

# Postnasal vowel deletion in Navajo

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Kari (1976) shows that in underlying /nV/ sequences in Navajo, the vowel is often deleted, while the nasal becomes syllabic. The applicability of the process depends on what follows the /nV/ sequence—in some cases it is obligatory, in others optional, and in others blocked. Furthermore, in optional cases deletion occurs more frequently in faster or more casual speech. In this paper I attempt to answer two questions regarding this process. First, why does the [n] become a nucleus even in contexts where it could remain a coda? Second, how can we account for the optionality of the process in terms of Optimality Theoretic constraint ranking?

In §1 I analyze the creation of syllabic nasals as a type of compensatory lengthening. In §2 I model the varying behavior of vowel deletion under a range of different speech styles by allowing a single markedness constraint to be reranked along a fixed hierarchy of faithfulness constraints. This account uses AGREE constraints in a novel way: they block the creation of a heterorganic NC sequence on the surface rather than force the repair of an underlying heterorganic sequence. Finally, in §3 I discuss some issues left unresolved in my account.

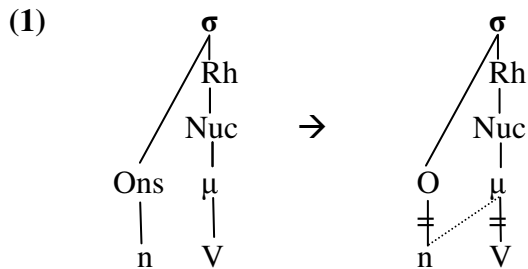
## 1. Syllabification

The syllabic nasal [ŋ] in Navajo occurs on the surface only as the result of a vowel deleting from an nV sequence. When a vowel is deleted after an [n], why does the nasal become syllabic rather than remain an onset, or become a coda for the preceding syllable? In some cases, this is clearly ruled out because an illegal cluster would

otherwise be created. For example, in the word [ɲto:koh]<sup>1</sup> (derived from /nito:koh/), if the [n] were to remain an onset, the resulting form would have an initial cluster [nt], violating Navajo's ban on complex onsets. However, there are cases in which leaving the [n] as a non-syllabic consonant would not disobey any phonotactic principles. One such example is [ʔabíntʃíħaʔ], in which the syllabic nasal is the result of postnasal vowel deletion. The fact that [n] can occur as a coda can be seen in words like [pi.ɣan.ti] and [nitsin]. What, then, rules out \*[ʔabíntʃíħaʔ]?

This can be explained as a kind of compensatory lengthening. If the deleted vowel leaves behind its mora, and the remaining consonant in the syllable is [n], which (unlike other consonants) is allowed to serve as a nucleus, the mora re-links to the consonant.

The deletion process is depicted autosegmentally below:



I assume that this is motivated by two high-ranking constraints: a faithfulness constraint against the deletion of moras (MAX-μ), and a markedness constraint that requires a mora to be linked to some segment in the same syllable (LINK-μ).

<sup>1</sup> Kari 1976, the source for all data cited in this paper unfortunately gives no glosses or morpheme boundaries.

We will also need a constraint that forces the vowel to delete. I will use \*STRUCTURE, which, at higher speaking rates at least, must be ranked above MAX(V).<sup>2</sup> \*STRUCTURE in this case must refer to segments rather than syllables, since the syllable count remains the same in the vowel deletion candidate. Furthermore, MAX(C) must outrank \*STRUCTURE, to prevent the [n] from deleting (and to keep consonants in general from deleting in faster speech). These rankings are shown in the tableau below.

(2) Ranking of \*STRUCTURE

/nVT/	MAX(C)	*STRUC	MAX(V)
☞ [n]		*	*
*[V]	*!	*	
*[nV]		**!	

