

CHAPTER 4

DIFFERENTIAL SYNCOPE AND EPENTHESIS

4.1 Introduction

Under the Leniency hypothesis, no constraint can ever refer to the least marked end of a harmonic scale. In chapter 3 I argued that there are no constraints that penalize *syllables* without reference to context: unfooted syllables are marked, light stressed syllables are marked, but syllables in general are not marked. This chapter is concerned with harmonic scales and constraints that refer to *vowels*. There are several phonological processes that shows evidence of scalar treatment of vowels: sonority-driven stress, the preference for sonorous syllable nuclei, and vowel reduction. Depending on the match of sonority with position, vowels may be marked or unmarked. This suggests that there are certain constraints that cannot exist in CON; for every harmonic scale, the least marked element escapes constraint violation under Lenient Constraint Alignment. This chapter will provide arguments that such constraints must indeed be excluded from CON.

The key ingredients for syncope are a markedness constraint and MAXV: if there is a markedness constraint against a particular structure that can be satisfied by deleting this structure, the prediction is that the structure should sometimes be deleted. Since certain vowels are marked in certain contexts, we expect to see them deleted where other vowels are not. This sort of pattern is called differential syncope.⁶⁸ Consider the pattern of Lebanese Arabic, where high vowels delete but low ones do not:

⁶⁸ The terms “differential” and “non-differential” are due to Cantineau 1939, who applied them to Arabic dialects.

(1) Lebanese Arabic high vowel syncope (Haddad 1984)

- | | | | |
|---------------|---------|-----------------|-----------|
| a. /nizil-it/ | níz.lit | ‘she descended’ | cf. nízil |
| b. /nizil-t/ | nzílt | ‘I descended’ | |

(2) No syncope of /a/ in the same environment

- | | | | |
|---------------|-----------|----------------------|----------|
| a. /saħab-it/ | sá.ħa.bit | ‘she withdrew (tr.)’ | *sáħ.bit |
| b. /xazaʔ-t/ | xazáʔt | ‘I tore’ | *xzáʔt |

Which constraints in CON can favor differential deletion of vowels? The constraints on which I will focus in this chapter are those that ban prominent, sonorous vowels (e.g., *a*) from occupying non-prominent positions (e.g., weak branches of feet), and constraints that ban non-prominent vowels (e.g., *ə*) from prominent positions (e.g., syllabic nuclei and strong branches of feet). Syncope results when these marked configurations cannot be avoided by other means, e.g., vowel lowering or raising. These alternative solutions can coexist in a grammar: in Lushootseed, unstressed low vowels are preferentially deleted but sometimes they must reduce to schwa. There is no economy principle behind reduction of unstressed *a*: economy principles can only be satisfied by *deletion* of structure, not *change* of structure.⁶⁹

In chapter 3 I argued that metrical syncope is not one process but many: diverse patterns result from the different rankings of SWP, PARSE- σ , WSP and other constraints with respect to each other and MAXV. One can speak of unfooted syllable syncope, syllable weight-induced syncope, etc. Similarly, differential syncope is not one process but many. Some differential syncope patterns look remarkably like metrical syncope.

⁶⁹ It can be argued that *ə* is a featureless vowel, in which case reduction of *a* to *ə* does reduce the amount of structure in the output, because it removes purportedly marked features. For a discussion of this view, see §4.3.6.2.

Lebanese Arabic is one such case (see (1)-(2) and §4.4): syncope forms often satisfy PARSE- σ and SWP better than the faithful alternatives do, and deletion is blocked by NONFINALITY, just as in Hopi. Yet this is not true of all differential syncope—some patterns are not metrical in any obvious sense. For example, deletion of schwa in Lillooet (discussed in detail in §4.3) is blocked only by phonotactic constraints. The one common thread among these patterns is that all involve the deletion of a vowel and the consequent reduction in structure.

As mentioned above, low-sonority vowels are penalized in some contexts and high-sonority vowels are penalized in other contexts. Can the constraints against these configurations “gang up” against all vowels and duplicate the effects of *STRUC(σ) or *V? In §4.2.2 I argue that this is impossible under the view that constraints in CON are lenient, i.e., no markedness constraint bans the least marked element of its markedness scale. On the other hand, such gang-up effects are not ruled out under the “everything-is-marked” view of CON.

