture is not associated with a stop and a following consonant.

Other markedness constraints

*α α structures do not occur.

ALIGN (MORPHEME, SYLLABLE)

Every morpheme edge coincides with a syllable edge.

ALIGN (PROMINENCE, RIGHT; TONE, LEFT)

Every prominent position P licenses a single high tone T, and the left edge of T is aligned with the right edge of P.

ALIGN (PROMINENCE, LEFT; TONE, LEFT)

Every prominent position P licenses a single high tone T, and the left edge of T is aligned with the left edge of P.

NORISE * T (adapted from Gussenhoven 1997)
(μ μ) $_{\sigma}$ i.e., no rising tone within a syllable

*SEG

Segment S does not occur.

STRESS TO WEIGHT

Kager 1999

A stressed syllable is heavy.

Faithfulness constraints

BE-IDENT-F

Kitto & de Lacy 2000:3

An epenthetic segment E and its base have identical values for feature F.

DEP

A segment that is present in the output is present in the input.

DEP- α

A segment that is dominated by α in the output is dominated by α in the input.

DEP-TONE

A tone in the output has a correspondent in the input.

MAX

A segment that is present in the input is present in the output.

MAX- α

If two segments are adjoined into an α structure in the input, they are adjoined into an α structure in the output.

MAX-*Position*-SEGMENT

(adapted from Beckman 1998 :131)

A segment S in a prominent position in the input has a correspondent in the output.

BIBLIOGRAPHY

- Albright, Adam. 1999. The effect of context on epenthetic vowels in Lakhota. Ms., UCLA.
- Alderete, John. 1995. Winnebago accent and Dorsey's Law. In J. Beckman, S. Urbanczyk, & L. Walsh Dickey (eds.) *University of Massachusetts occasional papers in linguistics 18: Papers in Optimality Theory*. Amherst, MA: GLSA.
- Alderete, John. 1999. Head dependence in epenthesis–stress interaction. In Ben Hermans & Marc van Oostendorp (eds.) *The derivational residue in phonology*. Amsterdam: John Benjamins.
- Allen, W.S. 1953. *Phonetics in ancient India*. London: Oxford University Press.
- Anderson, Stephen R. 1974. *The organization of phonology*. New York: Academic Press.
- Aoki, Haruo. 1968. Toward a typology of vowel harmony. *International journal of American linguistics* **34**. 142–145.
- Aronoff, Mark, Azhar Arsyad, Hassan Basri, & Ellen Broselow. 1987. Tier configuration in Makassarese reduplication. *Papers from the 23rd regional meeting. Chicago Linguistic Society, part two: parasession on autosegmental and metrical phonology*. Chicago: Chicago Linguistics Society. 1–15.
- Arvaniti, A., D. R. Ladd & I. Mennen. 1998. Stability of tonal alignment: The case of Greek prenuclear accents. *Journal of phonetics* **26**. 2–25.
- Awbery, Gwennlian. 1984. Phonotactic constraints in Welsh. In Martin Ball & Glyn E. Jones (eds.) *Welsh phonology*. Cardiff: University of Wales Press. 65–104.
- Bearth, T. 1971. *L'énoncé Toura (Côte d'Ivoire)* PhD dissertation. (Thèse, no. 196 / Faculté des lettres de l'Université de Genève. Summer Institute in Linguistics publications in linguistics and related fields; no. 30) Oklahoma: University of Oklahoma.
- Beckman, Jill. 1998. *Positional faithfulness*. PhD dissertation, University of Massachusetts. Amherst, MA: GLSA
- Blanc, Haim. 1970. The Arabic dialect of the Negev Bedouins. *Proceedings of the Israel academy of sciences and humanities* **4**. 112–50.
- Booij, Geert. 1995. *The phonology of Dutch*. Oxford: Clarendon Press.
- Borgstrøm, C. H. 1937. The dialect of Barra in the Outer Hebrides. *Norsk tidsskrift for sprogvidenskap* **8**. 71–242.
- Borgstrøm, C. H. 1940. *A linguistic survey of the Gaelic dialects of Scotland, vol. 1: the dialects of the Outer Hebrides*. Oslo: Norwegian Universities Press.
- Borgstrøm, C. H. 1941. *The dialects of Skye and Ross-shire*. Oslo: Norwegian Universities Press.
- Bosch, Anna. No date. A gestural analysis of epenthesis in Scottish Gaelic. Ms., University of Kentucky.
- Bosch, Anna. 1993. Syncope and epenthesis in Scottish Gaelic: rules and phonotactics. In A. Davison, N. Maier, G. Silva, W. S. Yan (eds) *Papers from the FLSM IV*. Iowa City, Iowa: University of Iowa Department of Linguistics.