If \*STRUCTURE outranks MAX(V), what prevents other vowels, those not following nasals, from deleting in rapid speech? In general, we can appeal to high-ranked MAX- $\mu$  and LINK- $\mu$ , which will prohibit the loss of a nucleus. The only cases in which vowels may delete without violating either of these two constraints are those in which an adjacent consonant can become syllabic, as with [n]. However, there are other permissible syllabic consonants in Navajo, such as [ʃ] and [ʒ]. Vowels do not regularly delete following these consonants. What makes [n] special? Perhaps this can be attributed to the sonority hierarchy. Of the possible syllabic consonants, [n] is the most sonorous. Thus, the following ranking is likely to be universal:

\*SYLLABICFRICATIVE >> \*SYLLABICNASAL

<sup>2</sup> Although see Gouskova (2003) for a different approach to syncope in OT, and arguments against the use of \*STRUCTURE.

If \*STRUCTURE is ranked between these two constraints, it will prevent all consonants except nasals from becoming syllabic under vowel deletion. This is shown in the tableaux below.

(3) Preventing syllabic fricatives

/ʃV/	*SYLLFRIC	*STRUC	*SYLLNAS
☞ [ʃV]		**	
*[ʃ]	*!	*	
/nV/	*SYLLFRIC	*STRUC	*SYLLNAS
☞ [n]		*	*
*[nV]		**!	

## 2. Optionality

### 2.1. The facts

Kari (1976) divides the contexts for postnasal vowel deletion into three types: those where it is required; those where it is optional; and those where it is blocked. The three contexts are listed below, with examples of each. In each case the factor that decides whether or not the vowel deletes is the type of consonant following the NV sequence.

(15) Postnasal vowel deletion contexts (Kari 1976)

(a) Required: before [+coronal, -continuant]

- (i) [ŋtʃige:h] \* [natʃige:h]
- (ii) [ŋto:koh] \* [nato:koh]
- (iii) [ʔabíŋtʃíʰaʔ] \* [ʔabínitʃíʰaʔ]

(b) Optional: before [+coronal, +continuant]

- (i) [ŋsíʰhiz] ~ [nísíʰhiz]
- (ii) [ŋnásxis] ~ [ninásxis]
- (iii) [ŋniʃte:h] ~ [niniʃte:h] ~ [ŋŋʃte:h]

(c) Blocked: before [-coronal, +continuant]

- (i) [niʋoʒ] \* [ŋʋoʒ]

- (ii) [nijo:ʔ]      \*[ɲjo:ʔ]  
 (iii) [nahaʔtin]      \*[ɲhaʔtin]

There are two additional wrinkles to add to these generalizations: (1) if the following consonant is a coronal non-continuant and belongs to a stem, vowel deletion is optionally possible (e.g. [ɲ-tsin]~[ni-tsin]); and (2) if the following consonant is [-coronal] and [-continuant], vowel deletion is possible, but there is a preference for variant without deletion (e.g. [ɲpé:ʃ]~[nipé:ʃ], with the former a rare variant).

Essentially, two features of the consonant contribute to vowel deletion: a [+coronal] feature and a [-continuant] feature. If both are present on the consonant, the vowel must delete. If neither is present, the vowel may not delete. If only one is present, the vowel may optionally delete. Of the two, coronality has a stronger influence in causing deletion.

## 2.2. AGREE and deletion

This generalization may be at least partially explained as the effects of an AGREE constraint. Although such a constraint is usually invoked to account for cases of assimilation, in this case the same constraint has the effect of blocking a deletion process that would bring non-agreeing consonants into contact. If AGREE(place) is ranked above the \*STRUCTURE constraint, which compels deletion, then deletion will be blocked when the nasal and the subsequent consonant have different places. IDENT(place) must outrank AGREE(place) so as to prevent place assimilation. This last ranking is also required to allow heterorganic clusters in cases that don't involve deletion. There is nothing phonotactically wrong with such clusters if they are underlying—as shown by words like

[ni:lká:t] ‘I will set them in a line’. It is only when a process like deletion would create such a cluster that the effects of the AGREE constraint can be seen.

