8 A Case of Appendicitis

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8.1 Introduction

Vaux and Wolfe (this volume) propose a very strict view of syllabification and the prosodic status of unsyllabified segments. Put simply, a phoneme must either be syllabified directly or be associated to a higher prosodic level via an appendix structure. The purpose of this commentary is two-fold. First, as I will show, analyses of one pattern of infixation and one pattern of reduplication in Nxaʔamxcín (Czaykowska-Higgins and Willett 1997, henceforth CHW) demonstrate that these processes may in fact be completely agnostic about prosodic structure. Consequently, the behaviors of these processes do not provide evidence relevant to determining the prosodic structure present in the language. Second, the analysis of a reduplication pattern in Thao (Chang 1998) demonstrates that a syllabification scheme utilizing degenerate syllables is necessary to account for the pattern. VW's explicit rejection of degenerate syllables raises the question of whether their strict claims about the nature of the syllable are tenable. Thus, the spirit of this commentary is to suggest that we must be careful before ruling out classes of analyses on the basis of VW's arguments. Instead, we should further investigate VW's examples in order to fully determine what import they have for constructing a theory of syllabification for phonology.

8.2 Reduplication and Infixation in Nxaʔamxcín

To begin evaluating whether an appendix-based analysis of syllable structure is helpful in understanding nonconcatenative morphological processes in Nxaʔamxcín, let us look at the out of control (OOC) reduplication forms in (1). The reduplicated consonants are underlined.

(1) *Out of control reduplication in Nxaʔamxcín (CHW 1997:395)*

	Out of control	*Gloss*	*Root*
a.	k'íp̲'əp'	'get pinched'	(k'ip')
	cə́k̲ək	'get hit'	(cək)
	q'á*l̲*'l'x^{w}	'something hanging'	(q'al'x^{w})
b.	c'q̲'^{w}q'^{w}únl'əx^{w}	'land gets named'	(c'q'^{w}u-n-ul'əx^{w})
	pt̲tíx̣^{w}əx^{w}	'spitting a lot'	(ptix̣^{w}-mix)
	t̲kkayi	'urinate (out of control)'	(tkay)

CHW convincingly demonstrate that Nxaʔamxcín has a simple syllable canon consisting of a maximal syllable of CVC for roots. Following Bagemihl (1991), CHW suggest that the initial consonant in CCVC roots is not syllabified (and that, more generally, consonants that cannot be parsed into a CVC syllable are not syllabified).[1] Thus, the forms in (1) are split into two groups on the basis of whether they begin with a syllabified consonant (1a) or an unsyllabified consonant (1b). Since VW explicitly reject the position that unsyllabified segments are not associated with any prosodic structure, the initial consonant in the forms in (1b) would be an appendix. (2) presents the data from (1) again, but focuses on the prosodic structure of the roots under an appendix-based analysis and the resulting reduplication pattern. For present purposes, I indicate syllables with curly brackets, { }, and I enclose segments in appendices in square brackets, [ ].

(2) *Appendix analysis of out of control reduplication*

a. *No initial appendix: #{CV...*

Root	*Gloss*	*Out of control*
{k'ip'}	'get pinched'	k'íp̲'əp'
{cək}	'get hit'	cə́k̲ək
{q'al'}[x^{w}]	'something hanging'	q'á*l̲*'l'x^{w}

b. *Initial appendix: #[C]{CV...*

Root	*Gloss*	*Out of control*
[c']{q'^{w}u}	'land gets named'	c'q̲'^{w}q'^{w}únl'əx^{w}
[p]{tix̣^{w}}	'spitting a lot'	pt̲tíx̣^{w}əx^{w}
[t]{kay}	'urinate (out of control)'	t̲kkayi

Displaying the OOC reduplication data as grouped in (2) highlights the difference with respect to which consonant is repeated as part of reduplication.[2] In (2a) the consonant in a coda position is copied, whereas in (2b) the onset consonant is copied. Syllabification provides no useful generalization because sometimes the onset reduplicates, and sometimes the coda. Therefore, whether the unsyllabified consonants are in appendices or not becomes moot.