- Bosch, Anna & Kenneth de Jong. 1997. The prosody of Barra Gaelic epenthetic vowels. *Studies in the linguistic sciences* **27**. 2–15.
- Bosch, Anna & Kenneth de Jong. 1998. Syllables and supersyllables: evidence for low level phonological domains. *Texas linguistic forum* **41**. 1–14.
- Boyce, Suzanne. 1990. Coarticulatory organization for lip rounding in Turkish and English. *Journal of the acoustical society of America* **88**. 2584–2595.
- Broselow, Ellen. 1982. On predicting the interaction of stress and epenthesis. *Glossa* **16**. 115–131.
- Broselow, Ellen. 1999. Stress–epenthesis interactions. Paper presented at the Phonology 2K symposium, Harvard/ MIT, April 1999.
- Browman, Catherine. 1994. Lip aperture and consonant releases. In Patricia Keating (ed.) *Phonological structure and phonetic form, papers in laboratory phonology III*. Cambridge: Cambridge University Press. 331–353.
- Browman, Catherine & Louis Goldstein. 1986. Towards an articulatory phonology. *Phonology* **3**. 219–252.
- Browman, Catherine & Louis Goldstein. 1988. Some notes on syllable structure in articulatory phonology. *Phonetica* **45**. 140–155.
- Browman, Catherine & Louis Goldstein. 1990. Tiers in articulatory phonology, with some implications for casual speech. In J. Kingston & M. E. Beckman (eds.) *Papers in laboratory phonology I: Between the grammar and physics of speech*. Cambridge: Cambridge University Press. 341–386.
- Browman, Catherine, & Louis Goldstein. 1992a. “Targetless” schwa: an articulatory analysis. In Gerard Docherty & D. Robert Ladd (eds.) *Papers in laboratory phonology II*. 26–56.
- Browman, Catherine, & Louis Goldstein. 1992b. Articulatory phonology: an overview. *Phonetica* **49**. 155–180.
- Browman, Catherine & Louis Goldstein. 1995. Dynamics and articulatory phonology. In Robert Port & Timothy Van Gelder (eds.) *Mind as motion*. Cambridge, MA: MIT Press. 175–94.
- Browman, Catherine & Louis Goldstein. 2001. Competing constraints on intergestural coordination and self–organization of phonological structures. *Bulletin de la communication parlée* **5**. 25–34.
- Buck, Carl Darling. 1904. *A grammar of Oscan and Umbrian*. Boston: Ginn and Company.
- Bye, Patrik. A. 2001. *Virtual phonology: rule sandwiching and multiple opacity in North Saami*. PhD dissertation, Universitetet i Tromsø.
- Byrd, Dani. 1995. C-centers revisited. *Phonetica* **52**. 285–306.
- Byrd, Dani. 1996. A phase window framework for articulatory timing. *Phonology* **13**. 139–169.
- Campbell, Lyle. 1974. Theoretical implications of Kekchi phonology. *International journal of American linguistics* **40**. 269–78.
- Cho, Taehong. 1998. Specification of intergestural timing and gestural overlap: EMA and EPG studies. MA thesis, UCLA.
- Clements, George N. 1986. Syllabification and epenthesis in the Barra dialect of Gaelic. In *The phonological representation of suprasegmentals*. Dordrecht: Foris. 317–36.