Forgetting for the moment the occasional cases in which non-coronals can cause deletion (I will return to them later), the following constraint tableau shows how the ranking described above will allow vowel deletion only when the nasal and the following consonant agree in place. In the candidate descriptions, “T” represents a coronal stop and “P” any non-coronal stop.

(4) Deletion triggered by place

(a) /nVT/	ID(place)	AGREE(pl)	*STRUC
☞ [n̩T]			**
*[nVT]			***!
(b) /nVP/	ID(place)	AGREE(pl)	*STRUC
☞ [nVP]			***
*[n̩P]		*!	**
*[nP]		*!	**
*[mP] <sup>3</sup>	*!		**
*[n̩T]	*!		**

For input (a), IDENT(place) and AGREE(place) are not violated by the deletion candidate, and so \*STRUCTURE is allowed to have its way. For (b), it is impossible for any deletion candidate to satisfy both AGREE(place) and IDENT(place), and so the fully faithful candidate wins.

This accounts for the effect of place on vowel deletion. Less straightforward is the effect of continuancy. If the consonant is coronal and a continuant, deletion is optional. I will argue that this is the result of an AGREE([cont]) constraint that is lower-ranked than the AGREE(place) constraint. This is assuming that nasals are [-continuant]; some problems with this assumption will be discussed in §5.3.

<sup>3</sup> This candidate is included as a hypothetical possibility, although undominated phonotactic constraints would prevent it from ever surfacing. In Navajo, [m] can never surface as a nucleus or coda.

### 2.3. Modeling speech styles

Before attempting a formal account of the system, I will first identify three speech styles based on the data in (15), ranging from slow, careful speech to fast, casual speech (this is of course an abstraction away from the many registers that are presumably available to the native speaker). Each style will correspond to a different ranking of \*STRUCTURE—as speech becomes faster, this constraint can be ranked higher and higher, resulting in deletion occurring in a wider range of contexts. The different styles are described below.

#### (5) Navajo speech styles

Speech Style	Does vowel delete in this context?			
	[+cor, -cont] n__T	[+cor, +cont] n__S	[-cor, -cont] n__P	[-cor, +cont] n__H
Most careful	Yes	No	No	No
Fairly careful	Yes	Yes	No	No
Least careful	Yes	Yes	Yes	No

Key: T=coronal stop; S=coronal continuant; P=non-coronal stop; H=non-coronal continuant

If a column contains only “Yes”, that context always requires deletion; a column that contains only “No” indicates a context where deletion is prohibited. The optional contexts are represented by the columns with both “No” and “Yes”. These are the cases where, depending on the speech style, either variant (deletion or non-deletion) is possible.

I have already established the ranking AGREE(place) >> \*STRUC in order to account for the requirement that postnasal vowels delete before coronal stops. We can now see that this ranking is not fixed; in the “n\_\_P” context, vowels can sometimes (though rarely) delete. However, the AGREE(place) >> \*STRUC ranking does characterize the most careful speech style. In this most careful style, \*STRUC is also dominated by AGREE([cont]), which means that deletion is only allowed when the consonant agrees with [n] by being both [+coronal] and [-continuant]. The ranking is summarized in (17).

(6) Most careful speech style ranking

AGREE(place) >> AGREE([cont]) >> \*STRUC

This ranking captures the distinction between “n\_\_T” and “n\_\_S”, as demonstrated in (7).

(7) Most careful

(a) /nVT/	AGREE(pl)	AGREE([cont])	*STRUC
☞ [n̥T]			**
*[nVT]			***!
(b) /nVS/	AGREE(pl)	AGREE([cont])	*STRUC
☞ [n̥VS]			***
*[n̥S]		*!	**

In the fairly careful style, agreeing in continuancy is no longer important, although agreeing in place is. This can be modeled by reranking \*STRUCTURE so that it dominates AGREE([cont]). This is shown in (8).