The best generalization about the OOC reduplication pattern in Nxaʔamxcín does not use syllabic information at all. Informally stated, it says that the second conso-

nant is reduplicated.[3] To formalize this insight, I will review the core proposals in Raimy 2000 about the nature of precedence in phonology.

In Raimy 2000, I argue that classical phonological representations such as the one for *cat* in (3a) do not formalize phonological precedence sufficiently for scientific investigation. Instead, representations such as (3b) that contain explicit marking of precedence relations (via →) are necessary.

(3) *Precedence in phonological representations*
   a. cat kæt
   b. cat # → k → æ → t → %

(3b) explicitly notates the precedence relations between the segments in the word *cat*. The symbols # and % indicate the beginning and end of the representation, respectively; they are necessary to determine well-formedness. Explicit representations of precedence in phonology enable us to better form questions about the nature of precedence. An immediate question that can be asked is whether a segment can be associated with more than one precedence relation. The answer is yes, and the bulk of Raimy 2000 demonstrates the utility of this answer in explicating the nature of reduplication.

One way to associate a segment with more than one precedence relation is to have a phonological representation contain a "loop" in its precedence structure.[4] Consider characteristic morphology reduplication in Nxaʔamxcín.

(4) *Characteristic morphology in Nxaʔamxcín (CHW 1997:403)*

	Characteristic	*Base*	*Gloss*
a.	ʔac-pəkpək	pək	'spotted'
b.	qilqil-t	qil	'it hurts'
c.	picpicx^{w}	picx^{w}	'disgusting'
d.	ʔitʔitx^{w}-ul	ʔitx^{w}	'he overslept'

Characteristic morphology in Nxaʔamxcín is expressed by CVC suffixing reduplication. As proposed in Raimy 2000, we can account for reduplication by saying that the morphology component creates a representation with a "loop" in the precedence structure. The resulting representations for characteristic morphology reduplication in Nxaʔamxcín are shown in (5).

(5) *Application of characteristic morphology reduplication in Nxaʔamxcín (affixes suppressed)*

	Root (base)	*Characteristic morphology*
a.	# → q → i → l → %	# → q → i → l → %
b.	# → p → i → c → x^{w} → %	# → p → i → c → x^{w} → %

On the left in (5) are the roots that undergo characteristic morphology reduplication. The phonological change caused by the spell-out of characteristic morphology is the addition of a precedence relation that states, "The segment after the first vowel precedes the first segment." The resulting phonological structures are on the right in (5). A bare output condition (Chomsky 1995) on the phonological component requires that phonological representations be legible at the phonetic interface.[5] Clearly, the interface cannot interpret segments with multiple precedence relations like those in (5). Linearization is the operation within the phonological component that ensures that any precedence structure created by the morphology ends up being interpretable; therefore, the reduplicated structures in (5) must be linearized. For present purposes, we only need to know that linearization will cause segmental material that is within a loop to be repeated. (6) presents the input-output mappings for the pre- and post-linearized structures in (5).

(6) *Linearization*

	Prelinearization structure	*Postlinearization structure*
a.	# → q → i → l → %	# → q → i → l → q → i → l → %
b.	# → p → i → c → x^w → %	# → p → i → c → p → i → c → x^w → %

In (6a), the entire root is contained "within the loop," so linearization creates the surface effect of total reduplication (which in this case is ambiguously CVC reduplication also). In (6b), only the segments /p/, /i/, and /c/ of the root are in the loop. Consequently, only these segments are repeated during linearization, giving the surface effect of CVC reduplication.

Surface reduplication patterns are the result of the description of the precedence relation added by the morphology that creates the loop. Precedence relations added by the morphology are described by the *anchor points* (Raimy 2000, 2005, this volume) that specify the segment at the beginning and the segment at the end of the added precedence link. For a phonological representation to be well-formed from a segmental point of view, each segment must have two precedence relations, one that specifies what it follows and one that specifies what it precedes. From a precedence relation point of view, each precedence relation must have segments (or the terminal symbols, # and %) associated with both its beginning and its end.

