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Vowel Length and Coda Cluster Interactions in Misantla Totonac[1]

1 Introduction

- Some researchers have used phonetic explanations (e.g, Licensing by Cue (Steriade 1997, 1999)) to replace syllabic analyses. I will argue that this approach is inappropriate for at least some phenomena.
- Misantla Totonac (MacKay 1999; henceforth Totonac) shows an interaction between vowel length and coda cluster permissibility that is best analyzed as the product of syllable size constraints.

2 Coda Clusters in Misantla Totonac

(1) Phoneme Inventory (MacKay 1999:30)

a. Vowels: /i/, /a/, /u/, /ḭ/, /a̰/, /ṵ/, each with numerous allophones. Their long counterparts are also phonemic.

b. Consonants:

	Labial	Alveolar	Alveo-palatal	Palatal	Velar	Uvular	Glottal
Stops	p	t			k	q	ʔ
Affricates		t͡s	t͡ʃ				
Fricatives		s, ɬ	ʃ				h
Laterals	l						
Nasals	m	n					
Glides	w			j			

- Totonac has two kinds of coda clusters, nasal+stop and stop+fricative:[2]

Two-Consonant Clusters

(2) Homorganic nasal plus dorsal stop (/q/, /k/, or /g/):

a. *lɔ**ɴq**.ʃta̰n* 'he/she was cold'
b. *muu.sii**ŋk*** 'cave'
c. *ta**ŋg**.wi.nḭʔ* 'money'

[1] I'd like to thank the UC Santa Cruz phonology reading group for valuable comments on this paper. Special thanks to Armin Mester, Junko Itô, and Adam Albright.

[2] There is a third kind of coda cluster, nasal+stop+fricative, which will be addressed below.

(3) Stop plus fricative:
  a. *tsa̰**qs*** ‘almost/about to’
  b. *tuu.t͡ʃu.tɔ**qʃ*** ‘he/she is lame’
  c. *pa**qɬ**.t͡ʃa* ‘tomato’
  d. *ʔṵt pa**ks*** ‘X is covered with dew’

- But only the nasal+stop clusters appear after long vowels:

(4) Nasal-Stop Clusters After Long Vowels
  a. *ki.ɬq**ɔɔɴɢ**.nan* ‘he/she (mouth) snores’
  b. *ʔḭ.ʃlaa.ɬq**ɔɔɴɢ**.na̰* ‘his/her snores’
  c. *muu.s**iiŋk*** ‘cave’
  d. **ki.ɬq**ɔɔqs**.t͡san*

- Nasals do not induce long vowels, either alone or in clusters:

(5) a. *pa̰**ɴ**q.ʃwa̰ʔ* ‘smallpox’
  b. *lɔ**ɴ**q.ʃta̰**n*** ‘he/she was cold’
  c. *ta**ŋ**g.wi.**n**ḭʔ* ‘money’
  d. *hɔ**ŋ**kukutaɬ* ‘DET oak grove’
  e. *mi**ŋ**ka**m**a**ŋ*** ‘your children’

- The ungrammaticality of (4d) compared to (3) suggests that Totonac has a maximal syllable size. A VCC rime is acceptable, but VVCC is not.
- But VVCC is fine if CC = nasal+stop. How can we account for this fact? What are the differences between these two kinds of clusters?
- Throughout the language, nasals assimilate in [place] to following consonants (MacKay 1999). The nasal+stop clusters are all homorganic.

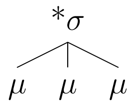
(6) *Nasal Assimilation*
  a. /mi**n**-pa̰ʃ-nḭ/ → *mi**m**pa̰ʃnɪ̰* ‘your pig’
  b. /mi**n**-kuʃ-muu-nḭ/ → *mi**ŋ**kuʃmuun* ‘your chest’
  c. /lu**n**q-ʃta̰n/ → *lɔ**ɴ**qʃta̰n* ‘he/she was cold’
  d. /a̰**n**-kan-laɬ/ → *ʔa̰**ŋ**kanlaɬ* ‘someone went’
  e. /ki**n**-pulḭ-Vt/ → *ki**m**pulɪt* ‘my sweat’

- In contrast, stop+fricative clusters cannot be homorganic. Every stop+fricative coda cluster is composed of consonants with different Place features (MacKay 1999).
- Only dorsal stops ([k] and [q], plus their voiced allophones) appear in coda clusters (both nasal-stop and stop-fricative). [k] only appears with [s], and there are no phonemic uvular fricatives. Homorganicity is impossible in stop-fricative clusters.
- From this point of view, it looks like Totonac allows only one Place feature to appear after long vowels. Two Place features are acceptable after short vowels.

