CHAPTER 4

SYNCOPE AND EPENTHESIS WITH PROCEDURAL CONSTRAINTS

4.0 Introduction

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The last chapter I examined a case of asymmetrical interaction between two phonological domains, prosodic and segmental phonology. I have shown that the systematic failure of the featural details of the segmental makeup of a word to figure in stress assignment rules presents a general problem for output-oriented theories like OT. Because all significant generalizations are hypothesized in OT to lie in output structures, the theory is not designed to handle generalizations that are stated in terms of processes. Prosody-segmental interactions present just such a generalization: only some processes (stress-driven segmental changes), but not others (segmentally-driven stress) are observed typologically. I argued that such an asymmetrical generalization cannot be stated as a condition on output forms. An output condition requiring that metrical prominence and certain segmental features be localized within the same syllable or segment does not tell the whole story: what matters is not only where stress and segmental features are in the output, but how they got there. Derivationally, such generalizations about input-output mappings are quite straightforward to state. In OT, on the other hand, the input-output mapping emerges from the entire constraint ranking in the grammar. I have taken a direct approach by introducing procedural constraints that penalize candidates resulting from undesirable processes; violation patterns of such constraints must depend on the ranking of the remaining constraints in the grammar.

In this chapter I turn to a related type of generalization that cannot be stated in terms of output structures: ENVIRONMENT-based generalizations. In derivational theories, it is possible to state generalizations about processes being confined to apply only in some contexts but not others. As I will show, from the point of view of OT, such generalizations would again look like too-many-solutions problems, albeit from a different perspective. Environment-based generalizations appear as situations where a given process is used as a repair for some but not all constraints that could potentially force it. I will argue here that vowel epenthesis and metrically-driven vowel deletion (syncope) are subject to such generalizations, and that the proposed mechanism of procedural constraints is able to handle it. The procedural generalizations from the last chapter and the environment-based generalizations present two facets of the same problem, which has to do with the locus of the phonologically significant observation. In both cases, the most insightful statement of the typology should be made at a level other than the output. This property puts both kinds of problems within reach of the new procedural constraints introduced in the last chapter.

This chapter is organized around the two main empirical domains, epenthesis and syncope. I begin by showing that many markedness constraints systematically fail to force epenthesis. The real typological generalization about epenthesis will turn out to be an environment-based one: it only applies to resolve marked consonant clusters. I will then provide a solution in terms of the framework of constraint interpretation developed in the last chapter. Next, I move on to syncope, and show again that OT does not provide a solution to the straightforward environment-based generalization that syncope does not apply to stressed vowels, a generalization that can be easily accomodated by my theory. I will survey in detail analyses of several languages with syncope, showing that whenever stressed vowel syncope has been proposed, alternative and better analyses are available.

However, before turning to the empirical issues, I will devote the next section to clarifying some terms.

4.0.1 What is 'context' in OT?

Because there are only two levels of representation in canonical OT, the input and the output, the reader might rightly ask if there is any meaning to the term 'environment' in the context of parallel output-oriented theories like OT. The derivational notion of the context (structural description) of a rule has a straightforward analog in OT only in the special case where the entire structural description is present in the underlying representation. Only in that case is there a level of representation where the conditioning environment of the process is present but the process itself has not applied. For example, in rule-based terms, word-final obstruent devoicing applies in the context __#; the structural description of such a rule is [–son, +voi]#. In OT, it makes sense to talk about the environment of this process only if the [–son, +voi]# sequence to which final devoicing eventually applies is present in the underlying form. It is true of Russian, for instance: every consonant that devoices due to the final devoicing constraint *[–son, +voi]# is word-final in the underlying form, and thus the structural description [–son,+voi]# is present at that level of representation. The situation need not be so simple, however; it is easy to see what a case would look like where the structural description would not be present at ANY level of representation. Suppose final devoicing is fed by another process, e.g. final vowel deletion (apocope). A toy derivation is given below.

(1)	/taba/	
	tab	*apocope*
	tap	*final devoicing*
	[tap]	

In a rule-based theory, there is always a level of representation where the structural description [–son, +voi]# is present; in this case, it is the output of the apocope rule [tab]. Indeed, the existence of such a level of representation is necessary for the devoicing rule to apply at all. In OT, however, such intermediate representations are not available: the only two representations are the input /taba/ and the output [tap].

(2) /taba/

	*[–son, +voi]#	*V#	MAX	IDENT
taba		*!		
tab	*!		*	
☞ tap			*	*

Intuitively, the process that takes /b/ to [p] in (2) is final devoicing, but it is problematic to say so, because there is no level of representation where the voiced consonant [b] is final. The only form that qualifies is the losing candidate [tab], one among infinitely many other losing candidates. Thus, we must be more clear about what the words 'context of a process' mean in situations like (2), by specifying what is special about the candidate [tab], where the structural description is present, as opposed to all of the other losers.

Here we will work along the same lines as in the previous chapter, where I defined the notion of a constraint driving a process in terms of the optimal candidate in a grammar with the constraint in question removed. The intuition there was that a constraint causes a process to apply to a given phonological object if that object behaves differently depending on whether the constraint is present in the grammar or not. Here, the intuition is the same: we will look for the context of a process driven by a given constraint in the optimal candidate of the alternative grammar with that constraint removed. In our toy example, the relevant constraint is the one responsible for final devoicing, *[–son, +voi]#. The grammar without it picks [tab] as the winner, as shown below.

(3) /taba/

	*[–son, +voi]#	*V#	MAX	IDENT
taba		*!		
☞ tab	*		*	
tap			*	*!

In other words, we say that the environment of devoicing in this example is 'word-final' because the stop that devoices would have been word-final had devoicing not applied. A more strict definition is given below.

(4) ENVIRONMENT OF PROCESS (Definition)
Given a grammar G, a constraint C, and an input /i/, output [o], and some process that the constraint C forces in [o], the ENVIRONMENT of that process is minimal locus of violation of C in the optimal candidate [o'] in the grammar G' that is identical to G except that C has been removed.

With this machinery in place, it is now easy to state, in plain English, generalizations about environments of processes in OT terms. For example, the (false) claim that devoicing only applies word-finally would take the following shape: "Devoicing only applies to consonants that would have been word-final had devoicing not applied". The (true) claim that syncope does not apply to stressed vowels (see below in this chapter) would take the form: "Syncope applies only to vowels which would have been unstressed had syncope not applied". The form of these statements should already suggest to the reader that such generalizations can be handled by the constraint evaluation method introduced in the last chapter, which relies on a similar notion of the winner in an alternative grammar with some constraint removed. In this chapter I make the connection more precise.

4.0.2 Epenthesis and syncope: introduction

Let me now move on to the empirical domain of this chapter, vowel epenthesis and syncope. In a nutshell, the typological behavior of these two processes can be most economically and insightfully stated not in terms of the character of the output they produce but the environment in which they apply. Despite the superficial complementarity of these two processes, examining their environments shows that they respond to altogether different pressures. Epenthesis universally serves to break up marked consonant clusters, but, in general, does not cater to metrical constraints. Vowel syncope, on the other hand, applies to weak vowels – that is, vowels in light syllables that are unstressed, unfooted, posttonic, or word-final. Crucially, metrically-driven vowel deletion can never target stressed syllables. These are generalizations about ENVIRONMENTS in which the processes of syncope and epenthesis apply. There is no output condition that can capture such a generalization. Positing constraints that prohibit weak vowels on the surface – e.g., constraints against unstressed short vowels in open syllables, or constraints against vowels unparsed by feet – would ensure that no such vowels appear on the surface, but would do nothing to control context of syncope. If the generalization about syncope is best stated in terms of the hypothetical structure where syncope has not applied, then access to more than just the surface is needed: rather, the constraint responsible for syncope must have access to the entire ranking of the language, in a way that I will make precise in this chapter.

Let me now move on to the first case, vowel epenthesis.

4.1 Epenthesis

This section is organized as follows: I begin with discussing rule-based view of the typology of epenthesis, and then show in section 4.1.2 how OT makes a radically different claim about the potential environments in which vowel epenthesis may apply. Sections 4.1.3 and 4.1.4 are then devoted to my approach to constraining OT in order to achieve a better fit between the observed and predicted typology of epenthesis.

4.1.1 Rule-based views and the typology of epenthesis

In rule-based phonology, vowel epenthesis has been standardly assumed to be used in only two types of situations: as a response to syllable template requirements and as a repair for word minimality (McCarthy 1979, Selkirk 1981, Broselow 1982, Blevins 1985, Itô 1986, 1989). Pre-OT literature has been largely devoted to the debates surrounding the kind of information that epenthesis rules may make reference to. One derivational view of epenthesis is the skeletal rule theory (e.g. Blevins 1985). In this approach, syllabification rules created prosodic structure, which was linked to a CV or X-slot template. Epenthesis rules then inserted skeletal slots in certain positions, making reference to the "stray" or unsyllabified status of adjacent skeletal slots. Epenthesis rules in such a theory take the following form, where C' indicates the stray status of a skeletal slot.

(5) $\varnothing \rightarrow V$ / C'__ (Itô 1989: 217)
$\varnothing \rightarrow V$ / __C'

Contrasting with this view was the prosodic theory of epenthesis (Itô 1989), which argued against the diacritic use of the notion of 'strayness'. According to Itô's proposal, the site of epenthesis should follow directly from the independently needed principles of syllabification. This move, which eliminates the need for rules such as (5), allows to account for the facts in a principled way, making epenthesis a consequence of prosodic theory in general, rather than relying on arbitrary rules. For the purposes of the present discussion in the context of OT, this debate between prosodic and skeletal views of epenthesis is of largely historical interest. What is important, however, is the shared assumption by all pre-OT researchers that epenthesis is, universally, a response to prosodic requirements at the level of the syllable. It is this generalization, previously considered too obvious to merit extensive discussion, that is no longer available in canonical OT, precisely because it is a generalization about the ENVIRONMENT of a process, not just about output structures.

This generalization has been most explicitly laid out by Broselow (1982), who lists three types of epenthesis processes, in terms of their environments. I will follow Broselow's classification in the discussion here. First, there is SYLLABICALLY-conditioned epenthesis, which applies in order to relieve violations of the syllable template of a language. This type of epenthesis is by far the predominant one; the following table (6) presents a far from complete list of cases discussed in recent literature. The cases fall in three broad, and potentially overlapping, categories: languages that insert vowels into complex syllable margins (Icelandic, Kekchi, Mono, Lenakel, Arabic, Mohawk, Fijian, Welsh); languages that use epenthesis for restrictions on codas, whether due to a complete prohibition of codas (Maori, Selayarese, Tongan), or due to a prohibition of codas of a particular type (Sranan, Japanese); and, finally, languages where epenthesis is used to repair sonority sequencing violations.

(6)

LANGUAGE	ENVIRONMENT	SOURCE
Modern Icelandic	C__r#	Kenstowicz 1994: 79
Kekchi	ʔ__C#	Hall 2003
Mono	complex clusters	Hall 2003
Lenakel	complex clusters	Kenstowicz 1994: 126
Palestinian, Iraqi Arabic	complex clusters	Kenstowicz 1994
Mohawk	complex clusters; sonority	Rawlins 2006
Fijian	C-clusters in loans	Kenstowicz 2003
Welsh	Marked coda clusters	Hall 2003
Cook island Maori	after final C	Hall 2003
Selayarese	after final codas	Kenstowicz 2003
Tongan	after final codas	Kenstowicz 2003
Sranan Creole	after final obstruents	Alber & Plag 1999
Japanese	non-nasal codas in loans	Hall 2003
Ponapean	heterorganic clusters	Kenstowicz 1994
Alguerese Catalan	sonority sequencing	Lloret & Jiménez 2006
Berber	sonority	Hdouch 2004
Irish, Scots Gaelic	clusters of falling sonority	Green 1997
Mawu	CR in loans	Hall 2003

Second, Broselow terms METRICALLY-conditioned epenthesis the set of cases where epenthesis is used as a repair for word minimality. These cases might be more properly called MINIMALITY-conditioned, because, as I will show below, epenthesis is not used as a response to the broad set of metrical conditions it might be expected to respond to, but only to requirements on the minimal size of the phonological word. Let me give some examples of the alternations that result from minimality-driven epenthesis.

In Mono, for example, a two-syllable word minimum is satisfied by prefixing a word with a copy of its root vowel (7)a. The language also has syllable contact-conditioned epenthesis into CR clusters which interacts opaquely with respect to minimality-driven epenthesis (7)b. The data below are from Hall (2003); see also Olson 2001.

(7)	a.	/ʒī/	→	īʒī		'tooth'
		/bè/	→	èbè		'liver'
	b.	/jābrù/	→	jābùrù		'goat'
		/gré/ →	égré	→	égéré	'big'

In a similar case, Mohawk monosyllabic words are supplied with an epenthetic vowel to satisfy the disyllabic word minimum (8)a (cf. Rawlins 2006). Iraqi Arabic presents the same phenomenon from a slightly different perspective. The language has an initial epenthesis process in words that begin with a cluster. Normally, this epenthesis is optional, but becomes obligatory just in case the base word is a monosyllable that contains a short vowel not followed by a consonant cluster (8)b. Assuming final consonant extrametricality, this requirement amounts to a bimoraic word minimum enforced by epenthesis.

(8) a. Mohawk[22]

/keks/	→	í:keks	'I eat'	(Broselow 1982: 117)
/weʔs/	→	í:weʔs	's/he/it is walking around'	(Rawlins 2006: 12)

b. Iraqi Arabic

ʔidrúus	~	drúus	'lessons'	(Broselow 1982: 125)
ʔídrus	~	*drus	'study!'	

Another case with a disyllabic minimality-driven epenthesis is Lardil (Hale 1973), where monosyllabic roots receive a final epenthetic vowel. The following data are taken from Hale 1973: 427. In *r*-final stems, the vowel *a* is added to augment the form up to the disyllabic minimum (9)a; in other stems, the augment is the syllable *Ca*, where *C* is a stop homorganic to the stem final (9)b. The data in (9)c shows that consonant-final stems longer than one syllable are not augmented.

(9)	a. /ṭer/	→	ṭera	'thigh'
	/yur/	→	yura	'body'
	b. /ṛil/	→	ṛilta	'neck'
	/wun/	→	wunta	'rain'
	/ṭuṛ/	→	ṭuṛṭa	'excrement'
	c. /thuŋal/	→	thuŋal	'tree'
	/kentapal/	→	kentapal	'dugong'
	/kethar/	→	kethar	'river'
	/miyaṛ/	→	miyaṛ	'spear'

Note that these examples of minimality-conditioned epenthesis all involve word minimality, not foot minimality. That kind of epenthesis, which would bring degenerate feet up to the required minimum whenever they arise, is not attested.[23] This fact shows that, although word minimality is caused by a minimal foot size requirement, it is not FTBIN per se but the constraint that requires every grammatical word to to comprise a prosodic word (GRW=PRW) that is capable of causing epenthesis.

The third set of cases in Broselow's typology is what she calls SEGMENTALLY-conditioned epenthesis. Broselow's criterion for an epenthesis process to qualify as segmentally-conditioned appears to be its reference to information across syllable boundaries, rather than to information on the type and content of a syllable margin, which is entirely contained within one syllable. In this category are the cases such as Dorsey's Law in Winnebago, where a sequence of an obstruent followed by a sonorant is disallowed and broken up by epenthesis (Miner 1979, Alderete 2006[1995]).

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[22] Mohawk also has a cluster-driven epenthesis process, discussed at length by Rawlins 2006, which interacts in an interestingly opaque way with stress.
[23] In such a language, for example, all odd-parity words could receive an epenthetic vowel.