In Raimy 2005, I present a constrained theory of the set of possible anchor points, based in part on proposals about infixation made by Yu (2003). Yu argues that crosslinguistic variation with respect to the positioning of infixes is limited to a small set of pivot points. In Raimy 2005, I suggest that Yu's pivot points are identical to anchor points. For example, we can understand the CVC-prefixing pattern of reduplication found in Nxaʔamxcín as the result of the pairing of the anchor points "after

the first vowel'' and ''first segment.'' Both of these anchor points are identical to pivot points suggested by Yu (2003:54–55).

With this background, we can return to the OOC reduplication pattern in Nxa?amxcín. This pattern can be captured by adding a precedence link that begins and ends at the ''second consonant,'' as shown in (7).

(7) *Out of control reduplication*

	Root	*Out of control (reduplicated)*
a.	# → k' → i → p' → %	# → k' → i → p' → % ↻
b.	# → c' → q'^{w} → u → %	# → c' → q'^{w} → u → % ↻

Although Yu does not include ''second consonant'' as a pivot point attested in infixation patterns, McCarthy (1985, 1986) suggests that this way of describing a phonological environment is central to understanding Obligatory Contour Principle (OCP) effects in Semitic. McCarthy (1985) argues for an autosegmental view of phonological representations with separate consonant and vowel tiers. The ability to separate consonants and vowels onto distinct tiers allows operations to be calculated over consonants and/or vowels only. Calculating only over consonants or vowels is a core component in explaining OCP effects in many languages. As McCarthy (1986) discusses, gemination and antigemination are also best accounted for by positing a separate consonant tier. Thus, the phonological environment ''second consonant'' is simply ''the segment that follows the initial segment on the consonant tier.'' The essence of OCP effects in Semitic roots is that the first and second (or last and next to last) consonants may not be identical. The fact that OCP effects are seen across vowels indicates that ''second consonant'' must be a viable structural description for phonology.

The analysis using ''second consonant'' is the most parsimonious analysis for the OOC reduplication pattern in Nxa?amxcín because it explains the choice of consonant for reduplication. Since the calculation is conducted only on the consonant tier, the resulting syllable structure, which requires vowels to appear in certain locations, is irrelevant to which consonant is being repeated. (8) presents the linearization of the forms in (7) with OOC morphology and schwa inserted in the appropriate place.[6]

(8) *Postlinearization out of control forms*

	Prelinearization structure	*Postlinearization structure with epenthesis*
a.	# → k' → i → p' → % ↻	# → k' → i → p' → ə → p' → %
b.	# → c' → q'^{w} → u → % ↻	# → c' → q'^{w} → q'^{w} → u → %

To summarize: proposals in Raimy 2000 about the nature of precedence relations in phonological environments, combined with proposals in Yu 2003 about pivot points, allow a novel analysis of the Nxaʔamxcín OOC reduplication pattern. This proposed analysis simply states that the OOC morphology adds a precedence link, which creates a reflexive precedence relation on the second consonant. When the representation containing this loop is linearized, the surface result is reduplication of the second consonant. The final, correct surface forms for this pattern are created by epenthesis of a schwa in appropriate places via Nxaʔamxcín phonology that is not discussed here. Since this analysis does not refer to syllable structure, this pattern of reduplication provides no evidence for or against any model of syllabification. Consequently, the Nxaʔamxcín facts do not support VW's proposals about the appendix; an appendix analysis would simply be superfluous.

Analysis of the inchoative morphology in Nxaʔamxcín further supports the utility of the "second consonant" anchor point. Examples of inchoative morphology on strong roots in Nxaʔamxcín are presented in (9). The allomorph of the inchoative morpheme for strong roots is an infixed glottal stop; the other allomorph is a suffixed /p/ (CHW 1997:394). Only the infixed glottal stop is of interest here.