3 Limiting Syllable Sizes

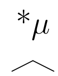
- Syllables in Totonac have three rime "slots." A short vowel leaves room for two coda consonants (i.e., Place nodes), but a long vowel only leaves room for one consonant (again, a Place node).
- We need constraints limiting syllable size:

(7) *3μ:



- This is a commonly assumed constraint; languages have two-way weight contrasts but rarely three-way contrasts.

(8) NON-BRANCHING MORAS:

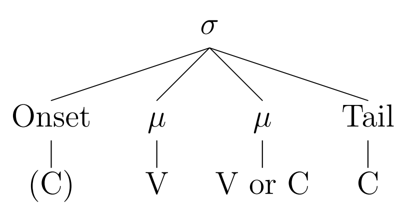


- NON-BRANCHING MORAS is in the spirit of WEIGHT BY POSITION: it penalizes rime segments that don't bear their own moras.
- These constraints limit syllables to maximally two moraic segments. All rime segments after these two moraic segments must appear in a non-moraic position at the right edge of the syllable. We can call them "Tail" segments.
- (9) limits syllables to a single Tail segment.

(9) *COMPLEX(Tail): Consonant clusters within the Tail are banned.

- *COMPLEX(Tail) captures the triple markedness of Tail clusters: they are codas, they are non-moraic, and they are clusters.
- With these three constraints, we end up with the maximal syllable in (10) (cf. Selkirk (1982)):

(10)



(11) When ranked over MAX and DEP, VCC rimes are permitted:

/t͡sa̰qs/ 'almost/about to'	*3μ	NON-BRANCHING MORAS	*COMPLEX(Tail)	MAX	DEP
☞a. t͡sa̰$_\mu$q$_\mu$s$_T$					
b. t͡sa̰$_\mu$q$_\mu$s$_\mu$	*!				
c. t͡s[a̰q]$_\mu$s$_\mu$		*!			
d. t͡sa̰$_\mu$[qs]$_T$			*!		
e. t͡sa̰q				*!	
f. t͡sa̰.qis					*!

(12) But VVCC rimes are ruled out:

/t͡sa̰aqs/	*3μ	Non-Branching Moras	*Complex(Tail)	Max	Dep
a. $\widehat{\text{ts}}$a̰$_\mu$a̰$_\mu$q$_\mu$s$_T$	*!				
b. $\widehat{\text{ts}}$a̰$_\mu$[a̰q]$_\mu$s$_T$		*!			
c. $\widehat{\text{ts}}$a̰$_\mu$a̰$_\mu$[qs]$_T$			*!		
☞d. $\widehat{\text{ts}}$a̰$_\mu$a̰$_\mu$q$_T$				*	
☞e. $\widehat{\text{ts}}$a̰$_\mu$a̰$_\mu$.qis					*

- As it stands, nasal+stop clusters are ruled out after long vowels, too.
- To allow nasal+stop clusters but not stop+fricative clusters, constraints must be sensitive to Place specifications. Essentially, we want constraints that identify segments by their Place nodes so that homorganic clusters are counted as single segments:

(13) *Complex(Tail)$_{[Place]}$: Within a syllable, multiple Place nodes are banned in the Tail.

- But this opens the door for identification of segments by any feature: *Complex(Tail)$_{[distributed]}$ and *Complex(Tail)$_{[lateral]}$. Unless we can single out Place nodes as special in some way, this approach is dangerous.
- Itô & Mester (1993) argues that a segment is licensed only if both its Root and Head are licensed. Roots are equated with root nodes, and a segment's Head is just its Place node. Place nodes are therefore unique within feature geometry.
- The constraints used so far have equated segments with Roots, but there's no reason we can't use Heads instead:

(14) *Complex(Tail)$_H$: Within a syllable, multiple Heads are banned in the Tail.

- The only difference between (14) and (9) is that one identifies segments by their Roots and the other uses Heads.
- Since nasal-stop clusters share a single Place node, they will not be penalized by *Complex(Tail)$_H$.

(15) Nasal+stop clusters are now allowed in the Tail:

/muusiiŋk/ 'cave'	*3μ	Non-Branching Moras	*Complex(Tail)$_H$	Max	Dep
☞a. muu.sii[ŋk]$_T$					
b. muu.siik$_T$				*!	
c. muusiiŋ.ki					*!

- How does this fit in with the rest of Totonac's coda facts?