(10) Epenthesis under Dorsey's Law (Alderete 2006[1995]: 32)

/hipres/	→	hip<u>e</u>rés	'know'
/krepną/	→	k<u>e</u>rep<u>ą́</u>ną	'unit of ten'

Cases such as Winnebago have been reanalyzed as epenthesis that caters to syllable contact preferences (see Alderete 2006[1995]), which disprefer sonority rises across syllable boundaries. Alternative analyses of the Winnebago case are available (e.g. see Hall 2003 for a more phonetically-based analysis), but all analyses make reference to syllable structure. The boundary between syllabically-conditioned epenthesis and syllable-contact epenthesis might not be rigid and depend on analysis, but in any case that distinction is not relevant for the typological point I am making here; what is crucial is that epenthesis acts at the level of syllable structure.

Another case of syllable contact-conditioned epenthesis is Catalan, where rises in sonority across syllable boundaries are resolved in a variety of ways depending on the particular nature of the segments; if the cluster involves a nasal or *s* followed by a rhotic, epenthesis is used. Data below is from Pons Moll 2005: 9; the cluster in the underlying form and its output with epenthesis are underlined.

(11) a.	/te<u>mɾ</u>iə/	→	tə<u>məɾ</u>íə	'(I) would be afraid'
	/te<u>mɾ</u>e/	→	tə<u>məɾ</u>é	'(I) will be afraid'
b.	/pla<u>ɲɾ</u>iə/	→	plə<u>ɲəɾ</u>íə	'(s/he) would complain'
	/pla<u>ɲɾ</u>a/	→	plə<u>ɲəɾ</u>á	'(s/he) will complain'
c.	/bɛn<u>sɾ</u>iə/	→	bən<u>səɾ</u>íə	'(I) would win'
	/bɛn<u>sɾ</u>e/	→	bən<u>səɾ</u>é	'(I) will win'

The typological claim made here is, thus, the traditional one: that epenthesis is universally used to resolve syllable structure markedness that has to with sonority sequencing, syllable contact, complexity of syllable margins, etc. Among metrical factors, only one may play a role in epenthesis, viz. word minimality. No other constraint can force vowel insertion. As I will show in this section, epenthesis cannot be used as a repair strategy for violations of purely metrical constraints such as *CLASH, *LAPSE, *NON-FINALITY, and so forth. Using the machinery discussed above in section 4.0.1, the generalization is equivalent to saying that in all cases where epenthesis applies, the winner of the alternative grammar without epenthesis contains either a marked consonant cluster, or is a subminimal word.

4.1.2 Non-observed epenthesis: metrical constraints

Apart from word minimality, other metrical factors are not observed to play a role in vowel epenthesis. There appear to be no examples in the typology of vowel epenthesis as a response to stress markedness constraints. In this section I show that the constraints NON-FIN, *CLASH, and *LAPSE can all potentially force the insertion of vowels, but these patterns are unattested. To make this clearer, I will construct some hypothetical examples of epenthesis driven by such stress markedness constraints.

Violations of NON-FIN, which penalizes candidates with a stress on the final syllable, can clearly be obviated by inserting material the intervenes between the stressed syllable and the word boundary. This would be simplest to observe in a language with lexical stress, where high-ranking MAX-PROM prevents any stress shift from its underlying position. If in such a language NON-FIN is ranked high enough – above DEP-V, to be exact – nothing would prevent the forms with underlying stressed final syllables from emerging with epenthetic final vowels serving as a buffer between the stressed syllable and the word edge. Consider the hypothetical inputs /pátak/ and /paták/: under the ranking MAXPROM, NON-FIN ⟫ DEP-V, we predict final epenthesis in the latter case (/paták/ → *patákə*), but not in the former case (/pátak/ → *pátak*). This is illustrated by the tableau below.

(12)

			MAXPROM	NON-FIN	DEP-V
/pátak/	☞	pátak			
		pátakə			*!
/paták/		paták		*!	
	☞	patákə			*
		pátak	*!		

In a slightly more complex but equally reasonable hypothetical language, vowel epenthesis at word edge to satisfy NON-FINALITY could occur in a system with predictable stress, such as Mekkan Arabic, where stress falls on final superheavy syllables. In such a language, *ə* epenthesis would take place just in face the final syllable is superheavy, and therefore stressed, in order to satisfy NON-FIN. To flesh this out, consider a language with Mekkan Arabic's stress system: final if superheavy, else penult if heavy, else antepenult. If at least NON-FIN and SWP outrank DEP-V, such a language would have epenthesis after final superheavy syllables, in order to prevent them from being stressed, as illustrated in the following tableau.[24]

(13)

			NONFIN	SWP	DEP-V
/patak/		pa(ták)	*!		
	☞	(pátak)		*	
		(páta)kə		*	*!
		pa(tákə)		*	*!
/patāk/		pa(tā́k)	*!		
		(pátāk)		*!	
		(pátā)kə		*!	*
	☞	pa(tā́)kə			*

What is problematic with such an epenthesis process is that vowel insertion is a response to a stress constraint (NON-FIN), not syllable structure constraints. The differing behavior of inputs like /patak/ and /patāk/ shows this: in the language described in

[24] Constraints penalizing other alternative repairs, such as MAX-μ, which prevents vowel shortening to get rid of the final superheavy syllable, must be high-ranked.

(13), epenthesis cannot be a response to a syllable structure constraint like 'no final obstruent stop', because it fails to take place just in case stress is not in danger of falling on the final syllable.

Likewise, the constraint *CLASH is predicted to cause unattested epenthesis patterns. If a language has a potential stress clash – such as any language with left-to-right moraic trochees – nothing prevents the clash situation in such a language from being resolved by vowel epenthesis. This case is exactly analogous to the previous example, so no tableau should be necessary here: just in case *CLASH outranks the constraint DEP-V, a 'buffering' *ə* may be inserted to relieve the clash. However, typological evidence suggests that *CLASH can force only one of two processes: destressing or stress shift.

A slightly more surprising case of non-occurring vowel epenthesis involves *LAPSE. Any sequence of two unstressed syllables – that is, a *LAPSE violation – can be repaired in a number of ways: by shifting or redistributing stress more evenly, or by creating degenerate feet with clash (/σ́ σ σ σ́/ → [σ́ σ σ̲́ σ́]). However, another perfectly reasonable but unattested strategy would be to insert an extra syllable. In languages with obligatorily binary feet, such a response would yield a sequence of syllables that could be parsed with maximally unmarked feet, without violating *LAPSE or *CLASH. This is more concretely illustrated by the tableau below, with an English-like example. Suppose the constraint against unstressed heavy syllables (WSP) is ranked high enough that both the initial and penultimate syllables of a word like *abracadabra* must surface with a stress. The actual English form violates *LAPSE in the string *raca*; ranking DEP low-enough would cause this *LAPSE violation to be obviated by inserting a whole syllable [ʔə], allowing the form to be parsed by maximally unmarked feet. No such epenthesis pattern is attested in any language.

(14)

		WSP	*CLASH	*LAPSE	DEP
abracadabra	áb.ra.ca.dáb.ra			*!	
	áb.rá.ca.dáb.ra		*!		
	ab.rá.ca.dáb.ra	*!			
☞	áb.ra.cá.ʔə.dá.bra				*

In sum, OT predicts that the prosodic constraints NON-FIN, *CLASH, and *LAPSE can all potentially cause epenthesis. This is a typological claim about the environment of epenthesis, in effect denying the more traditional generalization that, apart from word minimality, metrical factors cannot cause the insertion of segments or whole syllables.

I will now turn to the application of my theory of constraint interpretation to these cases, showing that using the implicational version of the constraints NON-FIN, *CLASH, and *LAPSE will allow a better fit with the observed typology.

4.1.3 Too many solutions and procedural constraints: epenthesis

Let me now go through each of these hypothetical cases and show how my proposal handles the non-occurrence of epenthesis as a repair strategy for these constraints.

4.1.3.1. NON-FIN

The rationale of the non-finality constraint is to protect the final syllable of a word from some prosodic constituent being built over it. Because non-finality is routinely repaired across languages by moving the stress rather than by other conceivable means such as epenthesis, the statement of the constraint in implicational terms must express the asymmetry between the properties of 'being final' and 'being stressed': the former is non-negotiable, while the latter, as far as the constraint is concerned, can be modified. Therefore I propose the following version of NON-FIN.

(15) ✦NON-FIN

If x is a word-final syllable, x is not stressed.

As a consequence, because 'being final' is the antecedent property of this constraint, it would be able to force stress shifts but not any changes that leads to the syllable whose designated state is 'final' to becoming non-final. Indeed, taking this constraint out of the system, we would compute the default location of the final syllable. Any candidate where the correspondent of that designated final syllable is not final would get fatally ✦-penalized by the implicational version of the non-finality constraint. This is illustrated by the tableau below.

(16) DS of [tak]: final

			MAXPROM	✦NON-FIN	DEP-V
/pátak/	☞	pátak			
		pátakə		✦!	*
/paták/	☞	paták		*	
		patákə		✦	*!
		pátak	*!		

In both forms, the designated state of the syllable [tak] is final: taking the constraint out of the ranking, we get the winners [pátak] and [paták] for the two inputs. Thus any candidate with epenthesis after the final syllable – the candidates [pátakə] and [patákə] in the tableau above – would receive a ✦ violation, thus becoming a perpetual loser. The upshot is that, as desired, epenthesis is not a response to NON-FIN. On the other hand, stress shift is still possible as a response to this constraint, as illustrated below: reranking MAXPROM below ✦NON-FIN in (16) would produce exactly such a system, where the input /paták/ undergoes a stress shift to surface as /pátak/ as a response to ✦NON-FIN.

*4.1.3.2 *CLASH*

The bad predictions generated by the interaction of *CLASH with DEP can be seen in a variety of hypothetical situations. Here I will focus on only one of these, as the other ones have a similar solution. Crosslinguistically, repairs for *CLASH include destressing in clash and stress shifts. The former can be seen in e.g. Central Yupik, where a syllable standing between two stressed syllables loses its stress. In Chevak Yupik, any syllable following a stressed syllable loses its stress (Hayes 1995: 250). In fact, Hammond 1984 has suggested that destressing is the universal repair strategy for *CLASH. Therefore, the negotiable property of 'being stressed', just as in the case of the NON-FIN constraint, is in the consequent of the implicational ✦*CLASH, while the non-negotiable syllable adjacency is in the antecedent.

(17) ✦*CLASH
If σ_1 and σ_2 are adjacent syllables, they are not both stressed.

Consider how this version of the constraint prevents epenthesis from being used as a repair strategy for *CLASH violations. The tableau is shown below.

(18) Designated state of [pa] and [ta]: adjacent

			MAXPROM	✦*CLASH	DEP
/pátáka/		pátaka	*!		
		páʔətáka		✦	*!
	☞	pátáka		*	

The antecedent of the constraint mentions two syllables' adjacency status. This means that if the designated state of any pair of syllables with respect to this constraint is 'adjacent', then any candidates where those syllables are not adjacent would be penalized by the *CLASH constraint and thus not a possible winner. Indeed, the epenthesis candidate [páʔətáka] is just such a form: the designated status of the syllables [pa] and [ta] is 'adjacent', while in this candidate they are separated by the intervening epenthetic syllable [ʔə]. No such candidate can win, and thus epenthesis is not a possible repair strategy for *CLASH.

*4.1.3.3 *LAPSE*

The analysis of *LAPSE and its interaction with DEP works along the same lines as the *CLASH case. Here, too, the strategy is to express the asymmetry of repairs conditioned by this constraint in the asymmetrical statement of the constraint itself. The repairs for *LAPSE that are observed crosslinguistically involve stress shifts. Just as in the case of clash, I propose the statement of the constraint, given below, where the negotiable property of stressedness is in the consequent, while syllable adjacency is in the antecedent.

(19) ✦*LAPSE
If σ_1 and σ_2 are adjacent syllables, they are not both unstressed.

Consider the input /abracadabra/. This word has two light syllables separated by two heavy syllables, *ab.ra.ca.dab.ra*; this means that a weight-sensitive stress system runs the risk of violating *LAPSE, e.g. *áb.ra.ca.dáb.ra*. We are trying to rule out candidates that avoid such a *LAPSE violation by epenthesizing an extra syllable between the two heavies, e.g. *áb.ra.cá.ʔə.dáb.ra*. Adopting the ✦*LAPSE version given above allows us to rule out any repair that interferes with the adjacency status of syllables, including epenthesis.

(20)

			✦WSP	✦*LAPSE	✦*CLASH	DEP
abracadabra		áb.ra.ca.dáb.ra		*!		
	☞	áb.rá.ca.dáb.ra			*	
		ab.rá.ca.dáb.ra	*!			
		áb.ra.cá.ʔə.dáb.ra		✦!	✦	*

✦*LAPSE mentions syllable adjacency in the antecedent. Any pair of syllables which are not adjacent in some candidate but whose designated state with respect to ✦*LAPSE is 'adjacent' will render that candidate incapable of winning. It follows that epenthetic candidates must fail. For the input /abracadabra/ (see (14)), the candidate [ábracáʔədábra] violates ✦*LAPSE, because the syllables [ca] and [dab], whose designated state is 'adjacent', are separated in this candidate by another syllable.

Because ✦*CLASH mentions the same category in its antecedent as ✦*LAPSE, these two constraints belong to the same antecedent class, and the designated states for these constraints are computed simultaneously. This means that any candidate that ✦-violates ✦*LAPSE also ✦-violates ✦*CLASH.

4.1.4 Attested cases of epenthesis

Recall from section 4.1.1 above that observed cases of epenthesis fall into three categories: syllabically conditioned, minimality-conditioned, and sonority-conditioned. Sections 4.1.2 and 4.1.3 were devoted to plausible but typologically unattested metrically-conditioned epenthesis. Treating metrical constraints like NON-FIN, *CLASH and *LAPSE as procedural helps regulate the kinds of repairs these constraints can force, allowing stress shifts but ruling out segmental changes like epenthesis.

Thus the strategy in dealing with epenthesis is to regulate constraints not directly related to it. The attested cases of epenthesis, on the other hand, require no new machinery. If syllable structure, sonority-sequencing, and syllable contact constraints retain their standard OT output-oriented form, then epenthesis is automatically predicted as a repair for violations of those constraints, among other repairs. That is the strategy I will adopt.

In Chapter 3 above I discussed the creteria for deciding whether a constraint belongs to the procedural or the standard OT class. The two types of constraints say different things: the former regulate input-output mappings, while the latter express static surface pressures. The best way of separating the two classes is by observing the typology of repairs that the constraints force. On the one hand, there are constraints with a very limited set of effects: stress-segmental constraints like ✦ASPIRATE and ✦SWP are observed to condition only stress-sensitive modifications of aspiration and weight, respectively. On the other hand, there are constraints like NOCODA, ONSET, and *COMPLEX, with a rich attested set of effects both across languages and within a single language. Epenthesis, deletion and featural changes are all attested as repairs of syllable structure constraints; this wide range of repairs led de Lacy (2003) to call prosodic markedness constraints 'heavyweights'. Constraints on sonority profiles of syllables have a similarly broad set of effects, and include epenthesis, deletion of consonants, and featural changes.

Thus, as long as the metrical constraints like ✦NON-FINM, ✦*CLASH, and ✦*LAPSE are prevented from forcing unwanted epenthesis, nothing new must be added to the theory.

4.2 Syncope

The environment of syncope also presents a challenge for standard OT. This section is devoted to two goals: establishing the typological generalization on the environment of syncope, and accounting for this generalization using the formal proposals of this dissertation. I begin in section 4.2.1 with a survey of rule-based views of syncope, and show in section 4.2.2 how the predictions of OT differ with respect to syncope of stressed vowels. Unlike the older derivational theory, OT allows, in the general case, stressed vowels to syncopate as a response to the pressure of prosodic markedness constraints. I will argue that it is the more restrictive derivational view that is empirically correct, and show how my formal proposals can allow OT to account for the typology of the syncope environments. I will illustrate my argument with several case studies of syncope in section 4.2.3.