- Clements, George N. 1991. The structure of vowel and consonant gestures. Paper given at the University of Illinois conference on "The organization of phonology: features and domains," May 1991.
- Davidson, Lisa. 2002. Weak syllable elision and gestural coordination in English. Presentation at HUMDRUM, University of Massachusetts.
- Dell, Francois & Mohamed Elmedlaoui. 1996. On consonant releases in Imdlawn Tashlhiyt Berber. *Linguistics* **34**. 357–395.
- Donselaar, Wilma van, Cecile Kuijpers, & Anne Cutler. 1999. Facilitatory effects of vowel epenthesis on word processing in Dutch. *Journal of memory and language* **41**. 59–77.
- Dorian, Nancy. 1965. *A phonological description of Brora, Golspie, and Embo Gaelic: an East Sutherland dialect*. PhD dissertation, University of Michigan.
- Eberhard, David. 1995. *Maimande stress: the need for strata*. Summer Institute of Linguistics publication 122.
- Fleischhacker, Heidi. Cluster-dependent epenthesis asymmetries. ms, UCLA.
- Gafos, Adamantios. 2002. A grammar of gestural coordination. *Natural language & linguistic theory* **20**. 269–337.
- Gafos, Adamantios & Linda Lombardi. 1999. Consonant transparency and vowel echo. *Proceedings of the Northeast linguistic society* **29**. 81–95.
- Garcia-Bellido, Paloma. 1999. Local movement and the syntax of Spanish sounds. In Raffaella Folli & Roberta Middleton (eds.) *Oxford University working papers* **4**.
- Gick, Bryan. 1999. A gesture-based account of intrusive consonants in English. *Phonology* **16**. 29–54.
- Goetry, Vincent, Philippe Mousty & Régine Kolinsky (in press). The influence of the language-specific orthographic representations on the conceptualization of the phonological structure of words: a cross-linguistic comparison between readers and pre-readers. Paper presented at the 7th Annual Meeting of the Society for the Scientific Study of Reading, Boulder, Colorado.
- Grammont, Maurice. 1933. *Traité phonétique*. Paris: Librairie Delagrave.
- Green, Antony Dubach. 1997. *The prosodic structure of Irish, Scots Gaelic, and Manx*. PhD dissertation, Cornell University.
- Greene, David. 1952. Middle quantity in Irish. *Ériu* **16**. 212–218.
- Gussenhoven, Carlos. 1993. The Dutch foot and the chanted call. *Journal of linguistics* **29**. 37–63.
- Gussenhoven, Carlos. 1997. The lexical tone contrast of Roermond Dutch in Optimality Theory. In Horne, Merle (ed) *Prosody: theory and experiment*. Amsterdam: Kluwer.
- Gussenhoven, Carlos & Peter van der Vliet. 1999. The phonology of tone and intonation in the Dutch dialect of Venlo. *Journal of linguistics*. **35**. 99–135.
- de Haas, Wim. 1987. An autosegmental approach to vowel coalescence. *Lingua* **73**. 167–199.