Another issue raised by differential syncope has to do with its relationship to epenthesis. In some languages, the distribution of certain vowels is virtually entirely predictable: they surface only where phonotactic constraints require their presence. An example of this is the distribution of schwa in Lillooet. In this language, every word must contain at least one vowel, and tautosyllabic clusters of sonorants or sonority sequencing violations are prohibited. Schwa surfaces only when its presence is required by these constraints:

(3) Lillooet schwa (van Eijk 1997)

a.	təq	‘to touch’	cf.	tq-alk’əm	‘to drive, steer’
b.	χ ^w əm	‘fast’	cf.	χ ^w m-akaʔ	‘to do smt. fast’
c.	s-nəm-nəm	‘blind’	cf.	nəm’ə-nm-’əp	‘going blind’

In a sense, schwa is treated as a *cheap vowel*—it is readily inserted when phonotactic constraints require but deleted otherwise.⁷⁰ This is how this pattern must be analyzed under the OT assumption known as Richness of the Base: markedness constraints apply only to outputs, while inputs are unrestricted (Prince and Smolensky 1993). The grammar must work regardless of how many or how few schwas there are in the input: if the input contains too many schwas, the grammar must delete all but the ones necessary for phonotactic reasons, and if the input contains too few, the grammar must ensure that they are inserted in all the right places. As I will show, *STRUC(σ) alone cannot explain why only low-sonority vowels behave like this—once the *STRUC analysis is fortified to deal with rich inputs, it comes with undesirable typological predictions.

The rest of the chapter is organized as follows. In §4.2, I review the constraint hierarchies that relate vocalic prominence to designated positions, which form the basis for the subsequent discussion. I then highlight the differences between the constraints possible in the lenient model of CON and in the traditional model, and some consequences of these differences for factorial typology. The case studies are organized around the theoretical issues overviewed above. I start with an examination of cheap vowels in Lillooet (§4.3), where I also present a theory of epenthetic vowel quality. The next two

⁷⁰ A parallel pattern is cheap consonants, e.g., glottal stop in German, Dutch, Tagalog, and others. In these languages, glottal stops surface in the absence of another onset but not otherwise. Similarly, *do*-support in syntax may require this sort of analysis (see chapter 2 and Grimshaw 1997).

case studies examine syncope in Lebanese Arabic (§4.4) and Mekkan Arabic (§4.5). Lushootseed is discussed in §4.6, and §4.7 concludes.

4.2 Differential constraints in the Lenient model of CON

In this section, I discuss three hierarchies of constraints that relate vocalic sonority to prosodic positions: constraints that require nuclei to be as sonorous as possible (*NUC/x), constraints that require weak foot branches to have as little sonority as possible (*MAR_{FT}/x), and constraints that require strong foot branches to be as sonorous as possible (*PK_{FT}/x). These constraints play a central role in the case studies that follow.

4.2.1 Sonority constraints on nuclei and foot branches

It is well known that in general, the more sonorous the syllable nucleus, the better (Clements 1990). To capture this preference, Prince and Smolensky (1993) posit constraints on the sonority of syllable peaks (nuclei) and margins (onsets). The constraints on vocalic nuclei (shown in (4)) are most relevant to the discussion at hand.⁷¹ The hierarchy in (4) is derived from the harmonic scale below, which is in turn derived by Harmonic alignment (discussed in Chapter 2). Note that by Lenient Constraint Alignment (also discussed in Chapter 2), no constraint refers to the least marked nucleus, *a*—there is no constraint *NUC/*a* in CON.

- (4) *NUC/ə >> *NUC/i,u >> *NUC/e,o
Nucleus harmony scale: nuc/*a* > nuc/*e,o* > nuc/*u,i* > nuc/ə

These constraints have many effects. They control syllabification by determining which of several eligible segments ends up in the nucleus of the syllable (see Dell and

⁷¹ It is possible for margins to be filled with vowels, as well, but I assume that when a vowel is parsed as a syllable margin (or onset), it surfaces as a glide: *i, e* → *j*, *u, o* → *w*, and *a* possibly as *ɹ* (Bakovic 1999, McCarthy 1993, Rosenthal 1994).

Elmedlaoui 1985, 1988 and Prince and Smolensky 1993 on Imdlawn Tashlhiyt Berber). They have also been argued to determine epenthetic vowel quality in languages that have epenthetic *a*, the most sonorous segment (de Lacy 2002a). Constraints on the sonority of syllable nuclei can favor the preservation of the more sonorous of two vowels in hiatus elision (see Casali 1996 and Pulleyblank 1998, although they use a hierarchy of MAX constraints based on the sonority scale). Vowel lowering (as in Sanskrit) is another effect (Beekes 1995:60). These processes are not economy effects, since they do not reduce the amount of structure in any sense.