4.2.1 Rule-based views of syncope

Much pre-OT literature viewed metrical vowel syncope as vowel reduction taken to its limit. The environment of syncope, therefore, did not pose a problem: metrically-driven vowel deletion was thought to apply in the same environments as vowel weakening, i.e. in unstressed, unfooted, final, and posttonic positions. This view goes back to the long-held assumption that vowel syncope correlates with strong stress, expressed, among many others, by Bloomfield's statement that "[l]anguages with strong word-stress often weaken or lose their unstressed vowels" (1961[1933]: 382). The assumption that only unstressed vowels can syncopate had been considered obvious enough not to merit discussion, and was often used tacitly to argue for particular analyses of phonological systems. To take a well-known example, classical philology has devoted considerable attention to Latin syncope taken AS EVIDENCE that archaic Latin had a dynamic stress (cf. Vendryes 1902, Leumann 1977, Sihler 1995). In particular, syncope of vowels that would have been stressed by the classical Latin stress rule was seen to indicate that at the stage at which syncope applied the stress rule had been different[25] – an argument that clearly relies on the assumption that stressed vowel syncope would be nonsensical. This classical view was inherited by generative phonology, even though it once again seemed too self-evident to be questioned seriously.

Let me discuss here in more detail one theory of vowel syncope which did seek to explain, or at least express, the generalization that stressed vowel syncope is impossible. The theory of vowel deletion in Taylor 1994, couched in a constraint-and-repair framework, exemplifies the kind of mechanisms a derivational theory would need in order to prevent syncope from applying to stressed vowels. We will see that, although the central claim in Taylor's work is that conditions on environments of processes such as vowel deletion are best reformulated as conditions on the structure of outputs, the

[25] The often cited case is syncope in words like *balineum* > *balneum* 'bath', where the syncopating vowel would have been stressed by the Latin stress rule. Such cases are used as evidence to argue that the stress rule at the stage when syncope applied was different, and assigned stress to the initial syllable of *bálineum*.

type of output conditions Taylor envisions are very different from the surface markedness constraints of OT, and in fact amount to conditions on processes from the point of view of parallel OT.

Let me examine the part of Taylor's proposal that deals with the restriction on accented vowel syncope. In the constraint-and-repair framework, the general approach is to first apply a phonological rule, and then examine the output with respect to certain constraints. If the output produced by the rule violates a constraint, then a repair mechanism is invoked, which serves to obviate the violation. The application of this repair is the device that is intended to account for the absence of some pattern in the output. Vowel deletion, in Taylor's theory, consists of three separate stages: delinking of the vowel from the timing slot; deletion of that X slot; and deletion of the unassociated vocalic melody.

(21) Vowel deletion according to Taylor 1994

a. Delinking of vowel from X slot
b. Deletion of unlinked X slot
c. Deletion of unlinked vocalic melody

At each of these stages, constraints on outputs can intervene to prevent vowel deletion from proceding all the way through, and repair strategies ensure that, in those cases, the vowel remains. Specifically, at the stage of vowel delinking, two types of constraints may have an effect on the derivation: constraints against delinked accented vowels, and constraints against delinked high-sonority vowels. The effect of these constraints is that unstressed vowels delete in preference to stressed vowels, and vowels lower on the sonority scale are more likely to be subject to deletion.

The following is the constraint used by Taylor to account for the failure of accented vowels to delete. It states that a delinked accented vowel is prohibited.

(22) $$\begin{array}{c} *\text{X} \\ \nmid \\ \acute{\text{V}} \end{array}$$ (Taylor 1994: 14)

This constraint conditions a repair strategy, viz. relinking of the delinked accented vowel to the timing slot.

(23)
$$\begin{array}{ccc} {}^{*}\mathrm{X} & & \mathrm{X} \\ \nmid & \Rightarrow & | \\ \acute{\mathrm{V}} & & \acute{\mathrm{V}} \end{array}$$

This repair strategy is invoked as soon as the constraint (22) is violated, i.e. at the delinking stage of vowel deletion (21)a. Thus, once (23) has applied, stressed vowels never get a chance to delete.[26] In other words, Taylor's theory requires a Duke-of-York (A→B→A) derivation any time an accented vowel is involved: first the vowel is deleted by the general syncope rule, and then the relinking repair strategy puts the vowel back, in order to prevent a violation of the constraint against stressed delinked vowels.

Although the constraint (22), which ensures that stressed vowels fail to syncopate, is stated as an output condition, it is very different from an OT surface markedness constraint. Indeed, the representation to which the constraint refers is necessarily an intermediate one: it exists only after vowel delinking but before timing slot deletion and vocalic melody deletion. The constraint crucially refers to information that only exists at this intermediate stage of representation: the X slot and the vocalic melody to which the X slot is not linked. This intermediate stage preserves crucial information about the derivational history of the form, viz. the fact that a stressed vowel has been delinked from an X slot. Because Taylor's constraint necessarily causes a repair mechanism to apply that, in effect, undoes the action of the prior syncope rule, the condition is equivalent to a statement about DERIVATIONS: it simply prohibits syncope from applying in the environment of a stressed vowel.

[26] Also operative at this stage are constraints on vowel sonority, which invoke a similar relinking repair strategy when high-sonority vowels like [a] are deleted. An interesting question that falls outside of the present discussion is what accounts for the exceptionless application of the accentuation constraint (22) – stressed vowels NEVER delete – but language-particular application of the vowel quality constraints – [a]s sometimes do delete. Taylor appears to endorse these typological generalizations, but it is unclear how they follow from her account.

OT constraints, on the other hand, only have access to the output and the input, so Taylor's constraint is restatable in OT terms only in the special case where stress is present in the underlying form. In this special case, a positional faithfulness constraint requiring an output stressed vowel to have an input correspondent would effectively ensure that input stressed vowels are not deleted (as well as that stress is not shifted to a different syllable). As discussed above, a general property of OT is that environment-based generalizations are only statable when the environment is present in the underlying form; the situation discussed here is simply a special case of that fact. In the general case, however, Taylor's stressed vowel constraint cannot have a straightforward OT correspondent. Indeed, the derivational constraint (22) is not sensitive to whether the stress on the vowel comes from the underlying form or had been assigned by a prior rule. In the latter case, the crucial information necessary to prevent stressed vowels from syncopating is only present at the intermediate stage of the derivation, a stage not accessible to any OT constraint.

What is more, even in the special case where stress is present in the underlying form and a positional faithfulness constraint like MAX-σ́ is available, there is no general account of the typological IMPOSSIBILITY of stressed vowel deletion, because, like all constraints, MAX-σ́ would be violable. If the constraint forcing vowel deletion were to be ranked high enough, MAX-σ́ would fail to protect a stressed vowel from deletion, and stressed vowel syncope would be predicted to result.

The upshot of this discussion of one representative derivational theory of syncope is that if the empirical generalization is correct, then OT has no direct way of accounting for it. In pre-OT theories, the typological generalization that stressed vowels do not syncopate was not seriously questioned; syncope was standardly assumed to fit into the general pattern of vowel weakening, which ought by rights to apply only to weak vowels. Because OT has no way of dealing with the previously assumed typology of syncope, the strategy – just as the original assumption, left largely implicit – was to deny the generalization itself, a step that, I argue here, is incorrect. Instead, I will show that the generalization is in fact true and presents a serious and systematic problem for OT, and that the proposal on modifying the interpretation mechanism of OT constraints made in the previous chapter can be harnessed to account for it.

4.2.2 Syncope in OT

OT has quietly set aside the claim of previous theories that syncope does not apply to stressed vowels. I argue in this section that this step is a mistake. To show that stressed vowels indeed cannot syncopate, I will go through several OT analyses of languages where stressed vowel syncope was proposed, and show that alternative and better analyses are available that do not require the traditional typological generalization to be violated. I will also discuss cases where, apart from OT theorizing, the facts seem to indicate that stressed vowels have deleted, and will suggest ways of interpreting the data in a way that is consistent with the proposals made here.

Before buttressing the typological generalization with these arguments, I will propose an analysis using the proposals on constraint interpretation that are the subject of this thesis.

The typological claim here, to be supported in the remainder of the chapter, is that syncope applies in WEAK positions: posttonically, in unfooted syllables, in the weak branches of feet, and in the final position (apocope). Possibly, pretonic syncope and initial vowel deletion (aphaeresis) must also be added to the list (see Taylor 1994). All of these environments fall in the broader category of 'unstressed syllable'; some languages show syncope in an environment that cross-cuts these more narrow contexts, i.e. in all unstressed syllables. These environments are listed below.

(24)
- a. Posttonic (Hopi, Southeastern Tepehuan)
- b. Unfooted (archaic Latin, Tonkawa)
- c. Weak branch of foot (Carib)
- d. Word-final, unstressed (apocope) (Lardil)
- e. Unstressed (Lebanese Arabic, Iraqi Arabic)

The goal of an OT analysis is to ensure that syncope-driving constraints force syncope only in these environments, but fail to cause stressed vowel deletion. Because deleting a stressed vowel would necessarily involve a stress shift, to account for the typology of syncope it would be sufficient to ensure that syncope constraints cannot force a stress shift; the proposal in the previous chapter is well-equipped to account for such a generalization. Recall that the strategy for ensuring that a given constraint does not force a stress shift is to put the category 'stressed syllable' in the antecedent of a procedural constraint. Then, given the proposed mechanism of interpreting procedural constraints, it would follow that the location of stress cannot be affected by such a constraint.

Thus, our syncope constraints must mention the environment, in terms of the location of stress, in the antecedent. What is in the consequent part of the constraint is slightly more problematic. The goal is to limit the effect of the syncope constraint to vowel deletion. Thus, whatever property is mentioned in the consequent of such a constraint must hold if and only if a vowel has deleted. The constraint must be able to "see" a trace of the deleted vowel in order to produce the desired typological prediction.

I will therefore adopt a representational assumption to ensure that such a trace is available to the constraint. The idea is that when a vowel deletes, it leaves an X-slot behind it, a featureless, empty syllable nucleus. This is not a new proposal; Kager's (1997) study of Carib and several other languages was aimed at establishing exactly this fact, viz. that in certain cases the syncopating vowel leaves an empty slot behind, which can be visible through its interaction with other processes such as assimilation.

Given this representational assumption about a trace left behind by the syncopating vowel, procedural syncope constraints can be formulated in a straightforward way.

(25) a. ✦SYNCOPE(POSTTONIC) 'If a nucleus is posttonic, it is empty'
b. ✦SYNCOPE(UNFOOTED) 'If a nucleus is in an unfooted syllable, it is empty'
c. ✦SYNCOPE(WEAK) 'If a nucleus is in a weak branch of a foot, it is empty'[27]

Given the procedural constraint interpretation mechanism we have been pursuing, these constraints can lead to syncope ONLY in the stated environment. Because the location of a vowel with respect to stress is mentioned in the antecedent of the constraint, no stress shift can result from its action. A fortiori, stressed vowels cannot be deleted – the removal of a stressed vowel would necessarily result in a stress shift. In the following hypothetical example, stress is assumed to be penultimate by default; the syncope constraint I use in this example is POSTTONIC. Empty nuclei (i.e. sites of deletion) are marked with the sign •.

(26) /$CV_1CV_2CV_3$/
Designated location of the posttonic nucleus: V_3

		✦SYNCOPE (POSTTONIC)	STRESS	MAX-V
	a. $CV_1C\acute{V}_2CV_3$	*!		
☞	b. $CV_1C\acute{V}_2C\,•_3$			*
	c. $C\acute{V}_1C•_2CV_3$	✦!	*	*

The first two candidates, (26)a and (26)b, show default penultimate stress with and without postonic syncope, respectively. The candidate (26)c violates the constraint ✦SYNCOPE because the location of the posttonic nucleus is different with respect to its designated location. Indeed, in the grammar with ✦SYNCOPE removed, stress falls on V_2, and hence the nucleus V_3 is postonic. In the candidate (26)c stress falls on V_1 and V_2 is posttonic; this ensures that candidate's fatal ✦ violation. In effect, this violation is due to the fact that a stressed vowel has syncopated in this candidate, causing a stress shift

[27] The problem with formulating the constraints in negative terms, e.g. "If a nucleus is posttonic, it is not followed by an open syllable with a short vowel", is that this constraint could potentially cause repairs other than syncope: lengthening, coda insertion, epenthesis, etc., would all be possible. None of these is an attested process applying in the WEAK environments where syncope is typical.

and thus a difference in the location of the posttonic nucleus with respect to its designated location.

An important consequence of this proposal is that stressed vowel deletion is only impossible under METRICAL pressures, i.e. constraints such as ✦SWP. Crucially, other constraints may still force stressed vowel deletion, a fact which, I argue, is consistent with the typology. In particular, the constraint ONSET may force the deletion of vowels in hiatus. In many cases (e.g. Tonkawa; see section 4.2.3.2 below), it is always the FIRST vowel in hiatus that deletes, regardless of its stressed/unstressed status. On my proposal, this is a consequence of the fact that ONSET is not a procedural constraint, and may condition a range of repairs as a standard OT markedness constraint.

This discussion of the analysis sets the stage for the survey of the typology of syncope. The following case studies in a number of languages are divided into three groups: first, I deal with languages that conform with my generalization (Carib, Tonkawa, Lebanese Arabic, Old Russian, Latin); second, I consider several languages where recent analyses have made use of stressed vowel syncope, and show that in each case alternative analyses are available and possibly superior (Southeastern Tepehuan, Hopi, Central Alaskan Yupik). Finally, I briefly discuss a case where the vowel deletion processes applies to stressed vowels, and argue that in these cases the deletions do not fall under the scope of metrically-driven syncope (Bedouin Hijazi Arabic).

4.2.3 Case studies

4.2.3.1 Carib

My first illustration of a well-behaved vowel syncope process comes from Carib (Hawkins 1950; Kager 1997), an iambic language where weak vowels are deleted. In words consisting of only light syllables, iambic feet are built left-to-right, and unstressed vowels are either deleted or reduced to a consonantal release, under conditions I will not discuss here. Stressed syllables are lengthened. In odd-parity words, the vowel in the final syllable is lengthened and the syllable is stressed. Main stress falls on the rightmost foot. In the following examples, beneath each form is its schematic representation where the deleted syllables are crossed out (σ̸).

(27)	a.	/pata/	(pᵊtá:)	'place'
		/σ σ/	(σ̸ σ́:)	
	b.	/piripi/	(prì:)(pí:)	'spindle'
		/σ σ σ/	(σ̸ σ̀:)(σ́:)	
	c.	/erepamɨ/	(ᵊrè:)(pmɨ́:)	'I arrive'
		/σ σ σ σ/	(σ̸ σ̀:)(σ̸ σ́:)	
	d.	/umanarirɨ/	(mà:)(nrì:)(rɨ́:)	'my cassava grater'
		/σ σ σ σ σ/	(σ̸ σ̀:)(σ̸ σ̀:)(σ́:)	

Heavy syllables disrupt the count relevant to stress and syncope: they bear stress, and the footing starts anew. Both CVV and CVC count as heavy.

(28)	a.	/seepɔrɔ/	(sèe)(prɔ́:)	'along here'
		/σ: σ σ/	(σ̀:)(σ̸ σ́:)	
	b.	/peʔmara/	(pèʔ)(mrá:)	'free'
		/σ: σ σ/	(σ̀:)(σ̸ σ́:)	
	c.	/eerepamɨ/	(èe)(rᵊpà:)(mɨ́:)	'I arrive'
		/σ: σ σ σ/	(σ̀:)(σ̸ σ̀:)(σ́:)	
	d.	/uyenkuʔtɨsaʔya/	(yè:)(kùʔ)(tᵊsàʔ)(yá:)	'if anyone deceives me'
		/σ σ: σ: σ σ: σ/	(σ̸ σ̀:)(σ̀:)(σ̸ σ̀:)(σ́:)	

The stress system in Carib is straightforwardly iambic: the only possible feet are (LH) and (H), assigned left-to-right. Degenerate feet (L) are prohibited, which accounts for the lengthening and final stress in odd-parity words like /piripi/→ (prì:)(pí:). In the weak position of the iambic foot heavy syllables are prohibited, resulting in the disruption of the left-to-right count whenever a heavy syllable occurs in an odd-numbered position, as in (28). Syncope or weakening applies to any vowel in the weak position of the (LH) foot. Thus, the data in (27)-(28) show that Carib syncope follows the predicted pattern and can be straightforwardly accounted for the constraint ✦SYNCOPE(WEAK).