- de Haas, Wim. 1988. A formal theory of vowel coalescence. PhD dissertation, Catholic University of Nijmegen.
- Haiman, John. 1980. *Hua: a Papuan language of the eastern highlands of New Guinea*. Amsterdam: John Benjamins.
- Hale, Kenneth & Josie White Eagle. 1980. A preliminary metrical account of Winnebago accent. *International journal of American linguistics* **46**. 117–32.
- Hall, Nancy. 2001. Max–position drives iterative footing. In K. Megerdoomian & L.A. Bar–el (eds.) *WCCFL 20 Proceedings*. 248–261. Somerville, MA: Cascadilla Press.
- Halle, Morris. 1995. Feature geometry and feature spreading. *Linguistic inquiry* **26**. 1–46.
- Halle, Morris & Paul Kiparsky. 1981. review article on ‘Garde: Histoire de l’accentuation slave’. *Language* **57**. 150–181.
- Harms, Robert T. 1964. *Finnish structural sketch*. Indiana: Research institute for inner Asian studies, Indiana University.
- Harms, Robert T. 1976. The segmentalization of Finnish ‘nonrules’. *Texas linguistic forum* **5** (Papers from the Transatlantic Finnish Conference). 73–88.
- Harrikari, Heli. 1999. Epenthesis, geminates, and the OCP in Finnish. *Nordic journal of linguistics* **22**. 3–26.
- Harrikari, Heli. 2000. A response to Suomi’s comments. *Nordic journal of linguistics* **23**. 95–96.
- Harris, Katherine S. & Fredericka Bell–Berti. 1984. On consonants and syllable boundaries. In L. Raphael, C. Raphael, & M. Valdovinos (eds.) *Language and cognition*. New York: Plenum Press. 89–95.
- Hasegawa, Yoko & Kazue Hata. 1988. Delayed pitch fall in Japanese. *Journal of the acoustical society of America* Suppl. 1.83, S29.
- Hayes, Bruce. 1995. *Metrical stress theory: Principles and case studies*. Chicago: University of Chicago Press.
- Hayward, Dick. 1984. *The Arbore language: A first investigation*. Hamburg: Helmut Buske Verlag.
- Hodge, Carleton T. 1947. *An outline of Hausa grammar*. *Language* dissertation no. 41. Baltimore: Linguistic Society of America.
- Hollenbach, Barbara E. 1984. *The phonology and morphology of tone and laryngeals in Copala Trique*. PhD Dissertation, University of Arizona.
- Holmer, Nils. 1938. *Studies on Argyllshie Gaelic*. Uppsala: Almqvist & Wiksells Boktryckeri–A.B.
- Honorof, D. N., & C. Browman. 1995. The center or edge: How are consonant clusters organized with respect to the vowel? In K. Elenius & P. Branderud (eds) *Proceedings of the XIIIth international congress of phonetic sciences*. vol. 3. Stockholm: KTH and Stockholm University. 552–555.
- Hudson, Grover. 1995. Consonant release and the syllable. *Linguistics* **33**. 1–21.
- Jannedy, Stefanie. 1994. Rate effects on German unstressed syllables. *OSU Working Papers in Linguistics* **44**. 105–124.

- De Jong, K. & J. McDonough. Tone and tonogenesis in Navajo. University of California, Los Angeles, *Working papers in phonetics* **84**. 165–182.
- Juret, Etienne. 1921. *Manual de phonétique latine*. Paris.
- Ka, Omar. 1994. *Wolof phonology and morphology*. Lanham, MD, New York, London: University Press of America.
- Kager, René. 1999. *Optimality Theory*. Cambridge: Cambridge University Press.
- Karlsson, F. 1983. *Suomen kielen äänne- ja muotorakenne*. [The structure of Finnish phonology and morphology] Juva: WSOY.
- Kawahara, Shigeto. 2000. Faithfulness among variants. Ms., International Christian University.
- Kawahara, Shigeto. 2003. Spreading and copying in phonological theory. Ms, University of Massachusetts-Amherst.
- Kaye, Jonathan. 1981. Les diphtongues cachees du Vata. *Studies in African linguistics* **12**. 225–243.
- Kaye, Jonathan. 1985. On the syllable structure of certain west African languages. In D. L. Goyvaerts (ed) *African linguistics: Essays in memory of M. W. K. Semikenke*. Amsterdam: John Benjamins.
- Kenstowicz, Michael. 2001. The Role of Perception in Loanword Phonology. A review of *Les emprunts linguistiques d'origine européenne en Fon* by Flavien Gbéto, Köln: Rüdiger Köppe Verlag. To appear in *Linguistique Africaine* vol xx.
- Kettunen, L. 1940a. *Suomen murteet IIIa. Murrekartasto*. Suomalaisen kirjallisuuden seura. [Finnish dialects IIIa. Dialect atlas. Finnish literature society.]
- Kettunen, L. 1940b. *Suomen murteet IIIB. Selityksiä murrekartastoon*. Suomalaisen kirjallisuuden seura 188. [Finnish Dialects IIIb. Explanations for the dialect atlas. Finnish literature society 188.]
- Kinkade, M. Dale. 1963–4. Phonology and morphology of Upper Chehalis. *International journal of American linguistics* **29**. 181–95, 345–356, **30**, 32–61, 251–260.
- Kinkade, M. Dale. 1998. How much does a schwa weigh? In E. Czaykowska-Higgins & M. D. Kinkade (eds.) *Salish languages and linguistics*. 197–216. Berlin: Mouton de Gruyter.
- Kitto, Catherine. 1997. *Epenthesis in Polynesian loanwords*. MA thesis, University of Auckland.
- Kitto, Catherine & Paul de Lacy. 2000. Correspondence and epenthetic quality. In Carolyn Smallwood & Catherine Kitto (eds.) *Proceedings of AFLA VI: The sixth meeting of the Austronesian formal linguistics association*. 181–200.
- Krumholz, Jeanne; Marjorie Dolson & Miguel Hernández Ayuso. 1995. *Diccionario Popoluca de San Juan Atzingo Puebla*. Tucson, Arizona: Insituto Lingüístico de Verano.
- Kuipers, Cecile & Wilma van Donselaar. 1997. The influence of rhythmic context on schwa epenthesis and schwa deletion in Dutch. *Language and speech* **41**. 87–108.
- Ladd, D. R., Ineke Mennen & Astrid Schepman. 2000. Phonological conditioning of peak alignment in rising pitch accents in Dutch. *Journal of the acoustical society of America* **107**. 2685–2696.