(8) Fairly careful speech style ranking

AGREE(place) >> \*STRUC >> AGREE([cont])

In this style, we get deletion in the “n\_\_T” and “n\_\_S” contexts, but not “n\_\_P”; this is shown in the tableaux in (9).

(9) Fairly careful

(a) /nVT/	AGREE(pl)	*STRUC	AGREE([cont])
☞ [n̥T]		**	
*[nVT]		***!	
(b) /nVS/	AGREE(pl)	*STRUC	AGREE([cont])
☞ [n̥S]		**	*
*[nVS]		***!	
(c) /nVP/	AGREE(pl)	*STRUC	AGREE([cont])
☞ [n̥VP]		***	
*[n̥P]	*!	**	

When we turn to the least careful style, things are not so straightforward. We need to rule out deletion only in those cases where the nasal and the following consonant disagree in *both* place and continuancy. Deletion is permitted if either feature fails to



\*STRUCTURE can occur at any of these three positions; the higher it is ranked, the less careful the speech style.

### 3. Residual issues

A few issues have been left unresolved. The first involves one of the “wrinkles” in the pattern mentioned above. Although I have assumed so far that coronal stops uniformly cause a preceding postnasal vowel to delete, this is not always the case—if the consonant in question is stem-initial, the vowel may optionally fail to delete. As for the cause behind this, I can offer only speculation. It may be that because of their crosslinguistically privileged position, stem-initial consonants require a better phonetic environment than other consonants. Formant transitions into a consonant from a preceding vowel, although not as important as the transitions into a following vowel, may be more necessary in stem-initial consonants, because of the higher-ranking faithfulness constraints that refer to consonants in this position. In more careful speaking styles, these constraints may be able to assert themselves, preventing the loss of a vowel that allows much better formant transitions than a syllabic nasal would.

Another issue involves a pattern evident in the data but not mentioned so far. When a word contains multiple nV sequences, the following deletion possibilities are available:

(13) [niniʃte:h] ~ [ɲniʃte:h] ~ [ɲɲʃte:h]      \*[niɲʃte:h]

When two /ni/ sequences occur consecutively, the second vowel may delete only if the first also deletes. This is predicted by my analysis; the first /ni/ is followed by another nasal, and thus is in the context of obligatory deletion. The second /ni/ is followed by the

coronal fricative [ʃ], and thus may be deleted in faster speech. There is no ranking, however, that could delete the second vowel without also deleting the first.

The only problem with these forms is the second variant, [niniʃte:h]. Normally deletion of the vowel is mandatory when it is followed by a [+coronal, -continuant] consonant. Why doesn't the vowel in the first [ni] delete even though it is followed by [n]? This is related to an issue that was mentioned earlier but never resolved: are nasals [-continuant]?

Evidence that bears on this can be found in the behavior of nV sequences before other nasals. Examples are given in (14).

(14)

(a) Coronal nasals

(i) [ɲnapah] ~ [ninapah]

(b) Non-coronal nasals

(i) [nímásí] \* [ɲmásí]

(ii) [nimá] \* [ɲmá]

According to this data, it appears that nasals pattern with [+continuant] consonants. This is a problem for my analysis, but not a fatal one. I will have to replace the AGREE([cont]) constraint with a markedness constraint that explicitly requires a nasal to be followed by a non-continuant.

If this is done, the problematic [niniʃte:h] variant is no longer a problem.

However, my modified account would no longer predict the absence of \*[niɲʃte:h]. If [n] and [ʃ] pattern identically as triggers for vowel deletion, the implicational hierarchy that gives us the pattern in (13) disappears. I will have to leave the resolution of this issue to future work on this topic.

## References

- Gouskova, Maria. 2003. Deriving Economy: Syncope in Optimality Theory. University of Massachusetts, Ph.D. dissertation.
- Kari, James. 1976. Navajo verb prefix phonology. University of New Mexico, Ph.D. dissertation.