There is one interesting complication to this pattern. Deletion does not apply when the vowel to be deleted is adjacent to a consonant cluster. This prohibition has to do with a well-motivated preference to avoid complex consonant sequences, expressed by a constraint like *CCC. However, not only does the vowel fail to delete in such circumstances, but the footing itself appears to be dependent on the outcome of reduction: the vowel that fails to undergo syncope surfaces as stressed, and the foot count restarts to its right.[28] If the vowel simply failed to reduce or delete in the form /kratupe/ (see below in (29)b), we would expect the footing to simply place it into the weak position of the iambic foot, resulting in the incorrect *(kratù:)(pé:). Instead, the actual form is (krà:)(tᵊpé:): the vowel in the first syllable, which otherwise would be subject to deletion, ends up with a stress. This stress attraction cannot easily be attributed to weight effects, because the consonant cluster that causes it is in the ONSET of the initial syllable. As Kager (1997: 473) puts it, "[a]n ordering paradox is evident: vowel reduction depends on metrical parsing, while metrical parsing must in turn depend on reduction".

(29)	a. /ptakaype/	(ptà:)(kày)(pé:)	'traira-fish now…'
		*(pt⁽ᵊ⁾kày)(pé:)	
		*(ptakày)(pé:)	
	b. /kratupe/	(krà:)(tᵊpé:)	'alligator now…'
		*(kr⁽ᵊ⁾tù:)(pé:)	
		*(kratù:)(pé:)	

These data present an apparent problem for my account. The implicational version of ✦SYNCOPE(WEAK) cannot derive the correct output (krà:)(tᵊpe) in this case, because this constraint in general can force only vowel deletion but not a stress shift. In other words, the only possible outputs for the input /kratupe/ are *(*kratù*:)(*pé:*) and *(*krtù:*)(*pé:*), depending on the ranking of *CCC. If *CCC is high-ranked, syncope simply fails and we get the form (*kratù*:)(*pé:*), where the vowel in the first syllable is

[28] A simple failure of vowel deletion following a cluster would not be unusual: it would amount to the blocking of syncope by a cluster condition. A similar situation exists in French: schwas delete unless a

protected by the consonant cluster (30). If *CCC is low-ranked, syncope applies and creates the marked consonant cluster in (*krtù:*)(*pé:*), as shown in (31).

(30) Designated footing: (σ σ̀)(σ́)

			*CCC	✦SYNCOPE	MAX-V	AL-R
/kratupe/	(☞)	(krà:)(tᵊpé:)		✦		*!
		(krtù:)(pé:)	*!		*	
	☹	(kratù:)(pé:)		*		

(31) Designated footing: (σ σ̀)(σ́)

			✦SYNCOPE	MAX-V	AL-R	*CCC
/kratupe/	(☞)	(krà:)(tᵊpé:)	✦!		*	
	☹	(krtù:)(pé:)		*		*
		(kratù:)(pé:)	*!			

Clearly, the actual candidate (*krà*:)(*tᵊpé*:) cannot win under these circumstances, because it incurs a fatal ✦ violation of the ✦SYNCOPE constraint.

There must be another constraint that would prefers the correct output (*krà:*)(*tᵊpé:*) over the incorrect *(*kratù:*)(*pé:*) in a way that affects the selection of the designated footing. One possibility is to invoke the set of constraints responsible for sonority-driven stress, which prohibit reduced vowels from being stressed. The series of constraints *NONHEAD/{a}, *NONHEAD/{a,e,o}, *NONHEAD/{a,e,o,i,u}, etc., as discussed in the preceding chapter, have stress not in their antecedent but in the consequent. This means that the sonority/stress constraint can affect the designated site of stress and as a result can force stress shifts.

(32) a. *NONHEAD/{a}
'If a syllable has the nucleus *a*, then it is stressed'
b. *NONHEAD/{a,e,o}
'If a syllable has the nucleus *a*, *e*, or *o*, then it is stressed'
c. *NONHEAD/{a,e,o,i,u}

consonant cluster would form. Cf. *événement* [evɛnmã] 'event' vs. *gredin* [grədɛ̃] 'rogue'.

'If a syllable has the nucleus *a*, *e*, *o*, *i*, or *u*, then it is stressed'

In other words, the solution to this puzzle is that Carib has, on top of the standard left-to-right iambic stress system, a sonority-sensitive restriction that prohibits full vowels from appearing in the weak branches of feet and causes stress attraction to full vowels. Although Kager's set of examples only contain cases where the exceptionally stressed vowel is *a*, it is safe to assume that all vowels except *ə* behave in this way, in absence of evidence to the contrary. This means the constraint at play here is *NONHEAD/{a,e,o,i,u}, which I will abbreviate as *NONHEAD(fullV). Because ✦SYNCOPE outranks ✦NONHEAD(fullV), syncope takes precedence, and the sonority-sensitive effect only emerges when syncope cannot apply due to other factors (*CCC).

(33) ✦SYNCOPE ≻ ✦*NONHEAD(fullV)
Designated state of footing: (σ σ́)
Designated state of initial vowel: [ᵊ]

			✦SYNCOPE	✦*NONHEAD(fullV)	*CCC	*CLASH
/pata/	☞	(pᵊtá:)				
		(patá:)	*!	*		
		(pà:)(tá:)	✦!	✦		*

(34) ✦SYNCOPE ≻ ✦*NONHEAD(fullV)
Designated state of footing: (σ̀)(σ σ́)
Designated state of initial vowel: [a]

			✦SYNCOPE	✦*NONHEAD(fullV)	*CCC	*CLASH
/kratupe/	☞	(krà:)(tᵊpé:)				*
		(krtù:)(pé:)	✦!	✦	*	*
		(kratù:)(pé:)	*!	*		*

Thus, Carib is a case of well-behaved syncope, once the additional complication is taken into account that, on top of the iambic system, the language has a minor sonority-sensitive stress 'subsystem'.

4.2.3.2 Tonkawa

Tonkawa syncope accords with the generalization that only unstressed vowels may undergo metrically-driven syncope. Interestingly, Tonkawa has not only metrical syncope, but also vowel deletion in hiatus, and the latter process indeed MAY apply to stressed vowels, as predicted by my proposal.

Stress in Tonkawa, as implied by Gouskova (2003: 124 and ff.) is based on the moraic trochee assigned left-to-right. Although the original description of Hoijer (1938; cf. also Kisseberth 1970) does not supply information about stress, it can be inferred from processes that depend on it, as Gouskova points out. Because of the circular reasoning that this uncertainty brings, Tonkawa has only a limited value for the point at hand, but the example is, I believe, still illustrative as a typical case of well-behaved syncope. It should be taken with a grain of salt.

Characteristically of trochaic systems, vowels shorten in iambic word-initial configurations: long vowels after initial L surface as short (35)a-b, but remain unchanged after an initial H (35)c. This suggests that a canonical moraic trochee, (H) or (LL), is enforced at the left edge, at the expense of unfaithfully mapping underlying LH sequences.

(35)	a.	/xa-kaana-oʔ/	(xaka)(noʔ)	'he throws it far away'
		/ke-yaaloona-oʔ/	(keya)(loo)(noʔ)	'he kills me'
		/we-naate-oʔ/	(wena)(toʔ)	'he steps on them'
	b.	/ke-soopka-oʔ/	(kesop)(koʔ)	'I swell up'
		/we-c^{ʔ}aapxe-oʔ/	(wec^{ʔ}ap)(hoʔ)	'he puts up several beds'
	c.	/nes-kaana-oʔ/	(nes)(kaa)(noʔ)	'he causes him to throw it away'
		/yaaloona-oʔ/	(yaa)(loo)(noʔ)	'he kills him'
		/ʔatsoo-k-laknoʔo/	(ʔat)(sook)(lakno)(ʔo)	'came to life, it is said'

The data furthermore suggest that word-initial CVC syllables count as heavy, while word-internal CVC syllables are light: although CVC is acceptable when following an initial L, as shown in (35)b above, initial CVC syllables do not cause shortening of the following vowel, as can be seen in (35)c. This sensitivity of CVC weight to the position of the syllable in the word is attested elsewhere, and is a well-known feature of several Yupik languages.

Tonkawa has at least two vowel deletion processes, syncope and elision. Syncope applies to vowels in the weak branch of a foot, as seen in the examples in (36) below. An important restriction is that root-final vowels may not undergo syncope. Thus, the second vowel in /ke-yakapa-nes-ʔoʔ/ → (*key*)(*kapa*)(*nesʔoʔ*) deletes, but the fourth root-final vowel is protected from syncope. The second type of vowel deletion is elision, which automatically eliminates vowels before other vowels in hiatus. Both stressed and unstressed vowels can elide, nor are root-final vowels protected from elision.

In the data below, vowels that syncopate are crossed out in the middle column, and surface forms are shown in the rightmost column. Root-final vowels are underlined. (36)a shows weak vowel syncope, (36)b shows elision of unstressed vowels, (36)c elision of stressed vowels, and (36)d gives some additional examples of both elision and syncope, where the latter applies in a foot other than the initial foot in the word.

(36) a.	/yamaxa-noʔ/	(yam~~a~~)(xanoʔ)	(yam)(xanoʔ)	'he is painting his face'
	/ke-yakapa-nes-ʔoʔ/	(key~~a~~)(kapa)(nesʔoʔ)	(key)(kapa)(nesʔoʔ)	'they two strike me'
b.	/we-yakapa-oʔ/	(wey~~a~~)(kap~~a~~oʔ)	(wey)(kapoʔ)	'he hits them'
	/ke-yamaxa-oʔ/	(key~~a~~)(max~~a~~oʔ)	(key)(maxoʔ)	'he paints my face'
c.	/yakapa-oʔ/	(yak~~a~~)(p~~a~~oʔ)	(yak)(poʔ)	'he hits it'
	/ke-we-yamaxa-oo-ka/	(kew~~e~~)(yam~~a~~)(x~~a~~oo)ka	(kew)(yam)(xoo)ka	'you paint your faces'
d.	/nes-yamaxa-oʔ/	(nes)(yam~~a~~)(x~~a~~oʔ)	(nes)(yam)(xoʔ)	'he causes him to paint his face'
	/taa-notoso-oʔs/	(taa)(not~~o~~)(s~~o~~oʔs)	(taa)(not)(soʔs)	'I stand with him'

Crucial for our purposes here is the difference in sensitivity to prosodic structure between the two vowel deletion processes: syncope applies only to vowels in the weak branch of a foot, while elision mechanically deletes vowels in hiatus regardless of the prosodic context.

4.2.3.3 Lebanese Arabic

In this section I will go through an example of well-behaved metrically-driven syncope that applies to unstressed vowels, and illustrate the shortcomings of an analysis that takes syncope to be driven by constraints such as SWP and Parse-σ. The problem with this analysis, as I will show, is not so much empirical as explanatory: deletion of unstressed vowels is treated as a collection of seemingly unrelated processes, and it appears to be an accident that all of them coexist in the same language. However, a crucial generalization about the syncope's ENVIRONMENT is lost; nothing in the standard OT analysis expresses the simple fact that it is the unstressed vowels that delete. In other words, the Lebanese Arabic situation presents a non-surface-based conspiracy from the point of view of OT. Moreover, the unexplanatory nature of the analysis of the Arabic data is symptomatic of a broader typological problem, viz. the failure of the theory to express the crosslinguistic connection between stress and sycnope.

Lebanese Arabic has a stress generalization typical of many Arabic dialects: the final syllable is stressed if it is superheavy, otherwise stress falls on the penult if it is heavy, and, if neither of these two conditions is met, the antepenult is stressed by default, as illustrated by the following representative data (Gouskova 2003).

(37) a. Stress final superheavy

ʔakált	'I ate'
nazzált	'I brought down'
saʔalúuk	'they asked you'
maktabáat	'libraries'

b. Else penult if heavy, and in disyllables

názzal	'he brought down'
náazal	'he encountered'
maʕáarik	'battles'
maktábti	'my library'
sáħab	'he withdrew'
ʔákal	'he ate'

c. Else antepenult

ʔákalit	'she ate'
máktabe	'library'

Some high vowels /i, u/ in open syllables are deleted under certain conditions, and the job of any analysis of syncope is to provide an account for which of the vowels syncopate. The environment-based generalization is straightforward: a high vowel in an open syllable is deleted whenever it would otherwise be unstressed. In the following examples the syncopating vowel is underlined. The middle column shows the application of the stress rule to the form without syncope, illustrating that the vowel that is deleted is always the one that is unstressed.

(38)

UR	STRESS	SF	GLOSS
/nizi̱lit/	ní.zi̱.lit	nízlit	'she descended'
/saaħibi̱tuu/	saa.ħí.bi̱.tuu	saaħíbtu	'his friend'
/saaħi̱bitna/	saa.ħi̱.bít.na	saaħbítna	'our friend'
/ʔibi̱nii/	ʔí.bi̱.nii	ʔíbnii	'my son'
/bagi̱lii/	bá.gi̱.lii	bágli	'my mule'
/ni̱zilt/	ni̱.zílt	nzílt	'I descended'
/fi̱himna/	fi̱.hím.na	fhímna	'we understood'

These facts are quite straightforward in terms of the proposal made here about ✦SYNCOPE constraints: syncope targets unstressed high vowels in open syllables, and hence results from the action of the constraint ✦SYNCOPE(UNSTR).[29]

(39) Designated location of stress: *ni*

	✦SYNCOPE	MAX-V

[29] I abstract away from the selective syncope of high vowels *i, u*; this is not crucial for the purposes of the discussion.

		(UNSTR)	
/nizilit/	nízilit	*!	
☞	níz•lit		*
	n•zílit	✦!	*
	nízil•t	*!	*

The designated locus of stress is on the initial syllable *ni*. The first candidate, *nízilit*, has no syncope at all, so the ✦SYNCOPE constraint is violated. The next candidate does not violate the constraint, because it has no unstressed non-empty nucleus in an open syllable. The candidate that deletes the stressed vowel, *nzílit*, fatally ✦-violates the syncope constraint, because it involves a stress shift with respect to the designated locus of stress. The final candidate *nízilt* once again has an *i* nucleus in an unstressed open syllable, and thus violates the ✦SYNCOPE constraint.

Note that there is no complex interaction between syncope and any other constraints in the grammar: the ✦SYNCOPE(UNSTR) constraint alone can decide which vowels will syncopate. This might be taken as a symptom of a bad analysis or of incorrect constraints in canonical OT. However, I suggest here that this usurpation by one constraint of the entire process is in fact a welcome development, because the syncope process has ONLY ONE reason to apply: it simply targets unstressed vowels. The constraint ✦SYNCOPE(UNSTR) straightforwardly captures that generalization, both within the given language, and typologically.

It is instructive to compare what drives syncope on Gouskova's analysis and mine. The simple generalization stated above – that the vowel that syncopates is the one that would end up unstressed – does not enter directly into Gouskova's analysis. Syncope's nature as extreme weakening is obscured by the disparate foot structure constraints that end up driving syncope. On Gouskova's view, there is no constraint specific to syncope; instead, the general constraint against marked nuclei, *NUC/i,u, forces the deletion of high vowels in general, while other prosodic constraints determine which high vowels end up syncopated. Nothing in the analysis links lack of stress to syncope, because the theory is not designed to handle environment-based generalizations. Indeed, this connection between weak prosodic positions and syncopation has all the characteristics of a phonological conspiracy.