- Ladefoged, Peter. Forthcoming. Some thoughts on syllables: an old fashioned interlude. In *Papers in laboratory phonology VI*.
- Ladefoged, Peter, Jenny Ladefoged, Alice Turk, Kevin Hind & St. John Skilton. 1998. Phonetic structures of Scottish Gaelic. *Journal of the international phonetic association* **28**. 1–41.
- Landman, Meredith. Forthcoming. Morphological contiguity. To appear in *University of Massachusetts Occasional Papers 26: Papers on Optimality Theory*. Amherst, MA: GLSA.
- Laurosela, J. 1922. *Foneettien tutkimus Etelä-Pohjanmaan murteesta*. [A phonetic study on southern Ostrobothnian dialects.] Helsinki: Finnish literature society.
- Leben, W. R. 1978. The representation of tone. In V. A. Fromkin (ed) *Tone. A linguistic survey*. New York: Academic Press.
- Leben, William R. and Osamu Fujimura (2000). “Extra-short vowels in West African languages.” *proceedings of LP 2000*, B. Palek and O. Fujimura, eds. Karolinum Press.
- Lenz, Rodolfo. 1940. Estudios Chilenos in *Biblioteca de dialectologia hispano-america tomo VI: El Espanol en Chile*. Buenos Aires: Instituto de Filologia.
- Lenz, Rodolfo. 1892, 1893. Chilenische studien. *Phonetische studien V–VI*.
- Levin, Juliette. 1987. Between epenthetic and excrescent vowels. *West coast conference in formal linguistics* **6**.
- Löfqvist, A. 1991. Proportional timing in speech motor control. *Journal of phonetics* **19**. 343–350.
- Malmberg, Bertil. 1965. *Estudios de fonética hispánica*. Madrid: Consejo superior de investigaciones científicas.
- Malone, Joseph L. 1993. *Tiberian Hebrew phonology*. Winona Lake, Indiana: Eisenbrauns.
- McCarthy, John. 1979. *Formal problems in Semitic phonology and morphology*. PhD Dissertation, MIT.
- McCarthy, John. 1991. *The phonology of Semitic pharyngeals*. Ms., University of Massachusetts– Amherst.
- McCarthy, John. 1998. Morpheme structure constraints and paradigm occultation. *Chicago linguistics society* **34: the panels**. 125–150.
- McCarthy, John & Alan Prince. 1993. *Prosodic morphology I: constraint interaction and satisfaction*. Technical report #3, Rutgers University center for cognitive science. 230–.
- McCarthy, John & Alan Prince. 1994. Generalized alignment. In Geert Booij & Jaap van Marle (eds) *Yearbook of Morphology 1993*. Dordrecht: Kluwer. 79–153.
- McCarthy, John & Alan Prince. 1995. Faithfulness and reduplicative identity. In J. Beckman, S. Urbanczyk, & L. Walsh Dickey (eds.) *University of Massachusetts occasional papers in linguistics* **18: Papers in Optimality Theory**. 249–384. Amherst, MA: GLSA.
- Metcalfe, C.C. 1975. *Bardi verb morphology*. Pacific Linguistics series B– no. 30.
- Michelson, Karin. 1988. *A comparative study of Lake-Iroquoian accent*. Dordrecht: Kluwer.
- Miner, Kenneth. No date. *Winnebago grammar*. Ms., University of Kentucky.