4 Other Phonotactics

4.1 Fricatives

- Given a choice, fricatives are syllabified as onsets, forming onset clusters where necessary. Fricative+C clusters are the only onset clusters in Totonac:

(16) *Onset Clusters*

a. *spat* 'soil/earth'
b. *sta̰.ku* 'star'
c. *sqɔ.nah* 'warm'
d. *sla.pɔχ* 'soft'
e. *smaaχ.smaaχ.wan* 'he/she cries'
f. *ʃkaɬ* 'he/she bit X'
g. *lak.ʃnuun* 'he/she stretches X'
h. *ɬta.ta* 'he/she sleeps'
i. *tɔq.ɬwan* 'he/she hiccoughs'

- But there are two exceptions to this generalization.
- Consecutive fricatives are disallowed. The first fricative deletes (MacKay 1999:56):

(17) *Fricative Deletion*

a. /i**ʃ**-**ɬ**tuk/ → *i.**ɬ**tuk* 'his/her thorn'
b. /i**ʃ**-**ʃ**iila/ → *i.**ʃ**ii.la* 'his/her chair'
c. /ik-t͡suqu**s**-**ʃ**wa̰a̰q/ → *ik.t͡sɔ.qɔ.**ʃ**wɛ̰ɛ̰χ* 'I scratch X's knee'
d. /ik-ki**ɬ**-**s**tak-nan/ → *i.ki.**s**tak.nan* 'my mouth is healing'
e. /ki**ɬ**-**ɬ**quunq-nan/ → *ki.**ɬ**qɔɔɴɢ.nan* 'he/she (mouth) snores'

- Fricative+affricate sequences can't be syllabified together. The fricative becomes a coda, and the affricate becomes an onset:[3]

(18) *Fricative-Affricate Syllabification*

a. /i**ʃ**-**t͡s**a̰la̰n/ → *ʔḭ**s**.**t͡s**a̰.la̰ʔ* 'you sprout'
b. /t͡sa̰q**s**-**t͡ʃ**a̰n-ʃta̰n/ → *t͡sa̰q**ʃ**.**t͡ʃ**a̰n.ʃta̰n* 'he/she was about to sow X'

- This phenomenon is important because it bears on where fricatives are syllabified, and therefore it influences the distribution of stop+fricative clusters.
- It is an OCP effect (Leben 1973, 1978; Goldsmith 1976; McCarthy 1986; Myers 1997).

(19) OCP(strid): Within a syllable, adjacent strident segments are banned.

- OCP(strid) forces fricative+affricate sequences to be heterosyllabic. It is never violated, so I rank it alongside the syllable-size constraints.

[3]The fricative also undergoes place assimilation, taking on the Place feature of the affricate. I do not analyze this process here.

(20)

/iʃ-t͡sa̰la̰n/ 'you sprout'	OCP(strid)	*3μ	NBM	*COMPLEX(Tail)$_H$	DEP	MAX
a. i.st͡sa̰.la̰n	*!					
☞b. is.t͡sa̰.la̰n						
c. i.t͡sa̰.la̰n						*!
d. i.ʃi.t͡sa̰.la̰n					*!	

- Since fricatives are syllabified as onsets wherever possible, only fricative+affricate sequences will yield fricative codas. Consequently, all word-internal stop+fricative coda clusters will be followed by an affricate.

4.2 Nasal Place Assimilation

- Recall that nasals undergo place assimilation when followed by a consonant. For our purposes, (21) is a suitable constraint.

(21) AGREE(place): Nasals agree in place with following consonants.

- It is never violated, so it is undominated.

(22) OCP(strid), AGREE(place), *3μ, NON-BRANCHING MORAS, *COMPLEX(Tail)$_H$ $\gg$ DEP, MAX

(23) Nasal+stop clusters are permitted after long vowels, provided the cluster is homorganic:

/iʃ-laa-ɬquunq-na̰/ 'his/her snores'	OCP(str)	AGR	*3μ	NBM	*COMP(Tail)$_H$	DEP	MAX
a. ʔḭ.ʃlaa.ɬqɔɔ[nɢ]$_T$.na̰		*!			*!		
☞b. ʔḭ.ʃlaa.ɬqɔɔ[ɴɢ]$_T$.na̰							
c. ʔḭ.ʃlaa.ɬqɔɔɢ$_T$.na̰							*!

(24) But stop+fricative clusters are banned after long vowels. The fricative is syllabified as an onset if possible:

/iʃ-laa-ɬquuqs-na̰/	OCP(str)	AGR	*3μ	NBM	*COMPLEX(Tail)$_H$	DEP	MAX
a. ʔḭ.ʃlaa.ɬqɔɔ[qs]$_T$.na̰					*!		
☞b. ʔḭ.ʃlaa.ɬqɔɔq$_T$.sna̰							
c. ʔḭ.ʃlaa.ɬqɔɔq$_T$.na̰							*!
d. ʔḭ.ʃlaa.ɬqɔɔ.qis.na̰						*!	