Consider disyllables. By the stress rule, the only situation when a disyllable can receive final stress is if the final syllable is superheavy; otherwise, stress will fall on the penult. Thus, *ʔakált* 'I ate' has final stress but *ʔákal* is stressed on the penult. It follows that, on the view that syncope applies to unstressed syllables, it only will apply to words like /nizilt/ 'I descended', which have a superheavy ultima, but not to /nizil/ 'he descended', with a heavy final. Indeed, we have *nzílt* but *nízil*, not **nzíl*.

On the *NUC/i,u analysis, what prevents syncope of the initial stressed syllable in *nízil* to **nzíl* (or, for that matter, the syncope of *i* in the closed second syllable to give **nízl*) is NON-FINALITY: in the syncopated forms the stress is on the final (and only) syllable, and this is taken as the reason why syncope fails to apply. This is captured by the ranking NONFIN(STRESS) ⟩⟩ *NUC/i,u. On the other hand, the form with an underlying superheavy syllable like /nizilt/ does syncopate because $\text{WSP}_{\mu\mu\mu}$, the constraint against unstressed trimoraic syllables, is ranked above NONFIN. The choice of the syncopating vowel in the trisyllable /nizilit/ is also made by NONFIN.

On the other hand, in forms like /saaħibituu/, the choice of the syncopating vowel is determined by another constraint, PARSE-σ: the optimal form (*saa*)(*ħíb*)*tu* parses more syllables into feet than the loser *(*sáaħ*)*bitu*. These examples are illustrated below.

(40) Lebanese Arabic syncope (Gouskova 2003: 238)

			NONFIN (STRESS)	NONFIN(FT)	*NUC/i,u	PARSE-σ
/nizilit/	☞	(níz)lit			**	*
		(nízi)lit			***!	*
		(nzílit)		*!	**	
		ni(zílt)	*!	*	**	*
		(nzílt)	*!	*	*	
/nizilt/	☞	(nzílt)	*	*	*	

		ni(zílt)	*	*	**!	*
/nizil/	☞	(nízil)		*	**	
		(nízl)	*!	*	*	
/saaħibituu/	☞	(saa)(ħíb)tu			*	*
		(sáaħ)bitu			*	**!

The form /fihimna/ presents still another case. Here, the choice between the correct (*fhím*)*na* and the incorrect candidate that syncopates the stressed vowel, *(*fíhm*)*na*, is actually not made by Gouskova's constraints, but a reasonable addition to the system, such as a constraint that bans trimoraic syllables (*μμμ), or a constraint against triconsonantal clusters (*CCC).

(41)

			*NUC/i,u	PARSE-σ	*CCC?
/fihimna/	☞	(fhím)na	*	*	
		fi(hím)na	**!	**	
		(fíhm)na	*	*	*!

Because the constraints responsible for the choice of the syncopating vowel in the various forms are freely ranked with respect to each other and the other constraints, the upshot of Gouskova's analysis is that the application of syncope in any one class of forms is in principle independent of its application in another class. There could be languages where PARSE-σ is ranked low enough that syncope applies to the stressed vowel in /saaħ ibituu/, but in /nizilt/ is still the unstressed vowel that syncopates. In other words, the generalization that syncope applies to whichever vowel would otherwise be unstressed has no place in the theory. This is a case of a phonological conspiracy: several constraints appear all to work toward the same goal of ensuring that only UNSTRESSED vowels syncopate.

Let me make this claim more precise. The ostensible virtue of analyses such as Gouskova's is that they link the location of syncope to the constraints that are responsible for the location of stress in the language: the same constraints that are necessary for stress placement, e.g. PARSE-σ, NONFIN, etc. are also responsible for the stress system and syncope.

In fact, a more detailed examination of the factorial typology shows that this claim is simply incorrect. Using the OT Soft program (Hayes et al. 2003), I have constructed a factorial typology from a subset of the Lebanese Arabic data. The inputs included all relevant forms for the stress system and two potentially syncopating forms: /nizilit/ and /fihimna/, where the correct outputs are *nízlit* and *fhímna*. For these two inputs I have included the following sets of candidates.

(42) a. /nizilit/
nízilit (no syncope)
nízlit (correct syncope)
nzílit (wrong syncope)
nízilt (wrong syncope)
nzílt (wrong syncope)

b. /fihimna/
fihímna (no syncope)
fhímna (correct syncope)

Overall, the system generates 155 distinct output patterns. Among these, I have selected only those that have a stress system that is surface-identical to the actual system of Lebanese Arabic. Within such systems, six different syncope patterns are possible, not counting the actually attested one. These are listed below, together with the rankings that produce them.

(43) a. *nízlit* (correct syncope)
fihímna (no syncope)
WSP(3), *CCC ⟩⟩ NONFIN(St) ⟩⟩ FTBIN, WSP, SWP ⟩⟩ Max-V ⟩⟩ *NUC/i,u, PARSE-σ ⟩⟩ NONFIN(Ft) ⟩⟩ ALFTR

b. *nízilit* (no syncope)

fhímna (correct syncope)
WSP(3), *CCC ⟩⟩ NONFIN(St) ⟩⟩ FTBIN, WSP ⟩⟩ PARSE-σ ⟩⟩ NONFIN(Ft), MAX-V ⟩⟩ *NUC/i,u, ALFTR, SWP

c. *nzílit* (wrong syncope)
fihímna (no syncope)
WSP(3), *CCC ⟩⟩ NONFIN(St), PARSE-σ ⟩⟩ MAX-V, WSP, SWP ⟩⟩ NONFIN(Ft), *NUC/i,u, FTBIN ⟩⟩ ALFTR

d. *nzílt* (wrong syncope)
fihímna (no syncope)
WSP(3), *CCC ⟩⟩ PARSE-σ ⟩⟩ WSP, SWP ⟩⟩ NONFIN(St), MAX-V ⟩⟩ NONFIN(Ft), *NUC/i,u, FTBIN ⟩⟩ ALFTR

e. *nzílt* (wrong syncope)
fhímna (correct syncope)
*NUC/i,u, WSP(3), *CCC ⟩⟩ NONFIN(St), MAX-V ⟩⟩ FTBIN, WSP, SWP ⟩⟩ PARSE-σ ⟩⟩ NONFIN(Ft) ⟩⟩ ALFTR

f. *nzílit* (wrong syncope)
fhímna (correct syncope)
WSP(3), *CCC ⟩⟩ NonFin(St), Parse-σ ⟩⟩ *Nuc/i,u, FtBin, WSP, SWP ⟩⟩ NonFin(Ft), Max-V ⟩⟩ AlFtR

The fact that the factorial typology contains languages that have a surface-identical stress system with that of Lebanese Arabic and a DIFFERENT syncope pattern shows that, in fact, the standard OT analysis fails to make a connection between stress and syncope. Two of the predicted systems show unstressed vowel syncope in some forms but not others (43)a-b. Four systems show stressed vowel syncope at least in some forms (43)c-f.

The diagnosis of the problem is clear. The syncope-driving constraint, *NUC/i,u, can be ranked at any point in the hierarchy; so can MAX-V and *CCC, which are not related to stress assignment. This freedom of ranking of at least the three constraints results in the loss of relationship between the location of stress, which is fixed by the stress constraints, and the location of syncope, which is fixed by these other constraints.

The actual system of Lebanese Arabic – with syncope of all and only unstressed vowels in open syllables – has no special status on this analysis; it is only one of several possible syncope patterns. This rather complicated relationship between the location of stress and the location of syncope is radically simplified by my proposal, which links the two in a direct way: given the setup of the theory, syncope simply cannot apply to a stressed vowel. The patterns in (43) that violate this generalization, predicted by the standard theory, become impossible on my proposal.[30]

4.2.3.4 Archaic Latin

Before moving on to the problematic cases in sections 4.2.3.5 and ff., let me briefly illustrate well-behaved unstressed vowel syncope in a language where two separate patterns appear to hold at the same time. Archaic Latin syncope is notoriously problematic, because the details of the sound change were different in different dialects. Syncope was never carried out to its full extent, and left a patchwork of exceptions and difficult forms in classical Latin (see general discussion of Latin syncope in Vendryes 1902 and in handbooks such as Leumann 1977 and Sihler 1995).

Despite the untidiness of the syncope's result in Latin, a certain set of patterns appear to emerge that make sense in terms of a particular theory of archaic Latin stress. Unlike the familiar classical Latin stress rule, prehistoric Latin had regular initial stress. A natural way of interpreting the archaic Latin stress rule is LEFT-TO-RIGHT MORAIC TROCHEES. I will not give the arguments for such an interpretation here; let us assume that the stage of Latin under discussion had this pattern. The first restriction is that syncope typically applied only to posttonic vowels, i.e. vowels in the second syllable. Furthermore, vowels syncopated in a different way depending on whether there were sonorants or obstruents in their context. As a rule, obstruent-adjacent vowels syncopated less often and in fewer environments than sonorant-adjacent vowels.

[30] Also supporting my analysis is Kiparsky's (2000) argument that, in a stratal theory of phonology, stress is lexical while syncope is postlexical and thus follows it in the derivation.

Secondly, the so-called TWO-MORA LAW restricted syncope to only those posttonic vowels that were followed by at least two moras in the word.

The following table, based on the data in based on Vendryes 1902, summarizes the tendencies of syncope in the second syllable depending on the weight of the preceding and following syllables. In obstruent contexts, vowels only syncopated when flanked by two heavy syllables, i.e. in words beginning with (H)<u>L</u>(H). In sonorant contexts, syncope also applied in case the initial syllable was light, in words beginning with (L<u>L</u>)X. When a light syllable was preceded by a heavy and followed by a light, syncope appears not to have taken place in regardless of segmental context.

(44) Syncope of posttonic vowels

	obstruent contexts	sonorant contexts
(L<u>L</u>)X	no	yes
(H)<u>L</u>(H)	yes	yes
(H)(<u>L</u>L)	unclear	no

Once again, due to the degree of irregularity in syncope's observed outcome, this table must be understood to indicate tendencies, not exceptionless facts. 'Yes' and 'no' in the table mean that syncope was predominant and rare, respectively.

Under the moraic trochee view of Latin stress, the difference between the contexts where the initial syllable is light and those where the initial syllable is heavy is reflected in the location of the right foot boundary: the initial foot parses the second syllable in the former case but not in the latter, as shown in (44). In words shaped like (H)(LL) the posttonic syllable is not only footed but is the head of its foot, i.e. bears secondary stress. The facts in (44) then invite a natural interpretation of syncope. In obstruent contexts syncope applies only to unfooted posttonic vowels, while syncope in sonorant contexts applies both to unfooted vowels and vowel in the weak branch of a foot.

This brief discussion, while not touching on the complexities of the Latin case, serves as another illustration of a well-behaved case of syncope, with the added twist that one language has two subpatterns in different contexts.

4.2.3.5 Yers in Old Russian[31]

A syncope process familiar to phonologists is the deletion of vowels known as yers, which applies in all Slavic languages. Originally a metrically-driven phenomenon, in the modern Slavic languages yer deletion has acquired the characteristics of a crazy rule, not motivated by metrical structure. More pertinent to the point at hand is the stage in the history of Slavic when yer syncope was still productive and conditioned by metrical factors. In this section I address the question of whether or not, at that stage, stressed yers could be deleted.

Late Common Slavic had two extra-short vowels *ĭ* and *ŭ*, known as the yers, weakened or strengthened depending on the environment. All Slavic languages point to the same original environments for strong and weak yers, suggesting that this division took place in the common period, but the languages disagree as to the eventual fate of the yers. In all Slavic languages the weak yers underwent syncope, but the strong yers changed into full vowels ("vocalized") in different ways depending on the language. All modern Slavic languages show synchronic vowel-zero alternations that reflect this original process of yer syncope and vocalization.

The environment for the distribution of weak and strong yers is known as Havlík's Law (see, a.o., V.Kiparsky 1979, Zalizniak 1985, Bethin 1998). Descriptively, a yer is strong only when it precedes a weak yer, counting from right to left. All other yers are weak. In other words, weak yers are word-final and those not adjacent to another yer. In yer sequences, even-numbered yers, counting from the right, are strong. In the data below, the Old Russian forms on the left have the strong yers underlined; the second column shows the modern Russian form with the strong yer vocalized and the weak yer deleted. In some cases, analogical leveling has replaced the expected forms with ones showing a different pattern of yer vocalization.

(45)	sŭmĭ̱rtĭnĕi	smertnoj	'death (adj.loc.sg.fem)'
	dĭnĭ̱sĭ	dnes^j	'today'
	dĭ̱nĭnica	dennica	'morning star'
	lŭ̱žĭno	ložno	'false (adv.)'
	lŭživyi	lživyi	'false (adj.)'
	lĭstĭ̱cĭ	l^{j}stec	'flatterer/antichrist'
	lĭ̱stĭca	lest^{j}ca > l^{j}steca	'flatterer/devil'
	otŭxodĭnikou	otxodnik-	'hermit'
	otŭšĭ̱lĭca	#otšel^{j}ca	'hermit'
	otŭ̱šĭlĭ̱cĭ	#otošlec	'hermit'
	rŭpŭ̱tŭ	rpot > ropot	'murmur'
	sŭlnĭ̱čĭnououmou	solnečnomu	'sunny'
	sŭnĭ̱mŭ	snem > sonm	'gathering'
	sŭ̱nĭmy	sonmy	'gatherings'
	šĭvĭ̱cĭ	švec	'shoemaker'

(V.Kiparsky 1979: 97)

In addition to the purely rhythmic environment for yer strengthening, a yer can be semi-regularly protected from deletion in case a complex consonant cluster would result.

Note that in the statement of Havlík's Law as presented above, only right-to-left counting and a yer's immediate environment are relevant to its strong or weak status. Although the process has the characteristics of metrical syncope – most importantly, the fact that it applies in a rhythmic fashion to alternating yers – the location of stress is conspicuously absent from the descriptive statement of this rule. This fact appears problematic for the proposal made here, because if syncope is metrically driven, my account predicts that, at the very least, stressed yers should fail to syncopate. In this section I argue that although stress indeed did not matter in Havlík's Law, some complications having to do with the distinction between phonological and predictable accent in Slavic allow an analysis of the yer alternations that does not pose problems for my proposal.

At first blush, it appears that the statement of Havlík's Law given above is incomplete and should in fact include some reference to stress. It is frequently claimed

[31] I am grateful to A.K.Polivanova for discussion of the issues in this section.

in Russian historical grammars that stressed yers were strong, and thus stress could protect a yer from deleting. For example, Borkovsky & Kuznetsov (1965: 102) adduce the frequently cited example of the Russian word *dósku* 'board.ACC', which comes from Old Russian *dŭsku*. By the rule of yer vocalization given above, the yer in this form, not being adjacent to any other yer, should syncopate to give *dsku* and eventually *cku*. Although this form is occasionally attested, the surviving *dósku*, according to the Borkovsky & Kuznetsov, shows the influence of accent on the yer.

If Borkovsky & Kuznetsov's claim were not controversial, my discussion could stop here, since, after all, the failure of stressed yers to delete would be a welcome fact for my analysis. However, as Zalizniak (1985) has shown, the claim that stress could protect a yer from deletion, in the form that it is traditionally maintained, is false. Below I will go through Zalizniak's argument, and then suggest a way in which the facts can be reconciled with the theory of syncope that I am advocating.

Slavic accent is a descendant of Indo-European pitch accent system. Both roots and affixes can be specified in the lexicon for the presence or absence of an accent on a particular syllable. Historically, the yers come from the short vowels *ĭ* and *ŭ*, which could be accented just as any other vowel. In Slavic, if the underlying accent fell on a yer that is weak by Havlík's law, the accent shifted to the preceding syllable, or, in absence of such, to the following one. This is a change reconstructible for the entire Slavic domain. As a result, no weak yer could have a PHONOLOGICAL accent at the time of the fall of the yers, which means that the question of whether such a stress could protect a yer from deletion is not decidable: all phonologically accented yers were strong anyway.