(9) *Inchoative infixation in Nxaʔamxcín (CHW 1997:395)*

	Root		*Inchoative root*	
a.	cíx	'lukewarm'	na-cí-ʔ-x	'water gets warm'
	p'íq	'ripe, bake'	p'í-ʔ-q	'it's ripe, gets warm'
b.	təmtəmút-n	'clothes'	ta-ʔ-mút	'round hemp bag'
	t'uwáy't	'cry hard'	s-t'a-ʔ-wáy't-s	'cry continuously'
	łuwám	'go, pl.'	ła-ʔ-wám	'walk around'
c.	c'q'^{w}ú-n-m	'say, name'	c'-aʔ-q'^{w}ú-n-m	'read'

With respect to segmental makeup of the root, the pattern in (9) is similar to the OOC reduplication pattern. The roots in (9a) are CVC in composition and are completely parsed into a single syllable. The roots in (9b) have a predictable schwa that breaks up the root-initial obstruent-resonant sequence (CHW 1997:390); note that [ɬ] is classified as an obstruent. The predictable schwa alternates with /u/ before /w/ and with /a/ before a pharyngeal segment. Finally, (9c) presents a CCVC root where the first and second Cs are heterosyllabic (CHW 1997:393). The resulting inchoative form does have a predictable schwa, here triggered by the glottal stop; glottal stop patterns with resonants in Nxaʔamxcín in that it triggers schwa epenthesis (which alternates with /a/, as described above).

Considering the analysis of OOC reduplication developed above, we can see that an appendix-based analysis of Nxaʔamxcín syllabification is not helpful in understanding infixation of the glottal stop. (10) presents the different types of syllable structure that VW's proposals would assign to the forms in (9).

(10) *Appendix-based analysis of Nxa?amxcín roots*

	Root syllabification	*Infixation*
a.	{cíx}	{cí-ʔ-x}
b.	{t'u}{wáy't}	{t'a-ʔ}{wáy't}
c.	[c']{q'^{w}ú}	{c'-aʔ}{q'^{w}ú}

When prosodic structures are built for the data in (10) according to VW's appendix theory, there is no clear generalization for infixing the glottal stop. For the forms that do not have an appendix, (10a,b), we could posit that the infix occurs after the first vowel (in line with Yu's (2003) proposals on the nature of infixation). However, this generalization does not hold for the form in (10c) that does have an appendix. It appears that an appendix-based analysis of Nxa?amxcín is not beneficial because positing an appendix structure prevents a uniform description of the locus of infixation.

The above analysis of the OOC pattern, relying on the anchor point "second consonant," suggests a generalization for identifying where to infix the inchoative-marking glottal stop: it precedes the second consonant and follows what precedes the second consonant. This generalization creates the following derivation of the inchoative form for strong roots:

(11) *Inchoative morphology on strong roots*

	Root	*Inchoative*
a.	# → c → i → x → %	# → c → i → x → % ↘ ↗ ʔ
b.	# → c' → q'^{w} → u → %	# → c' → q'^{w} → u → % ↘ ↗ ʔ

The same principles of linearization that hold for patterns that create a loop in the precedence structure also hold for infixation patterns that create a "detour." However, since there is no loop, no reduplication occurs; linearization instead creates the surface effect of infixation. (12) presents the linearization of (11a,b) with the resulting epenthesis triggered by the glottal stop.

(12) *Linearization and epenthesis in inchoative forms*

	Prelinearization structure	*Postlinearization structure with epenthesis*
a.	# → c → i → x → % ↘ ↗ ʔ	# → c → i → ʔ → x → %

b. # → c’ → q’^{w} → u → % # → c’ → a → ʔ → q’^{w} → u → %
ʔ

The most important thing to note about the present analysis of the Nxaʔamxcín infixation pattern is that it is agnostic about the actual syllable structure of the root. Because the calculation of where the infix goes only considers a linear sequence of consonants, it is moot whether root-initial members of consonant clusters are in an appendix or not.

These two phenomena from Nxaʔamxcín, then, do not provide evidence in favor of (or against) VW’s proposals. The most parsimonious analyses for these phenomena are completely agnostic about any kind of prosodic structure. Note also that in both cases, adding the relevant morphology to the root creates marked unsyllabified segments that are sometimes but not always repaired by epenthesis of a schwa. The clearest examples of this aspect of these patterns are repeated in (13), with syllable structure indicated.