Another set of constraints that relate sonority to positions are sonority-sensitive stress constraints, recently examined in the work of Crosswhite 1999a, Kenstowicz 1996b, and de Lacy 2002a. The hierarchy in (5) bans prominent, sonorous vowels from non-prominent positions such as the weak branch of a foot; the hierarchy in (6) bans vowels of low sonority (e.g., ə) from highly prominent positions such as the strong branch of a foot. These constraints are derived from the following harmonically aligned

scales:⁷²

⁷² The exact details of the formulation of these constraints vary somewhat by author. Kenstowicz 1996b and Urbanczyk 1996 use *P/x and *M/x to refer to peaks and margins of feet, as do I. Crosswhite 1999a uses *σ/x and *σ̄/x for “stressed syllable” and “unstressed syllable.” In de Lacy’s (2002a) more elaborate theory, prominence constraints can refer to Designated Terminal Elements (DTEs or “Δ”) and non-DTEs (basically, head segments) at every level of the prosodic hierarchy, so the constraints are called *Δ_{F_i}/x and *-Δ_{F_i}/x. For my purposes, reference to peaks and margins of feet is sufficient.

- (5) Constraints on the sonority of vowels in strong branches of feet
 $*PK_{FT}/\emptyset \gg *PK_{FT}/i,u \gg *PK_{FT}/e,o$ (cf. de Lacy 2002a, Kenstowicz 1996b)
Foot Head (peak) scale: $Peak_{FT}/a \succ Peak_{FT}/e,o \succ Peak_{FT}/u,i \succ Peak_{FT}/\emptyset$
- (6) Constraints on the sonority vowels in weak branches of feet
 $*MAR_{FT}/a \gg *MAR_{FT}/e,o \gg *MAR_{FT}/i,u$ (de Lacy 2002a, Kenstowicz 1996b)
FtNonHead (margin) scale: $Mar_{FT}/\emptyset \succ Mar_{FT}/u,i \succ Mar_{FT}/e,o \succ Mar_{FT}/a$

By Lenient Constraint Alignment, CON does not contain the constraints $*PK_{FT}/a$ and $*MAR_{FT}/\emptyset$, because highly prominent foot peaks and minimally prominent foot margins are unmarked.

The diverse effects of these constraints are well known. Avoidance of unstressed sonorous vowels or stressed \emptyset or i can force deviations from the default footing pattern if one of the constraints in (5) or (6) dominates a markedness constraint on foot placement (de Lacy 2002a, Kenstowicz 1996b). These constraints can also be satisfied by reducing/raising sonorous vowels in unstressed positions and by lowering vowels that lack prominence in stressed syllables (Crosswhite 1999a). They can also determine the quality of epenthetic vowels in particular contexts (de Lacy 2002a). Again, these are not economy effects—these processes do not make the output shorter.

Syncope is just another predicted effect of the constraints on nuclei and foot branches. If IDENT[F] and $*NUC/\emptyset$ dominate MAXV, schwa has no choice but to delete in at least some circumstances. Likewise, low vowels might delete if MAXV is dominated by IDENT[F] and $*MAR_{FT}/a$, though $*MAR_{FT}/x$ constraints interact with a variety of other constraints that can potentially affect the outcome. The main point here is that these constraints have already received ample justification in work on processes that have little

or nothing to do with economy or syncope, and their mere presence in the OT grammar together with MAXV *predicts* that deletion will occur.

4.2.2 No gang-up effect

It is not the goal of this study to explore all the possible differential syncope patterns predicted by these constraints. Rather, I will concentrate on showing that if the hierarchies are formulated leniently (i.e., excluding *NUC/a, *PK_{FT}/a and *MAR_{FT}/ə from CON), they cannot duplicate the effect of *STRUC(σ) (Zoll 1996) or its near-equivalent,⁷³ *V (Hartkemeyer 2000).

To begin, consider how syllable nuclei are evaluated in the traditional “everything-is-marked” theory of CON. If there is a constraint *NUC/a in CON, then the *NUC/x hierarchy assigns violations to the full range of possible nuclei, which duplicates the effect of *STRUC(σ) or *V.

(7) Purported constraint *NUC/a as an economy constraint

	*NUC/ə	*NUC/i,u	*NUC/e,o	*NUC/a	*STRUC(σ)	*V
a. ...Cə...	*				*	*
b. ...Ci...		*			*	*
c. ...Ce...			*		*	*
d. ...Ca...				*	*	*

The comparison is even plainer if the constraints are evaluated and formulated stringently, as in de Lacy’s (2002a) theory (see also Prince 1997a, b). Stringently formulated constraints assign a violation mark to *x* and everything that is more marked

⁷³ *V is not an exact equivalent of *STRUC(σ): they differ in evaluating syllabic sonorants. *STRUC(σ) assigns two violation marks to something like [di.mŋ], *V only one.

than x . $*\text{NUC}/\leq a$ in this approach is defined roughly as follows: “no nuclei with sonority equal or less than that of a .” Since all nuclei have sonority equal to or less than that of a , $*\text{NUC}/\leq a$ assigns a violation to every possible nucleus—equivalent to $*\text{STRUC}(\sigma)$. The three most stringent constraints in (8) are shaded to highlight the similarity.