Slavic inherited from Indo-European a rule known as The Basic Accentuation Principle, which assigns stress to the leftmost accent in case there is more than one underlying accent in a word, and assigns default stress to the leftmost syllable in forms without any underlying accent. Relevant for the discussion at hand is this latter class of forms, known traditionally as *enclinomena*: could their default initial accent protect a yer from deletion? Here Zalizniak's convincing argument is that stress plays no role in yer deletion: stressed initial weak yers delete just as unstressed ones.

A comprehensive list of phonologically unaccented forms with a potentially weak yer in the first syllable shows that, in the general case, this yer syncopates. These forms fall into several classes, shown below. First, there is a class of unaccented nouns with CV̆C-stems, where the yer is weak in those case forms that have a full-vowel marker. Relevant here are the inherently unaccented case forms, such as the masculine genitive -*a* and the feminine genitive -*i*. In (46)a I list several such noun stems, together with the modern Russian forms of the relevant case form, showing that the yer indeed deletes. (46)b shows some other forms that do not fall into the same declensional pattern, like the numerals *sŭto* and *dŭva* and the interrogative pronouns *kŭto* and *čĭto*. Here, too, the yer in the initial syllable is not protected from syncope by the default initial prominence of these phonologically unaccented forms.

(46)	a. dĭn-	dn^{j}a	'day'	b.	kŭn^{j}azĭ	kn^{j}az^j	'prince'
	lĭn-	l^{j}na	'flax'		Tĭxvěrĭ	Tver^j	'Tver (city)'
	pĭn-	pn^{j}a	'stump'		sŭto	sto	'100'
	vŭš-	vši	'louse'		kŭto	kto	'who'
	rŭž-	rži	'rye'		čĭto	čto	'what'
					dŭva	dva	'2'

The environment of yer syncope is also met in a large class of verb stems of the shape CV̆C-, where in forms like the first singular the yer is weak and accented according to the initial default principle. Once again, all of the modern Russian forms show that this prominence does not shield the yer from syncope (47).

(47)	žĭgu	žgu	'burn'	mĭru	-mru	'die'
	žĭdu	ždu	'wait'	zĭr^{j}u	zr^{j}u	'see'
	čĭtu	čtu	'honor'	mŭču	mču	'hurry'
	rŭvu	rvu	'tear'	mĭn^{j}u	mnu	'crumple'
	pĭnu	pnu	'kick'	sŭpl^{j}u	spl^{j}u	'sleep'
	vĭru	vru	'lie'	lĭšču	l^{j}šču	'flatter'
	žĭru	žru	'devour'	mĭšču	mšču	'avenge'

Those forms where the yer fails to delete in the weak environment under default initial stress are shown below in (48). In most cases (48)a the yer in question is in an environment that would create a complex consonant cluster if the yer were to fall. Most commonly in such cases, the yer precedes a *st* group. In one single case, the word *sóty* 'honeycomb' (48)b, cluster phonotactics cannot explain the failure of yer deletion.

(48)	a.	lĭst-	l^{j}esti	'flattery'
		mĭst-	m^{j}esti	'revenge'
		čĭst-	česti	'honor'
		tĭst-	t^{j}est^{j}a	'wife's father'
		dŭsku	dosku	'board'
		dŭč-	doči	'daughter'
	b.	sŭt-	soty	'honeycomb (nom.pl)'

In nearly all such forms, cases with yer deletion are also attested.

(49)	OR	MR	also attested
	lĭsti	l^{j}esti	lsti
	mĭsti	m^{j}esti	msti
	čĭsti	česti	čti
	tĭst^{j}a	t^{j}est^{j}a	ct^{j}a
	dŭsku	dosku	dsku, cku
	sŭty	soty	sty

What is crucial is that the survival of the yer in the neighborhood of complex consonant clusters does not depend on the stress, as Zalizniak points out (1985: 170). The cases *dŭ žd^{j}á* > *dožd^{j}á* 'rain', *stĭkló* > *stekló* 'glass', *pĭstró* > *pestró* 'variegated' illustrate that the yer may fail to delete in weak positions in a consonant cluster environment even when it was not default-stressed, i.e. in forms with a stress on another syllable. In other words, whatever the explanation for yer survival in (48)a, it has nothing to do with stress at all. Finally, the isolated case *sŭty* > *soty*, with *sty* also attested, can be explained by analogy to the genitive plural form *sŭtŭ* > *sot*, or simply discounted as an exception – a not unnatural move in case of a process as complicated as the fall of the yers.

To summarize the discussion so far: (a) the role of phonological stress in yer deletion is unknown, because weak yers could not bear phonological stress due to an earlier stress shift, and (b) the default word-initial prominence appearing in phonologically unaccented words failed to protect a weak yer from deletion. Thus, yer deletion appears to present a problem for my proposal: stressed vowels seem to syncopate.

I believe that it is possible to reconcile the facts with the typological generalization that stressed vowels do not syncopate. Let me now take a broader look at the prosody of Old Russian. As mentioned above, given the Basic Accentuation principle inherited from Indo-European, Russian words fell into two broad classes: those with at least one underlying accent, and those without any underlying accent at all. In words of the former class, it is the leftmost stress which surfaced, while in words of the latter class, the *enclinomena*, default stress was assigned to the initial syllable. Jakobson (1963) suggested that the latter was cued by both pitch and intensity, while the former only by pitch; this proposal was in part designed to account for the different behavior of the two types of accent with respect to syncope, and thus cannot be used here without circularity to argue for any particular analysis of syncope.

What is crucial here is that the domain of the application of the Basic Accentuation principle, i.e. the phonological word, was much larger than the grammatical word, and included much cliticized material. This material included not only a host of function words such as prepositions, conjunctions, and particles, but also the *enclinomena*, even if they were lexical words. This is no longer true of Modern Russian, but Jakobson points out that in the archaic language of epic songs, one occasionally finds formulas that show the earlier system. In such formulas, phonologically unaccented words like *more* 'sea', *slovo* 'word', and *grudi* 'breasts' fail to surface with default initial stress but are cliticized to the preceding phonological word, as they would have been in Old Russian: *sinʲó <u>more</u>* 'blue sea', *takovó <u>slovo</u>* 'such a word', *belý <u>grudi</u>* 'white breasts' (Jakobson 1963: 161). Unstressed *enclinomena* in Old Russian occurred especially commonly in prepositional phrases, e.g *béz vorna* 'without a raven', of which there are many relics in the modern language: *ná zimu* 'for the winter', *zá gorodom* 'outside of the city', *ná golovu* 'onto the head'.

Facts such as these are standardly taken as evidence that, despite the existence of the default initial stress rule in Old Russian, in actual practice, phonologically unaccented forms frequently remained unaccented on the surface. Thus, each *enclinomenon* existed in two variants, one with the initial default stress, whatever its phonetic realization, and one without any stress at all. The obvious upshot of this fact is that the yers that deleted in the initial syllables of the *enclinomena* in the forms in (46)-(47) were not obligatorily stressed. On the assumption that yer deletion started in the unstressed variants of these forms, and then became lexicalized, the Russian yer deletion facts do not violate the typological generalization that stressed vowels do not syncopate.

In the modern Slavic languages, the synchronic reflexes of the old yer syncope rules undeniably cause stressed vowel deletion. These cases of vowel deletion are clearly not metrically motivated, falling into the category of "crazy rules" (Bach and Harms 1972), and thus are not subject to the generalization.

4.2.3.6 Southeastern Tepehuan

Rhythmic syncope in Southeastern (SE) Tepehuan has been assumed to target stressed syllables, in contradiction to my proposal. I show here that there is an alternative analysis of the stress system that makes it unnecessary to assume stressed vowel syncope. Because SE Tepehuan is standardly analyzed as an iambic language, syncope in examples such as /tɨroviɲ/ → [(tɨr)viɲ] 'rope' appears to target the second syllable, which, if syncope did not apply, would have been stressed. However, SE Tepehuan can also be analyzed as a trochaic, not an iambic language. Under such an analysis, syncope is regularly posttonic.

In SE Tepehuan stress falls on the initial syllable if it is heavy, and on the second syllable if the word begins with a LH sequence, as shown below.

(50) a. **H-initial words**: initial stress

vóohi	'bear'
vátvirak	'went to bathe'
táatpɨʃ	'fleas'

b. **LH-initial words**: second syllable stress

takáaruiʔ	'chicken'
kakárvaʃ	'goats'
sapók	'story'
tapɨ́ɨʃ	'flea'

This fact has led to the standard analysis of the stress system, endorsed by Kager 1997 and Gouskova 2003, in terms of left-to-right iambs. A single iambic (H) or (LH) foot is constructed at the left word edge in order to account for the stress facts in (50). However, the stress facts just mentioned, by themselves, do not inevitably diagnose an iambic system. There are many systems with identical stress generalizations but a clearly trochaic foot structure. For example, in Tümpisa Shoshone (Dayley 1989; Hayes 1995: 180), main stress falls on the initial syllable if it is heavy, and on the second syllable in words beginning with a LH sequence, just as in SE Tepehuan. These two patterns are illustrated below. The data below are from Dayley 1989: 436, cited in their phonemic transcriptions for simplicity, ignoring the effects of predictable processes like vowel devoicing. CVV syllables are heavy, CVC and CV are light.

(51) a. **H-initial words**: initial stress

té:wìngkɨppɨ̀hantɨ̀n	'told (someone)'
pá:kàntɨn	'having water'
tá:ttsɨ̀witɨ̀n	'seven'

b. **LH-initial words**: second syllable stress[32]

[32] Some LH-initial words in Tümpisa Shoshone may optionally have stress on the first syllable. There appear to be no such words that MUST be initial-stressed.

kukkwí:ppɨh	'smoke'
pihná:witɨn	'bee'
pomá:ppɨh	'grass, hay'
topó:mpi	'desert'
tuttsá:ppɨh	'dirt, dirty'
tsitó:hin	'push'
tɨtsɨ́:nna	'to count'
wɨkkɨ́:nappɨh	'fog'
pakɨ́:nappɨh	'cloud'

Despite the identity of the stress generalization with SE Tepehuan, Tümpisa Shoshone is standardly analyzed as trochaic. What would unambiguously diagnose a language with a pattern like the one in (50) or (51) as iambic or trochaic is how initial LL sequences behave: in iambic languages like Hixkaryana or Alaskan Yupik, words beginning with LL receive second syllable stress, while in trochaic languages like Tümpisa Shoshone, stress falls on the initial syllable of LL sequences, as illustrated below with data from Dayley 1989: 436 and ff.

(52) **LL-initial words**: initial stress

náttusùʔungkàntɨn	'doctor'
ké: námokkùpɨhkantɨn	'not having money'
nátɨpìnniyàha	'be named'
túkummàhannìngkɨnnà	'cook for'

The obvious analysis of the Tümpisa Shoshone stress facts is that a perfect moraic trochee, i.e. a (H) or a (LL) foot, is built as close to the left edge as possible. This results in H- and LL-initial words receiving initial stress, but LH-initial words receiving second syllable stress because no perfect moraic trochee can parse the initial syllable.

In SE Tepehuan, it is impossible to observe directly how LL-initial words behave, because, due to rhythmic syncope, no such words occur on the surface: in all underlying CVCV-initial words, the second vowel is deleted. Therefore, analyzing SE Tepehuan as an iambic language is a tempting choice in view of the stress of LH words, but an arbitrary one, because the crucial data which would decide between the iambic and the trochaic analyses are absent. If SE Tepehuan is treated as a trochaic system, then the generalization that it is the unstressed syllables that syncopate can be maintained.

The following examples illustrate the stress system analyzed in terms of moraic trochees.

(53) Stress

	a.	(vóo)hi	'bear'
		(vát)virak	'went to bathe'
		(táat)pɨʃ	'fleas'
	b.	ta(káa)ruiʔ	'chicken'
		ka(kár)vaʃ	'goats'
		sa(pók)	'story'
		ta(pɨ́ɨʃ)	'flea'

Black (1993) considers the trochaic analysis of SE Tepehuan briefly, but argues against it based on the following data, where the vowel that syncopates immediately follows a heavy syllable. In the following data (Blake 1993: 47), the input vowels that syncopate are underlined. In both cases, they follow the main stressed syllable.

(54)	/naan<u>a</u>kasɨr/	→	naankasɨr	'scorpions'
	/vapoot<u>V</u>podaʔ/	→	vapootpodaʔ	'worms'

The data in (54) are indeed not easily compatible with an analysis with standard L→R moraic trochees, because the syncopating vowel would bear secondary stress. Forms beginning with a HLL sequence would be footed as (H)(LL), and thus the vowel in the second syllable would be ineligible for syncope, according to the hypothesis pursued here. However, there is a trochaic analysis of SE Tepehuan that is consistent with the data in (54): one where a high-ranked *CLASH prevents adjacent syllables from being stressed. Two options are available: either the forms like those in (54) contain a "Germanic foot" (Dresher & Lahiri 1991), i.e. the uneven trochee (HL), or else forms beginning with HLLL contain an unparsed syllable separating the main stress from the first secondary stress, (H)L(LL). These two options are illustrated below; I will not argue for one or the other option here.

(55)	a.	(HL)(LL)L	(naaná̸)(kasɨr)
	b.	(H)L(LL)L	(naa)ná̸(kasɨr)

Whichever of the two analyses in (55) is chosen, vowel syncope is compatible with my hypothesis: it is the UNSTRESSED posttonic vowel that deletes.

SE Tepehuan has a vowel shortening process that applies to long vowels in unfooted final syllables. It can be seen in reduplication of words that begin with a CVV syllable: once the underlying long vowel is no longer in the main stress foot, it shortens (56)a. The data in (56)b show that this shortening process does not apply to long vowels that are parsed by feet.

(56) Vowel shortening in unstressed syllables

a.	(kóoʔ)	'snake'	/koo-ko̲o̲ʔ/	(kóo)ko̲ʔ	'snakes'
	(káam)	'cheek'	/káa-ka̲a̲m/	(káa)kam	'cheeks'
b.	ga(gáa)	'cornfield'	*(gága)		
	to(páa)	'pestle'	*(tópa)		
	ta(pɨ́ɨʃ)	'flea'	*(tápɨʃ)		

SE Tepehuan also has a final vowel apocope process that deletes short vowels word-finally (57)a, unless the output form would end in a consonant cluster or *h* (57)b. Final long vowels in LH words are not deleted (57)c.

(57) Apocope: short final vowels delete unless preceded by cluster or *h*

a.	/hiɲ#novi̲/	hiɲ#(óv)	'my hand'
	/hiɲ#noo-novi̲/	hiɲ#(ɲóo)nov	'my hands'
	/tu#huana̲/	tu#(huán)	'he is working'
	/nakasɨɽi̲/	(nák)sɨɽ	'scorpion'

b.	/hupna/	(húp)na	'pull out'	*(húpn)
	/voohi/	(vóo)hi	'bear'	*(vóoh)
c.	/gagaa/	ga(gáa)	'cornfield'	*(gág)

Syncope applies to even-numbered non-final open syllables, including syllables containing long vowels. Prefixes, here separated from the stem by the sign #, are ignored for the purposes of stress assignment and syncope. The data in (58)a show the deletion of short vowels, and (58)b the deletion of long vowels.

(58)	a.	/tɨroviɲ/	(tɨr)viɲ	'rope'
		/tɨɨtɨroviɲ/	(tɨ́ɨt)ropiɲ	'ropes'
		/totopaa/	(tót)pa	'pestles'
		/taatapɨɨʃ/	(táat)pɨʃ	'fleas'
		/taatakaaruiʔ/	(táat)karuiʔ	'chickens'
		/tu#maamatuʃidʒaʔ/	tu#(máam)tuʃdʒaʔ	'will teach'
	b.	/gaagaagaʔ/	(gáaˀŋ)gaʔ	'he will look around for it'[33]
		/suisuimaʈ/	(súis)maʈ	'deer (pl.)'
		/hiɲ#ɲuuɲuutʃiʃ/	hiɲ#(ɲúuɲ)tʃiʃ	'my brothers-in-law'
		/hiʃ#maimaikak/	hiʃ#(máim)kak	'sweet (pl.)'