- Miner, Kenneth. 1979. Dorsey's Law in Winnebago–Chiwere and Winnebago Accent. *International journal of American linguistics* **45**. 25–33.
- Miner, Kenneth. 1981. Metrics, or Winnebago made harder. *International journal of American linguistics* **47**. 340–42.
- Miner, Kenneth. 1992. Winnebago accent: the rest of the data. Indiana University Linguistics Club Twenty–Fifth Anniversary Volume. Bloomington, Indiana: Indiana University Linguistics Club. 28–53.
- Miner, Kenneth. 1992b. *Winnebago field lexicon*. Ms., University of Kentucky.
- Moussa, Bamba. 1986. Mawukakan loanword phonology. Ms., University of Pennsylvania.
- Ní Chiosáin, Maire. 1991. *Topics in the phonology of Irish*. PhD Dissertation, University of Massachusetts. Amherst, MA: GLSA.
- Ní Chiosáin, Maire. 1994. Barra Gaelic vowel copy and (non–) constituent spreading. *West coast conference on formal linguistics* **13**. 3–13.
- Ní Chiosáin, Maire. 1999. Syllables and phonotactics in Irish. In Harry van der Hulst & Elizabeth Ritter (eds.) *The syllable: views and facts*.
- Nittrouer, S. K. G. Munhall, J. A. S. Kelso, B. Tuller, & K. S. Harris. 1988. Patterns of interarticulator phasing and their relation to linguistic structure. *Journal of the acoustic society of America* **84**. 1653–1661.
- Ó Baoill, Dónal P. 1980. Preaspiration, epenthesis, and vowel lengthening– interrelated and of similar origin? *Celtica* **XIII**. 79–108.
- Oftedal, Magne. 1956. *A linguistic survey of the Gaelic dialects of Scotland, vol. III: the Gaelic of Leurbost, Isle of Lewis*. Oslo: H. Aschehoug & Co.
- Ohala, J. J. 1978. The production of tone. . In V. A. Fromkin (ed) *Tone. A linguistic survey*. New York: Academic Press.
- Ohman, S.E.G. 1966. Coarticulation in VCV utterances: spectrographic measurements. *Journal of the acoustical society of America* **39**. 151–168.
- O'Rahilly, T.F. 1932. *Irish dialects past and present*. Dublin institute for advanced studies.
- Ó Siadhail, Micheál. 1989. *Modern Irish: Grammatical structure and dialectical variation*. Cambridge: Cambridge University Press.
- Paradis, Carole & Jean–François Prunet. 1989. On coronal transparency. *Phonology* **6**. 317–348.
- Parker, Steve. 1994. Laryngeal codas in Chamicuro. *International journal of American linguistics* **60**. 261–71.
- Purcell, Edward T. 1979. Formant frequency patterns in Russian VCV utterances. *Journal of the acoustical society of America* **66**. 1691–1702.
- Quilis, Antonio. 1981. *Fonética acústica de la lengua española*. Madrid: Editorial Gredos