(13) *The creation of unsyllabified segments*

	Root	*Out of control*	*Gloss*
a.	{q’al’}x^{w}	{q’ál’}l’x^{w}	‘something hanging’
	c’{q’^{w}u}	c’q’^{w}{q’^{w}ún}{l’əx^{w}}	‘land gets named’
	p{tix̣^{w}}	pt{tí}{x̣^{w}əx^{w}}	‘spitting a lot’
	t{kay}	tk{ka}{yi}	‘urinate (out of control)’
b.	*Root*	*Inchoative*	
	{cíx}	{na}{cíʔ}x	‘lukewarm’/‘water gets warm’
	{p’íq}	{p’íʔ}q	‘ripe, bake’/‘it’s ripe, gets warm’

All of the forms in (13a) with OOC morphology end up with two unsyllabified segments even though the root began with just one. The forms in (13b) with inchoative morphology end up desyllabifying the coda of the root since Nxaʔamxcín does not allow complex codas (CHW 1997:398–402). The production of phonological forms containing marked structure that may or may not be repaired by general processes in the language is a predicted result of analyses that are agnostic about syllabification. This result would be an anomaly for any approach based on the goal of producing well-formed prosodic structures.

8.3 Reduplication in Thao

While the previous sections’ analyses of OOC reduplication and inchoative morphology on strong forms in Nxaʔamxcín are orthogonal to syllabification, the analysis of reduplication in Thao to be developed here crucially relies on syllable structure.

Chang (1998) provides a description of Thao and in particular the reduplication pattern in (14).

(14) *Thao rightward reduplication (Chang 1998:284)*

Base	*Reduplicated form*	*Gloss*
šnara	pa-šnara-nara	'ignite'/'burn s.t. repeatedly'
kikaɬi	kikaɬi-kaɬi	'ask'/'ask around'
qriuʔ	q-un-riu-riuʔ	'steal'/'steal habitually'
patihaul	matihau-haul	'spell'/'cast a spell'
ag.qtu	agqtu-qtu	'contemplate'/'think about'
ar.faz	m-arfa-rfaz	'fly'/'fly continuously'
m-ig.kmir	igkmi-kmir-in	'grasp'/'roll into a ball'
bu.qnur	mia-buqnu-qnur	'anger'/'be irritable'

Fitzpatrick (to appear) points out the theoretical importance of this pattern, stemming from the fact that the reduplicated region of the word (underlined in (14)) varies among CVCV, CCV, and CVV sequences. This set of consonant-vowel sequences defies any sort of prosodic characterization and often cuts across syllable boundaries. The most interesting aspect of the data, though, is that as Fitzpatrick points out, they follow directly from a classical Marantzian CV template analysis (Marantz 1982). If a CVCV template is infixed after the final vowel, right-to-left association will produce the correct reduplication pattern. However, this classical Marantzian template is not available to contemporary models of reduplication.

Fitzpatrick points out that like other contemporary analyses of reduplication, the precedence model is unable to make a clean generalization for rightward reduplication in Thao. This conclusion is correct if a surface syllabification of the data with complex onsets and codas is assumed. If a more abstract syllabification is posited instead, a clean generalization is possible.

The abstract syllabification required to account for Thao posits strict CV syllables with both empty nuclei and empty onsets to break up consonant-vowel clusters; final consonants are analyzed as extraprosodic. Consider the abstract syllabification for relevant Thao forms in (15). Empty nuclei are represented as Ø, empty onsets are represented as O, and angle brackets indicate extraprosodic consonants.

(15) *Abstract syllabification in Thao*

Stem	*Syllabification*	*"Reduplicant"*
kikaɬi	{ki}{ka}{ɬi}	{ka}{ɬi}
qriuʔ	{qØ}{ri}{Ou}⟨ʔ⟩	{ri}{Ou}
patihaul	{pa}{ti}{ha}{Ou}⟨l⟩	{ha}{Ou}
ag.qtu	{Oa}{gØ}{qØ}{tu}	{qØ}{tu}
ar.faz	{Oa}{rØ}{fa}⟨z⟩	{rØ}{fa}

Once this abstract syllabification is posited, the classical Marantzian template effect can be captured in the precedence model of reduplication. The reduplication pattern is that the "last vowel" precedes the "next to last onset." Again, the concept "second" proves useful, but instead of being calculated on the consonant tier, it is being calculated on the syllable tier, specifically on onsets.