Syncope does not apply to long vowels following an initial light syllable (see (53)b and (56)b), showing that only unfooted vowels may syncopate. Apocope takes precedence over syncope, and feeds the stress rule, as shown below.

(59)	a.	/hiɲ#noo-novi/	hiɲ#(ɲóo)nov	'my hands'	*hiɲ#(ɲoon)vi
		/ʃi#ʔomiɲi/	ʃi#ʔo(míɲ)	'break it!'	*ʃi#(ʔóm)ɲi
		/naanakasɨʈi/	(náan)kasɨʈ	'scorpions'	*(náan)kasʈi

From the point of view of the theory developed here, SE Tepehuan is only problematic if the stress system is analyzed as iambic. If, on the other hand, the moraic trochee is the basis of the stress system, then syncope applies to UNSTRESSED vowels.

[33] This form shows the effects of an unrelated process, which turns coda voiced obstruents into preglottalized nasals.

The treatment of Southeastern Tepehuan as trochaic appears to be endorsed by Willet's (1991) description, although he does not formulate it in terms of foot structure. However, his statement that "vowels are deleted from every second nonfinal, open syllable following the accented syllable" (1991: 23) clearly suggests that on his view, derivationally, LL-initial words receive stress on their first syllable and then syncope applies to the posttonic – i.e. second – syllable.

In light of the reanalysis of the stress system of SE Tepehuan as iambic, the syncope process presents no problem whatsoever for the typological generalization under discussion.

4.2.3.7 Hopi

Of all the cases discussed here, Hopi presents the most serious challenge to my generalization: stressed vowels appear to syncopate. I argue that a closer look at the data shows that Hopi syncope is, in fact, well-behaved and applies in posttonic syllables.

Hopi has a typical iambic stress system: the initial syllable is stressed if heavy, otherwise the second syllable. Words beginning with the sequence LL are stressed on the second syllable, unlike Southeastern Tepehuan, which clearly diagnoses the Hopi system as iambic. Hopi also shows a preference, typical in iambic languages, to assign initial stress to disyllabic words, no matter what their weight profile. CVV and CVC syllables count as heavy, CV as light. The stress system is illustrated below.

(60) a. Initial if heavy
ʔác.ve.wa 'chair'
b. Otherwise the second syllable
ca.qáp.ta 'dish'

		qö.tö́.som.pi	'headband'			
		ki.yá.pi	'dipper'			
	c.	Disyllables have initial stress				
		kó.ho	'wood'			
		táa.vok	'yesterday'			
		má.mant	'maidens'			

The syncope pattern as presented by Gouskova (2003: 97) is as follows: in /LLL/ and /HLL/ words, the second vowel deletes, while in longer words of the shape LLL, the third vowel syncopates. In addition, because superheavy (CVVC) syllables are prohibited, whenever such syllables arise, their nucleus vowel shortens (61)b.

(61)	a.	/LLL/ words					
		/soma-ya/	sóm.ya	'tie (pl.)'	cf.	sóma	'tie (sg.)'
		/soma-ŋ^{w}i/	sóm.ŋ^{w}i	'tie (nomic)'			
		/soʔa-ya/	sóʔ.ya	'die (pl.)'		sóʔa	'die (sg.)'
	b.	/HLL…/-initial words					
		/tooka-ni/	tók.ni	'sleep (fut.)'		tóoka	'sleep (non-fut.)'
		/mooki-ni/	mók.ni	'die (fut.)'		móoki	'die (non-fut.)'
		/naala-ya-n-ta/	nál.yan.ta	'be alone'		náala	'alone'
	c.	/LLL…/words					
		/navota-na/	na.vót.na	'inform'		navóta	'notice'
		/kawayo-sa-p/	ka.wáy.sap	'as high as a horse'		kawáyo	'horse'
		/aŋa-katsina/	a.ŋák.tsi.na	'Long Hair kachina'		áŋa	'long hair'
						katsína	'kachina'
		/tuhisa-tuwi/	tu.hís.tu.wi	'ingenuity'		tuhísa	'ingenious'
						túwi	'knowledge'
		/qövisa-tapna/	qö.vís.tap.na	'make pout'		qövísa	'bad sport'

While syncope in (61)b-c is clearly postonic, the cases in (61)a, i.e. the trisyllabic LLL words like /soma-ya/, are problematic. Here syncope appears to apply to a syllable that would otherwise bear stress. Gouskova's analysis of such a pattern is to attribute syncope to the joint action of NONFIN and SWP, as illustrated below in (39). The non-syncopating candidate *somáya* fails because its stressed syllable is not heavy, in violation of SWP, and lengthening the vowel to *somáaya* is not an option due to high-ranking

DEP-μ. Syncopating the final vowel to produce **somáy*, even though satisfying SWP, is also not possible because **somáy* would violate NONFIN. This leaves syncopating the would-be stressed vowel to give the output *sómya*.

(62) /soma-ya/

		DEP-μ	NONFIN	SWP	PARSE-σ	MAX-V
	(somá)ya			*!	*	
	(somáa)ya	*!			*	
☞	(sóm)ya				*	*
	(somáy)		*!			*

Such an analysis is impossible in my theory, where the procedural constraint ✦SWP cannot lead to a shift of stress, as illustrated below. The candidate *sómya* incurs a fatal ✦-violation of SWP, because it has initial stress, while the designated stress locus is on the second syllable.[34] Is Hopi then a counterexample to my proposal?

(63) /soma-ya/ DS of stress: second syllable

		DEP-μ	NONFIN	✦SWP	PARSE-σ	MAX-V
☞	(somá)ya			*	*	
	(somáa)ya	*!			*	
	(sóm)ya			✦	*	*!
	(somáy)		*!			*

In reality, Hopi syncope does not challenge the generalization that stressed vowels cannot syncopate; Gouskova's proposal as presented in (39) above results from an incorrect analysis of the syncope environment. The key to the solution is to be found in footnote 39 in Gouskova 2003: 97, which mentions that syncope applies only in derived environments, but leaves the account of the derived environment effect outside of the scope of the analysis. Indeed, forms like *ʔácvewa* 'chair' and *qötö̋sompi* 'headband' from (60) and *navóta* 'notice' from (61) show that syncope does not apply to give outcomes like **navta*; in all such forms the environment of syncope is non-derived.

On the other hand, the problematic set of cases of the type /somaya/ → *sómya* all consist of a disyllabic stem followed by a monosyllabic affix. Recall that disyllables regularly have initial stress (60)c. Supposing that the stress of the affixed from /somaya/ inherits the stress of the base form /soma/, syncope is in fact posttonic. This hypothesis is presented in derivational terms below.

(64)	/soma-ya/	→	[sóma-ya]	→	*sómya*
	/soma-ŋʷi/	→	[sóma-ŋʷi]	→	*sómŋʷi*
	/soʔa-ya/	→	[sóʔa-ya]	→	*sóʔya*

It turns out that Hopi gives us direct confirmation of the claim in (64) that affixed forms retain the accetuation of the base. Jeanne's (1982) description lists a substantial number of forms which are exceptions to syncope, for arbitrary lexical reasons (1982: 248). There exist both LL and HL stems which fail to delete their second vowel when suffixed. The forms listed below should undergo syncope on the model of (61), but unpredictably fail to do so.

(65)		UR	FUTURE	NON-FUTURE	gloss
	a.	/maqa-ni/	máqa-ni	máqa	'give'
		/tɨwa-ni/	tɨ́wa-ni	tɨ́wa	'find'
		/sowa-ni/	sówa-ni	sówa	'eat'
	b.	/tɨɨva-ni/	tɨ́ɨva-ni	tɨ́ɨva	'throw away'
		/peena-ni/	péena-ni	péena	'write'
		/niina-ni/	níina-ni	níina	'kill'

What is crucial in these forms is their stress (Jeanne 1982: 256). Precisely these forms fail to surface with stress on the second syllable, as would be expected if the iambic stress rule had applied. Instead, we have *máqa-ni* rather than **maqáni*. This fact supports my proposal that the stress of the affixed form is retained from the base form, and thus syncope in forms from (61) like /soma-ya/ → *sómya* is in reality posttonic. In

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[34] Using the procedural or standard version of NONFIN would have no effect on the outcome, so I keep the standard version for simplicity.

other words, the attachment of the suffix -*ni* and other suffixes counterfeeds the stress assignment rule. This opaque interaction is directly supported by the forms in (65)a, where there is no syncope to obscure the location of stress.

This reanalysis also solves Gouskova's derived environment problem: forms like *navóta* fail to syncopate on the model of /soma-ya/ because the environment of syncope is not met. The vowel in the second syllable of *navóta* is not posttonic, and hence not eligible for syncope in the first place.

To summarize the discussion of Hopi so far: Gouskova's claim that the forms in (61)a show stressed vowel syncope was based on an erroneous analysis of the stress system of the language. A broader look at the phonology of Hopi shows that the vowel that deletes in (61)a is in fact not stressed but posttonic. Now I move on to another process in Hopi, reduplication, which also appears to present a problem for my proposal, and also argue for a reanalysis that saves the typological generalization.

Hopi has a reduplication process whose outputs undergo syncope (data from Jeanne 1982: 249 and ff.). LL stems reduplicated by copying the initial syllable and syncopating the following vowel: $C_1V_1C_2V_2$ reduplicates to $C_1V_1C_1C_2V_2$ (see (66)a). HL stems copy the initial long vowel and shorten the second vowel of the resulting form: $C_1VV_1C_2V_2$ becomes $C_1VV_1C_1V_1C_2V_2$ (see (66)b). This shortening process, targeting long vowels after initial long vowels, is phonologically regular.

(66)		SG	PL	gloss
	a.	koho	kókho	'wood'
		como	cócmo	'hill'
		sihɨ	síshɨ	'flower'
		leŋi	lélŋi	'tongue'
		tamö	tátmö	'knee'
	b.	saaqa	sáasaqa	'ladder'
		tooci	tóotoci	'shoe'
		siivɨ	síisivɨ	'pot'
		sooya	sóosoya	'planting stick'
		noova	nóonova	'food'

There are two alternative analyses of the shape of the reduplicant. The first possibility is that in LL the reduplicant is CV, and syncope applies to the second syllable of the resulting LLL words, while the reduplicant in HL stems is CVV. The long vowel in the second syllable would shorten by the regular shortening process. The second possibility is to assume a CVV reduplicant in all forms, with syncope and shortening in closed syllables applying in LLL words (cf. shortening in closed syllables in (61)b). These two options are illustrated below.

(67) a. **Option 1**: CV reduplicant in LL stems, CVV reduplicant in HL stems

/CV-koho/	→	ko-koho	→	kókho		'wood'
/CVV-saaqa/	→	saa-saaqa	→	sáasaqa		'ladder'

b. **Option 2**: CVV reduplicant in all stems

/CVV-koho/	→	koo-koho	→	kookho	→	kókho
/CVV-saaqa/	→	saa-saaqa	→	sáasaqa		

Gouskova appears to endorse Option 1. However, the Option 1 analysis is incompatible with my proposal, because it would necessarily involve stressed vowel syncope in LLL forms like /kokoho/. If, on the other hand, Option 2 can be argued to be correct, then the generalization that syncope is posttonic can be preserved, because Hopi's iambic stress system would automatically force stress on the initial syllable of [koo-koho], and syncope would regularly apply to the second syllable. It is then crucial for the purposes of the discussion here to establish that it is Option 2, not Option 1, that is the correct analysis of the shape of the reduplicant.

Jeanne's (1982) description provides several pieces of evidence in favor of the Option 2 analysis. I present three arguments here. First, syncopation in reduplicated forms whose bases have more than two syllables clearly favors the CVV analysis. The forms in (68)a below have LL-initial bases, while (68)b begin with LH.

(68)

	SG	PL	gloss	
a.	kɨyapi	kɨ́kyapi	'dipper'	*kɨkɨ́ypi
	yɨŋʸapɨ	yɨ́yŋʸapɨ	'plague'	*yɨyɨ́ŋʸpɨ
	pitanakci	píptanakci	'hat'	*pipítnakci
	qötösompi	qö̋qtösompi	'headband'	*qöqö̋tsompi
b.	caqapta	cácqapta	'dish'	
	panapca	pápnapca	'widow'	
	möcikvɨ	mö̋mcikvɨ	'trash'	
	melooni	mémlooni	'melon'	

For LL-initial bases, if the reduplicant were CV, then the resulting form would begin with LLL, where it is the third, not the second vowel that would be expected to syncopate (cf. (61)c). The two options are illustrated derivationally in (69). We would have the incorrect outputs **kɨkɨ́ypi* and **pipítnakci* along the lines of *navótna* from /navotana/. Instead, it is the second vowel that deletes, showing that the reduplicant must be CVV, which renders the second vowel post-tonic.

(69)

CV reduplicant:	pi-pitanakci	→	*pipítnakci		
CVV reduplicant:	pii-pitanakci	→	piiptanakci	→	píptanakci

Second, reduplicants with initial CVC syllables contain a long vowel, showing that the reduplicant is indeed CVV. Note that the second vowel in these forms does not syncopate, because it is in a closed syllable.

(70)

SG	PL	gloss
naqvɨ	náanaqvɨ	'ear'
tɨsna	tɨ́ɨtɨsna	'body dirt'
napna	náanapna	'shirt'
ŋɨmni	ŋɨ́ɨŋɨmni	'flour'

The third and strongest piece of evidence in favor of the Option 2 (CVV) analysis of reduplication concerns exceptions. Just as in the case of LLL words with suffixes (65), there are reduplicated forms which undergo syncope optionally, creating variant forms. Just in those cases where the second vowel surfaces faithfully (and thus does not create an initial closed syllable), the long vowel of the reduplicant emerges, as illustrated by the forms in the third column below.

(71)

	SG	PL *variant 1*	PL *variant 2*	gloss
	léŋi	lélŋi	léeleŋi	'tongue'
	ŋáhɨ	ŋáŋhɨ	ŋáaŋahɨ	'medicine'
	ʔówa	ʔóʔwa	ʔóoʔowa	'stone'
	kʷite	kʷíkʷte	kʷíikʷite	'braid'

I take these three arguments to suggest that the reduplicant is uniformly CVV, that Option 2 in (67) is the correct analysis of Hopi, and that, therefore, syncope is uniformly posttonic.

There are, in addition to the patterns discussed above, a small set of polysyllabic animate nouns that appear to reduplicated with CV- in the plural, and also take the suffix -*t*. These nouns undergo an unprecedented syncope of the FOURTH syllable, a fact for which Gouskova's analysis has no answer.

(72)

	SG	PL underlying	PL surface	gloss
	koyoŋo	/ko-koyoŋo-t/	kokoyoŋt	'turkey'
	ʔaŋʷɨsi	/ʔa-ʔaŋʷɨsi-t/	ʔaʔaŋʷɨst	'crow'
	laqana	/la-laqana-t/	lalaqant	'squirrel'
	qapira	/qa-qapira-t/	qaqapirt	'goat'
	tokoci	/to-tokoci-t/	totokoct	'wild cat'

Although Jeanne does not mark stress in these forms, a reasonable hypothesis about stress assignment can explain the unexpected syncope pattern. If, just as suffixed forms, CV-reduplicants retain the stress of their bases, then syncope here would also be posttonic. The hypothesis is that the stress in the reduplicated form *ko-koyóŋo-t* corresponds to the base form stress *koyóŋo*. If this is the case, then the third syllable in the CV-reduplicants would indeed be stressed and the fourth syllable would be expected to undergo posttonic syncope. I repeat that this hypothesis cannot go beyond speculation, because Jeanne does not supply stress information for the forms in (72).