- Reenan, Pieter van. 1986. The vocalization of /l/ in standard Dutch, a pilot study of an ongoing change. In F. Beukema & A. Hulk (eds.) *Linguistics in the Netherlands*. Amsterdam: John Benjamins. 189–199.
- Saltzman, Elliott. 1986. Task dynamic coordination of the speech articulators: A preliminary model. In H. Heuer & C. Fromm (eds) *Generation and modulation of action patterns*, Experimental brain research series 15. New York: Springer-Verlag. 129–144.
- Saltzman, E. & K.G. Munhall. 1989. A dynamical approach to gestural patterning in speech production. *Ecological psychology* **1**. 333–382.
- Schuchardt, Hugo. 1867. *Der Vokalismus des Vulgärlateins*. Leipzig: Teubner.
- Smith, Norval. 1999. A preliminary account of some aspects of Leurbost Gaelic syllable structure. In Harry van der Hulst & Elizabeth Ritter (eds). *The Syllable: views and facts*.
- Sovijärvi, A. 1937. Foneettisia havaintoja Tornionjoen ja Pohjanmaan murteiden svaavokaaleista. [Phonetic observations on schwa in the Tornionjoki and the Ostrobothnian dialects.] *Suomi* **5**. 1–29.
- Sproat, Richard & Osamu Fujimura. 1993. Allophonic variation in English /l/ and its implications for phonetic implementation. *Journal of phonetics* **21**. 291–311.
- Stemberger, Joseph Paul. 1993. Glottal transparency. *Phonology* **10**. 107–38.
- Steriade, Donca. 1987. Locality conditions and feature geometry. *Proceedings of the North Eastern linguistics society* **17**. Amherst, MA: GLSA. 595–618.
- Steriade, Donca. 1990. Gestures and Autosegments. In John Kingston & Mary Beckman (eds.) *Papers in laboratory phonology I*. Cambridge: Cambridge University Press. 382–397.
- Sugito, Miyoko. 1968. Dootai sokutei ni yoru nihongo akusento no kaimei. *Gengo Kenkyuu* **55**. Reprinted in M. Sugito (ed) 1982. *Nihongo akusento no kenkyuu*. Tokyo: Sanseido. 49–75.
- Suomi, Kari. 1990. Huomioita yleiskielen konsonanttien yhdistelyrajoituksista ja pohjalaismurteiden epenteettisestä vokaalista. [Observations on restrictions on consonant combinations in standard Finnish and on the epenthetic vowels in the Ostrobothnian dialects.] *Virittäjä* **94**. 139–160.
- Suomi, Kari. 2000. Nearly a million Ostrobothnians cannot be wrong: comments on an Optimality Theoretic analysis of “Ostrobothnian”. *Nordic journal of linguistics*. **23**. 89–93.
- Susman, A. 1943. *The accentual system of Winnebago*. PhD Dissertation, Columbia
- Suzuki, Keiichiro. 1998. *A typological investigation of dissimilation*. PhD Dissertation, University of Arizona.
- Ternes, Elmar. 1973. *A phonemic analysis of Scottish Gaelic*. Hamburg: Helmut Buske Verlag.
- Thompson, R. L. Svarabhakti and some associated changes in Manx. *Celtica* **V**
- Ultan, Russell. 1971. A typological view of metathesis. *Working papers of language universals* **7**. 1–44.
- Venneman, Theo. 1988. *Preference laws for syllable structure and the explanation of sound change: with special reference to German, Germanic, Italian, and Latin*. Berlin: Mouton de Gruyter.

- Warner, Natasha, Allard Jongman, Anne Cutler, & Doris Mücke. 2001. The phonological status of Dutch epenthetic schwa. *Phonology* **18**. 387–420.
- Wehr, Hans. 1971. *A dictionary of modern written Arabic*, edited by J. Milton Cowan, 3d edition. Ithaca, NY: Spoken Language Services.
- White Eagle, Josie. 1982. Teaching scientific inquiry and the Winnebago language. *International journal of American linguistics* **48**. 306–319.
- Whitney, William Dwight. 1889. *Sanskrit grammar*. Cambridge, Mass.: Harvard University Press.
- Wiik, Kalevi. 1965. *Finnish and English vowels*. Turun Yliopisto.
- Wijnen, Frank, Evelien Krikhaar & Els Den Os. 1994. The (non)realization of unstressed elements in children's utterances: evidence for a rhythmic constraint. *Journal of child language* **21**. 59–83.
- Wolff, Hans. 1950. Comparative Siouan III. *International journal of American linguistics* **16**. 168 – 178.
- Wright, Joseph. 1905. *The English dialect grammar*. Oxford: Clarendon Press.
- Xu, Y. 1997. Contextual tonal variations in Mandarin. *Journal of phonetics* **25**. 61–83.
- Xu, Y. 1998. Consistency of tone-syllable alignment across different syllable structures and speaking rates. *Phonetica* **55**. 179–203.
- Xu, Y. 1999. Effects of tone and focus on the formation and alignment of f0 contours. *Journal of phonetics* **27**. 55–105.
- Zsiga, Elizabeth. 1995. An acoustic and electropalatographic study of lexical and postlexical palatalization in American English. In Mary Beckman & John Kingston (eds.) *Phonology and phonetic evidence: Papers in laboratory phonology IV*. 282 – 302.
- Zsiga, Elizabeth. 1997. Features, gestures and Igbo vowels: an approach to the phonetics–phonology interface. *Language* **73**. 227–274.