The relevance of this Thao reduplication pattern is that in order to produce an elegant analysis, one must posit an abstract syllabification. Because VW (section 5.4) reject the idea of degenerate syllables, it is hard to see how their theory can insightfully account for these phenomena. The important question at hand about the Thao data is whether syllabification changes during the derivation. It may be that the proposed abstract syllabification for Thao exists only early in the derivation. As the derivation progresses, processes could occur that convert the empty onsets and nuclei into complex syllables. Only further research on Thao will answer this question. The surface syllabification of Thao clearly allows complex onsets, but this level of syllabification does not appear to be relevant to the reduplication pattern. Thus, I find VW's rejection of some possible analyses of syllabification to be unjustified.

8.4 Conclusion

These brief comments are meant to be taken as complementary to the main proposals made by VW in this volume. My goal here has been to provide some insight into further issues in determining the most appropriate theory of syllabification. I wholeheartedly agree with VW's position that the types of evidence required to investigate syllable structure should be based in morphological and phonological processes. One complication that VW only hint at is that syllabification is likely not uniform through an entire derivation. CHW (1997) strongly suggest that this is the case for Nxa?amxcín in that consonant clusters in roots are repaired differently than nonroot consonant clusters. This observation has a very natural account in any model of phonology that is stratal or derivational in nature. The complexity that arises, though, is that early syllabification (e.g., cyclic syllabification) may be distinct from later syllabification (e.g., noncyclic syllabification), and this could produce either false or conflicting data about the nature of syllabification in a particular language.

In conclusion, VW argue persuasively that the idea of an appendix in syllable structure is a useful theoretical construct and that it explains a variety of linguistic phenomena. What I do not accept, though, is the conclusion that only an appendix-based account of unsyllabified consonants should be utilized. The brief examples discussed here suggest that there are classes of linguistic phenomena that are best accounted for without reference to syllable structure or can only be accounted for with a non-appendix-based syllabification system. Because of these types of linguistic

phenomena, of which many more exist beyond the few examples presented here, an exclusively appendix-based approach to unsyllabified segments cannot be accepted.

Notes

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1. CHW also follow Bagemihl (1991) in claiming that unsyllabified consonants are moraically licensed. I follow Cook (1994) in rejecting the position of moraic licensing because "extending the notion of Prosodic Licensing to such syllabically unaffiliated obstruents entails serious erosion of the explanatory power of the overriding principle" (p. 326). Instead, Cook suggests that languages that tolerate unsyllabified segments simply lack the operation of Stray Erasure, a proposal I follow here.

2. The /x^w/ in the last form of (2a) has been designated as an appendix under assumptions based on VW's proposals and CHW's analysis of Nxa?amxcín. All segments must be associated with prosodic structure, either in a syllable or in an appendix. Since the syllable structure for Nxa?amxcín is CVC, in a word-final CC cluster the final C will be an appendix.

3. This generalization is also suggested by CHW.

4. Note that no special formal status is attached to precedence links referred to as "loops." All precedence links are formally the same except for morphological affiliation. In other words, although it is useful for expository reasons to refer to precedence relations that create the surface effect of reduplication as "loops," there is no fundamental distinction between precedence links that cause the surface effects of reduplication, infixation, truncation, or deletion.

5. Linearization in Raimy 2000 is conceptually similar to proposals for linearization made by Mester (1988) and for tier conflation made by McCarthy (1985). As Cook (1994:315) states, linearization is not a reduplication-specific device. Owing to advances in the representation of precedence proposed in Raimy 2000, the formal implementation of linearization is distinct from proposals made in Mester 1988.

6. CHW mention the insertion of the schwa in these forms but do not explain its presence or absence. They do not suggest that the schwa is part of the OOC morpheme, though.

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