To summarize the discussion of Hopi, I have shown here that a closer look at the phonology of the language ensures that in all cases syncope is simply posttonic, and that Gouskova's proposal was based on an incorrect analysis of stress and reduplication. Let me conclude with presenting an overall picture of the relevant processes in Hopi phonology, from a stratal point of view (Kiparsky to appear).[35] Two strata are necessary: an earlier one with CVV reduplication and stress assignment, and a later one, with tense-aspect affixes and possibly CV reduplication, posttonic syncope, and shortening.

This proposal is illustrated derivationally below with the two representative examples of syncope: suffixed forms like *sómya* and reduplicated forms like *kókho*. Within each stratum, the interaction of the phonological processes is transparent; the only instance of opaque interaction between the two stata is the inheritance of the stress pattern of the base form *sóma* in the suffixed form *sómya*.

(73)		/soma/	/koho/
Stratum 1:	CVV Reduplication		koo-koho
	Stress assignment	sóma	kóo-koho
Stratum 2:	Tense-aspect affixes	sóma-ya	
	Posttonic syncope	sómya	kóokho
	CV Reduplication (72) (?)		
	Shortening		kókho
		sómya	*kókho*

Once again, what is crucial for the purposes of the discussion here is that the picture in (73) does not require stressed vowel syncope, and thus Hopi is not a counterexample to my typological generalization.

4.2.3.8 Central Alaskan Yupik

Another serious challenge to the generalization that stressed vowels do not syncopate is presented by Central Alaskan Yupik (CAY). The discussion here is based on Jacobson 1995, Hayes 1995, and Gordon 2001. In a nutshell, stressed vowels in open syllables are lengthened, but long schwas are prohibited. Thus, if a stress were to fall on a schwa in an open syllable, the schwa deletes. In OT terms, this deletion process is standardly understood as a last resort in a situation when other options are not available: CAY has an absolute prohibition of a stressed short schwa *ə́ and of a long schwa *ə̄. The only way of satisfying both of these constraints when stress would otherwise fall on a schwa is to delete it.

The stress system of CAY is iambic. Initial CVC count as heavy, but CVCs elsewhere in the word count as light. The following data show the iambic stress generalization.

(74)	(əɣán)(ɣuq)	'she begins to cook'
	(kúi)(ɣú:q)	'it is a river'
	(áŋ)(já:)	'his boat'
	(íʁ)(nía)(ŋuk)	'she acquires a child'

Stressed non-final vowels in open syllables are lengthened, as is typical in iambic systems, as shown by the following data.

(75)	/akutamək/	(akú:)(tamə́k)
	/nunaka:/	(nuná:)(ká:)
	/aŋyaχpaka/	(aŋ)(yaχpá:)ka

[35] Nothing hinges here on a commitment to the stratal view of phonological opacity; I use it here because it allows an especially conspicuous picture of the phonology of the language.

Crucially for the present discussion, if a stress were to fall on a schwa, the schwa deletes and stress shifts one syllable to the left. This deletion applies not only in the cases where the schwa is preceded by a full vowel (76)a, but also when it is preceded by another schwa (76)b-c.

(76)	a.	/qanʁutəka:/	(qán)(ʁút)(ká:)	*(qán)(ʁutə́)(ká:)
		'he's talking about her'		*(qán)(ʁutə́:)(ká:)
	b.	/aŋutə-ŋə-ciq-uq/	(aŋú)(tə́ŋ)(ciqúq)	*(aŋú)(təŋə́)(ciqúq)
		's/he will acquire a man'		*(aŋú)(təŋə́:)(ciqúq)
	c.	/nuna-nətə-ɬini-luni/	(nuná:)(nə́t)(ɬiní:)(luni)	*(nuná:)(nətə́
		)(ɬiní:)(luni)		
		's/he apparently being in the village'		*(nuná:)(nətə́
		:)(ɬiní:)(luni)		

Furthermore, as shown by the following datum, weak schwas in iambic feet do not delete.

(77)	/qana:təkaqa/	(qan)(na:)(təka:)qa	'I speak about it'

These data indicate that schwa deletion applies IF AND ONLY IF the schwa would otherwise be stressed and in an open syllable. Deletion does not happen when the schwa is unstressed, or when it would be in a closed syllable. Thus, the standard analysis of this deletion process is that it results from the impossibility of simultaneously satisfying the two constraints against stressed monomoraic syllables (SWP), and against long schwas *$\bar{ə}$.

This interpretation is not compatible with the idea that syncope is what happens to weak vowels. In particular, SWP, on my theory, is not capable of causing syncope and the concomitant stress shift that results from deleting the stressed vowel. Indeed, the following tableaux illustrate that the actual winner, *(qán)(ʁút)(ká:)*, is a perpetual loser, because it incurs a fatal ✦ violation of the ✦SWP constraint. Depending on the ranking between ✦SWP and *ə:, the predicted winner is either the candidate with a long schwa, in violation of the *ə̄ constraint (78), or the candidate with a stressed short ə, thus violating ✦SWP (79).

(78) Designated location of stresses: (qán)(ʁutə́)(ka:)

			✦SWP	*ə̄	MAX-ə
/qanʁutəka:/		(qán)(ʁutə́)(ká:)	*!		
	(☞)	(qán)(ʁút)(ká:)	✦!		*
	☹	(qán)(ʁutə́:)(ká:)		*	

(79) Designated location of stresses: (qán)(ʁutə́)(ka:)

			*ə̄	✦SWP	MAX-ə
/qanʁutəka:/	☹	(qán)(ʁutə́)(ká:)		*	
	(☞)	(qán)(ʁút)(ká:)		✦	*!
		(qán)(ʁutə́:)(ká:)	*!		

The strategy I would like to pursue in dealing with this problem is along the lines of the solution presented for a similar problem in Carib above, although the situation is somewhat more difficult in CAY. Recall that Carib, I argued, has a sonority-sensitive stress subregularity on top of its iambic stress system, which accounts for an apparent deletion of a stressed vowel. In Yupik, the solution would run along the same lines: I would argue for making use of an additional sonority-sensitive constraint. Specifically, if the a constraint against stressed schwas is able to force stress shift onto a preceding syllable, and a SEPARATE constraint ensured the deletion of the now weak schwa, then we might solve the problem posed by (78)-(79) in a manner analogous to the Carib case. The constraint in this case would be the familiar constraint against ə in head syllables, ✦*HEAD{ə}. Ranked high, it would have precedence over ✦SWP, and would thus affect the designated place of stress for that constraint.

(80) Designated location of stresses: (qán)(ʁútə)(ká:)

			*ə̄	✦*HEAD{ə}	✦SWP	MAX-ə
/qanʁutəka:/		(qán)(ʁutə́)(ká:)		*!	✦	
		(qán)(ʁútə)(ká:)			*!	
	☞	(qán)(ʁút)(ká:)				*
		(qán)(ʁutə́:)(ká:)	*!		✦	

Of course, this reanalysis only takes care of the cases where stress shifts off a schwa to a full vowel, still leaving those like (76)b-c where it shifts to a preceding schwa. Consider the case (76)b, repeated below.

(81) /aŋutə-ŋə-ciq-uq/ (aŋú)(tə́ŋ)(ciqúq) *(aŋú)(təŋə́)(ciqúq)
's/he will acquire a man' *(aŋú)(təŋə́:)(ciqúq)

If the generalization that only unstressed schwas can syncopate is to be preserved, then something must cause the shift of the stress from *ŋə* to *tə*, i.e. some constraint must prefer the foot (tə́ŋə) over (təŋə́). The constraint ✦*HEAD{ə}, which was used to cause a stress shift from a schwa to a full vowel in (80), cannot do this job here. However, according to the iambic-trochaic law (Hayes 1995), iambic feet, unlike trochaic feet, have a tendency for quantitative unevenness. The quantitatively even trochaic foot (tə́ ŋə) better conforms to this preference than the quantitatively even iambic foot (təŋə́). The shift of stress off the second schwa onto the first schwa would then be a consequence of general principles of rhytmic organization. This shift can be accounted for by a constraint like UNEVENIAMB, which would penalize right-headed feet containing quantitatively identical syllables.

4.2.3.9 Bedouin Hijazi Arabic

The interaction of vowel deletion with stress in Bedouin Hijazi Arabic (BHA; Al Mozainy et al. 1985) appears to be a difficult counterexample to my proposal. In certain contexts, low vowels in this language delete, and this deletion process may apply to stressed vowels, in which case the stress migrates to the following syllable. Al Mozainy et al. used these facts to argue for deriving the directionality of the stress shift from the tree-based representation of the metrical structure of the language.

The stress rule in BHA is identical to the rule in Lebanese Arabic (see section 4.2.3.3 above): superheavy ultimas are stressed, otherwise heavy penults, otherwise antepenults. The low vowel *a* deletes in an open syllable if followed by another open syllable with the nucleus *a*. The following rule was used by Al Mozainy et al. (1985: 136) to deal with the *a*-deletion facts.

(82) $\mathrm{a} \rightarrow \varnothing \,/\, \mathrm{C}\ \_\_\ [\mathrm{Ca}]_{\sigma}$

The following examples illustrate that this process may apply to the stressed vowel (i.e. the vowel that would have been stressed had the deletion rule not applied). In the following data, non-deleting forms are in the left column, and the vowel that deletes in the right column forms is underlined.

(83)	a. sáḥab	'he pulled'	/s$\underline{\text{a}}$ḥabat/	→	sḥábat	'she pulled'
	b. saḥábna	'we pulled'	/s$\underline{\text{a}}$ḥabaw/	→	sḥábaw	'they (m.) pulled'
	c. náxal	'palm trees'	/n$\underline{\text{a}}$xalah/	→	nxálah	'a palm tree'
	d. g^{y}álaʕ	'castles'	/g^{y}$\underline{\text{a}}$laʕah/	→	g^{y}láʕah	'a clastle'
	e. sálag	'hunting dogs'	/s$\underline{\text{a}}$lagah/	→	slígah[36]	'a hunting dog'
	f. ɣánam	'sheep'	/ɣ$\underline{\text{a}}$nami/	→	ɣními	'my sheep'

(Al Mozainy et al. 1985: 136)

These forms show the deletion of the vowel that would be stressed by the normal stress rule of the language: e.g. stress would fall on the antepenult in *saḥabat* by the regular stress rule, but the *a* in that syllable deletes.

These data are compatible with an opaque serial interpretation: if syncope applies before stress assignment, the stress rule would give the correct outcome for forms like *sḥ*

[36] This and the following form, as well as the forms in (84), undergo a separate raising process, *a* → *i*, which is not important for the purposes of the discussion here.

ábat and other forms in the right column of (83). This solution, however, is not available for longer words. As the following forms show, stress must be assigned prior to *a*-deletion, because otherwise there is no way to account for its surface location.

(84)	a. ʔínkisaṛ	'he got broken'	ʔinksáṛat	'she got broken'
	b. ʔíntiðaṛ	'he waited'	ʔintðáṛan	'they (f.) waited'
	c. ʔíftikaṛ	'he remembered'	ʔiftkáṛaw	'they (m.) remembered'
	d. ʔíxtibaṛ	'he took an exam'	ʔixtbáṛaw	'they (m) took an exam'

(Al Mozainy et al. 1985: 137)

If *a*-deletion simply preceded stress assignment, we would expect incorrect antepenultimate stress, due to derivations like /ʔinkasaṛat/ → [ʔinksaṛat] → **ʔínksaṛat*. Rather, stress must be assigned prior to vowel deletion, and separate principles (which were the focus of Al Mozainy et al.'s study) must ensure that it shifts rightward under stress deletion: /ʔinkasaṛat/ → [ʔinkásaṛat] → [ʔink∅́saṛat] → *ʔinksáṛat*. In other words, the BHA data appear to stand in direct contradiction to my proposal: stressed vowels can syncopate.

In the cases discussed above my strategy has been to reanalyze the environment of syncope itself and to show that a closer look at the process makes it unnecessary to treat syncope as applying to stressed vowels. Such was the approach in Hopi and SE Tepehuan. Here, however, I take a different course by suggesting that the process in question, although it does apply to stressed vowels, is not metrically-driven syncope, but rather an abstract process not unlike the deletion of the yers in modern Slavic languages. In fact, Al Mozainy et al. remark that the *a*-deletion process in BHA is unlike many other syncope process in Arabic dialects in at least two respects: it applies to stressed vowels, and it singles out the MOST sonorous vowel *a*, not the LEAST sonorous high vowels as is typical of syncope processes.

> "[M]ost syncope rules explicitly eschew deletion of stressed vowels or precede the assignment of stress and thus could not show stress shift … In other words, these syncope rules delete vowels that are less prominent by virtue of their lack of stress and, in some cases, their relatively lesser sonority… [The BHA deletion rule] appears to function as a fairly abstract kind of dissimilation, eliminating an underlying configuration of two successive identical nuclei by deleting the first of them". (Al Mozayni et al. 1985: 142)

I conclude that the *a*-deletion rule in BHA is not sensitive to metrical structure, but is a "crazy rule" in the sense of Bach and Harms (1972). While the existence of such rules weakens the proposed typological generalizations, they are an inevitable part of phonology, and the typology of syncope is no exception.

4.2.4 Syncope blocking conditions

One striking generalization is that syncope can be blocked in those and only those environments that allow vowel epenthesis. These are the consonant cluster conditions of two types (conditions on complex margins, and conditions on sonority), and word minimality conditions. In many languages, syncope fails to apply just in case it would create a marked consonant cluster, just as those consonant clusters may be resolved by epenthesis. In a smaller number of languages, syncope fails to apply if it would create a subminimal word. Syncope blocked by word minimality is attested both in systems with a disyllabic and a bimoraic minimum. An example of the former is Lardil (Hale 1973), where final vowels delete only in words longer than three syllables, which is part of the general prohibition against monosyllabic words (recall from (9) above that underlying monosyllables are augmented to respect the disyllabic minimum). The data below is from Hale 1973: 421, 424. The examples in (85)a show final vowel deletion in stems longer than two syllables, while (85)b shows that deletion does not apply to vowel-final disyllabic stems.

(85)	a.	/yalulu/	→	yalul	'flame'
		/mayara/	→	mayar	'rainbow'
		/karikari/	→	karikar	'butter-fish'
		/kaŋkaṛi/	→	kaŋkaṛ	'father's father'
	b.	/paṛŋa/	→	paṛŋa	'stone'
		/kela/	→	kela	'beach'
		/wanka/	→	wanka	'arm'
		/ṭarŋka/	→	ṭarŋka	'barracuda'

An example of syncope being blocked by a bimoraic word minimum is Ojibwe (Nishnaabemwin) (Piggott 1991, Valentine 2001), where final vowels fail to delete just in case the resulting word would have fewer than two moras.

This behavior is just what is predicted by the theory: epenthesis is driven by ordinary OT constraints on syllable structure and sonority sequencing, and these constraints can block the effect of the ✦SYNCOPE constraints in the ordinary fashion.

CONCLUSION

This thesis has addressed a recurring difficulty in OT phonology, the too-many-solutions problem. I have argued that the diagnosis of the problem has to do with the locus of phonologically significant generalizations. Contrary to standard OT thinking, at least some important generalizations are best stated not as surface conditions, but as conditions on input-output mappings and environments of processes.

The thesis is an exploration of what it would take for a pure-markedness approach to the problem. I have argued that, in order to handle non-surface generalizations, markedness constraints must be modified quite radically. Procedural constraints, whose job is to penalizes candidates involving certain PROCESSES, must have access to the rest of the ranking of the language. I have proposed a formal mechanism that allows such constraints to function, and showed how the addition of this new class of constraints can greatly restrict the typology of phonological processes, at least in two domains: prosody-segmental interactions, and vowel syncope. My theory of procedural constraints allows for a direct control over processes and environments in OT, thus bringing generalizations about input-output mappings within the scope of the theory.