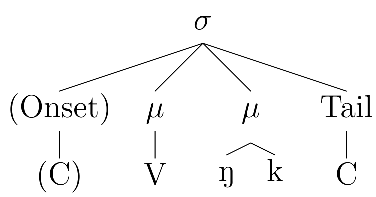
(25) But deletion or epenthesis is preferred where this option is unavailable (hypothetical input):

/iʃ-laa-ɬquuqs-t͡ʃa̰/	OCP(str)	AGREE	*3μ	NBM	*COMPLEX(Tail)$_H$	DEP	MAX
a. ʔḭ.ʃlaa.ɬqɔɔ[qs]$_T$.t͡ʃa̰					*!		
b. ʔḭ.ʃlaa.ɬqɔɔq$_T$.st͡ʃa̰	*!						
☞c. ʔḭ.ʃlaa.ɬqɔɔq$_T$.t͡ʃa̰							*
☞d. ʔḭ.ʃlaa.ɬqɔɔ.qis.t͡ʃa̰						*	

5 Triconsonantal Clusters

- If we can identify segments by their Heads, we predict a third kind of coda cluster:

(26)



- With homorganic nasal-stop clusters under the second mora (and thus not violating a Head-oriented NON-BRANCHING MORAS), the Tail is free for another consonant.
- This Tail could be a fricative: We know that stop+fricative coda sequences are acceptable in Totonac, so we might suppose that nasal+stop+fricative clusters are licit.

(27) This is a correct prediction: *nah.laχ.tʃaɴqʃ* 'he/she will chop' is attested.

(28)

/naɬ-lak-t͡ʃanqʃ/	OCP(str)	AGREE	*3μ	NBM$_H$	*COMPLEX(Tail)$_H$	DEP	MAX
☞a. nah.laχ.t͡ʃa[ɴq]$_\mu$ʃ$_T$							
b. nah.laχ.t͡ʃaɴ$_\mu$q$_T$							*!
c. nah.laχ.t͡ʃa.niq$_\mu$ʃ$_T$						*!	

6 Alternative Analyses

- Sonority Sequencing (Fudge 1969; Selkirk 1984; Clements 1990) can't account for the long-vowel asymmetry. If stop+fricative clusters are licensed by sonority considerations after short vowels, it's unclear how this might change after long vowels.
  - Sonority Sequencing just compares adjacent segments. It can't compare strings of more than two segments, and it's not clear how vowel length would be taken into consideration.

- Licensing by Cue (Steriade 1997, 1999) is also unsatisfactory. Stop+fricative could be ruled out if the cues for one segment are suppressed.
  - But after long vowels, these cues should be more salient compared to post-short-vowel contexts. Stop+fricative clusters should be preferred after long vowels. If anything, Licensing by Cue makes the wrong predictions.

7 English

- The constraints developed here are also relevant to English.
- After long vowels, only coronal clusters are permitted (Selkirk 1982): *find* [faind] vs. **fimp* [faimp]. This could be accounted for by modifying *Complex(Tail) to rule out only non-coronal clusters, perhaps as a reflection of the unmarkedness of coronals.
- There are many biconsonantal coda clusters that can't be combined into monomorphemic triconsonantal clusters:

(29) *Unattested Tautomorphemic Three-Consonant Coda Clusters in English*

Unattested Cluster		**Attested Pairs**
[rnd]	**harnd*	*warn, hand*
[rnt]	**pirnt*	*warn, pint*
[rnt͡ʃ]	**warnch*	*warn, inch*
[rnd͡ʒ]	**rarnge*	*warn, range*
[rmp]	**farmp*	*farm, limp*
[rlk]	**pearlk*	*pearl, milk*
[rŋk]	**irnk*	*warn, ink*
[rŋ(g)]	**sirng*	*warn, sing*

- This is a consequence of limiting rimes to three segments, perhaps using Roots instead of Heads here.

8 Conclusion

- Misantla Totonac shows an interaction between coda cluster permissibility and vowel length: only a subset of the language's coda clusters appear after long vowels.
- This is best analyzed as a symptom of syllable size limitations that interact with other phonotactic constraints in the language.
- Rather than limiting syllable size in a stipulative manner (cf. Fudge (1969); Selkirk (1982); Borowsky (1986)), the analysis proposed here uses constraints that are motivated by more general markedness considerations.
- The syllable-size analysis has applications beyond Misantla Totonac.

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