(8) Purported $*\text{NUC}/a$ as an economy constraint, formulated stringently

	$*\text{NUC}/\leq \emptyset$	$*\text{NUC}/\leq i,u$	$*\text{NUC}/\leq e,o$	$*\text{NUC}/\leq a$	$*\text{STRUC}(\sigma)$	$*V$
a. ...Cə...	*	*	*	*	*	*
b. ...Ci...		*	*	*	*	*
c. ...Ce...			*	*	*	*
d. ...Ca...				*	*	*

In the Lenient theory of CON, which does not admit $*\text{NUC}/a$, $*\text{STRUC}(\sigma)$, or $*V$, the constraints in the $*\text{NUC}/x$ hierarchy ban only the marked subset of syllable nuclei.

The least marked nucleus, a , violates no constraints in this set:

(9) $*\text{NUC}/x$ formulated leniently

	$*\text{NUC}/\emptyset$	$*\text{NUC}/i,u$	$*\text{NUC}/e,o$
a. ...Cə...	*		
b. ...Ci...		*	
c. ...Ce...			*
d. ...Ca...			

Therefore, these constraints by themselves cannot duplicate the effects of $*\text{STRUC}(\sigma)$. Yet a is not universally unmarked in all contexts—in fact, it is the most marked vowel in the weak branch of a foot, since it violates $*\text{MAR}_{\text{FT}}/a$ (see (d)):

(10) Lenient *NUC/x and *MAR_{FT}/x

	*NUC/ə	*NUC/i,u	*NUC/e,o	*MAR _{FT} /a	*MAR _{FT} /e,o	*MAR _{FT} /i,u
a. (CáCə)	*					
b. (CáCi)		*				*
c. (CáCe)			*		*	
d. (CáCa)				*		
e. (CáCə)Ca	*					
f. (CáC)Ca						

This is the only context where *a* is marked with respect to any sonority

constraint.⁷⁴ Unfooted syllables with low vowel nuclei do not violate *MAR_{FT}/a. As it is formulated, *MAR_{FT}/a doesn't even assign a mark to an unstressed, unfooted *a* in (e)-(f)

above.⁷⁵ And since the *MAR_{FT}/x hierarchy is formulated leniently, ə is unmarked as a foot margin. (It is marked as a nucleus, of course.) GEN is able to provide at least some forms that do not violate any *MAR_{FT}/x constraints, and a subset of them does not even violate any sonority constraints at all. *MAR_{FT}/x and *NUC/x put together cannot match the power of *STRUC(σ) or *V.

Adding *PK_{FT}/x constraints to the mix does not change this picture. *PK_{FT}/x constraints are less stringent than the *NUC/x hierarchy: they penalize vowels of low sonority in a smaller set of environments. Just as was the case with syllable nuclei, *a* is unmarked as a foot head (see (e-f) in (11)):

⁷⁴ I am ignoring constraints on vowel harmony, agreement with adjacent consonants, and so on—these can assign violation marks to *a* in specific contexts as well.

⁷⁵ If the constraint were instead on unstressed syllables, the picture would be different—cf. *Ǿ/x Crosswhite 1999a or Struijke's (2001) *UNSTRESSED VOWEL.

(11) *NUC/x, *MAR_{FT}/x and *PK_{FT}/x

	*NUC/ə	*NUC/i,u	*NUC/e,o	*M/a	*M/e,o	*M/i,u	*P/ə	*P/i,u	*P/e,o
a. (CəCə)	**						*		
b. (CiCə)	*	*						*	
c. (CeCə)	*		*						*
d. (CaCə)	*								
e. (CaC)Ca									
f. (CaC)									

Within this constraint set, a prediction emerges: the minimal vowel inventory of a language is {*á*}. Assuming that inputs are in no way restricted, *á* cannot fail to emerge in the surface forms of every language: none of the markedness constraints in (11) ban it. Such small inventories are unattested in adult languages, all of which have at least a height contrast (Ladefoged and Maddieson 1990). However, Jakobson 1941 hypothesizes that *a* is the earliest vowel to emerge in child speech because it is so sonorous, and my examination of three longitudinal databases of child speech (Compton and Streeter 1977, Pater 1997) confirms this—children’s early vowel inventories are confined to stressed low vowels.

It appears that the sonority constraints in (11) cannot gang up against all vowels of a language—at least some of the forms slip through the filter. This suggests that even if all of these constraints dominated MAXV, the deletion pattern still would not look like the “delete-where-you-can” pattern produced by *STRUC(σ)>>MAXV (recall chapter 3). The conclusion is that in the Lenient model of CON, constraints relating sonority to positions cannot be used to indiscriminately count syllables or vowels, economy-style.

This brings up a question: if non-differential syncope (e.g., metrical syncope of the sort discussed in Chapter 3) can always be attributed to factors other than vowel or

syllable economy, are there any “delete-where-you-can” syncope patterns at all? The answer is yes, but they are always differential. Moreover, such patterns always affect the less sonorous vowels, i.e., *ə* or *i* but never *a*. An archetypal example of this is examined in the next section.

4.3 Cheap vowels in Lillooet

4.3.1 Introduction: epenthesis, deletion, and Richness of the Base

Lillooet cheap schwa presents an interesting challenge for any theory of economy effects. The distribution of schwa in Lillooet is entirely predictable: it is absent unless the phonotactics of the language require its presence. On the other hand, the distribution of other vowels (*i*, *u*, *a*) is unpredictable. This is undoubtedly an economy effect; schwas are dispensed rather parsimoniously in the language. Is this a property peculiar to vowels of low sonority or can other vowels behave like this? As it turns out, the traditional rule-based analysis, economy, and the *NUC/*ə* analysis presented here differ on this. The *NUC/*x* analysis predicts that only low-sonority vowels can have this distribution, but under rule-based and economy OT analyses, other vowels can as well.

Lillooet raises another issue for economy: where in the grammar are economy effects obtained? The traditional analysis of this sort of pattern is to ban schwas from the input altogether—their predictable, economic distribution is the product of an epenthesis rule; there is no deletion. This is the gist of Brainard’s (1994) analysis of predictable distribution of *ɪ* in Karao and Bobaljik’s (1997) analysis of *ə* in Itelmen. An interesting consequence of this research strategy is that the epenthesis rule can insert any vowel. If any vowel can be banned from the input in the rule-based framework, this means that any vowel can have this predictable distribution—an odd prediction.

In OT, however, all economy effects have to follow from surface constraints. Inputs are not subject to constraints under the assumption known as Richness of the Base, or ROTB (Prince and Smolensky 1993, see also McCarthy 2002b:70-71). The OT grammar acts as a filter that is capable of dealing with any sort of input, whether it respects the output constraints of the language or not. Because inputs are unrestricted, an OT analyst cannot just ban schwas from the underlying representations in Lillooet and posit that all surface schwas are epenthetic. If an input happens to have all and only the necessary schwas, it will pass through the grammar filter unscathed, but if it has too many or too few, the grammar will need to fix the problem.

An ROTB-compliant analysis in terms of economy constraints shares some similarities with the rule-based analysis, with some important differences: e.g., there is no need to impose constraints on the input, because both epenthesis *and* deletion are the result of constraint interaction. The analysis must explain not only why schwa syncopates (while other vowels do not) but also why it is epenthetic. This turns out to be a problem, as I will show.

In the present framework, there are no economy constraints or restrictions on the input. The avoidance of schwa suggests that it is in some sense marked, but must also be unmarked in another sense to be selected as the epenthetic vowel. I claim that Lillooet schwa syncopates because it is the most marked vowel according to the *NUC/x hierarchy. On the other hand, schwa is the least marked *epenthetic* vowel. This follows from the theory of vowel epenthesis outlined in the next subsection.

This analysis predicts that only vowels on the less prominent end of the sonority scale can act as cheap vowels. The reason for this is that the constraints penalizing more

sonorous vowels (e.g., *a*) are so context-specific that they can never favor general deletion of the sort that *NUC/x constraints favor. This prediction will be explored in §4.2.2. The rest of this section runs as follows. Section 4.3.2 outlines the prominence minimization theory of epenthesis. Then I lay out the Lillooet patterns (§4.3.3) and analysis (§4.3.4), which is followed by a discussion of the prediction that only the less prominent vowels can have predictable distribution (§4.3.5). Alternatives are discussed in (§4.3.6).

4.3.2 Prominence minimization and epenthetic vowel quality

It is well-known that, unlike epenthetic consonants,⁷⁶ epenthetic vowels are very diverse: while epenthesis of *ə* and *i* is very common, *e* and *a* can be epenthetic as well (for recent surveys of epenthetic vowel quality, see de Lacy 2002a, Lombardi 2003).

*NUC/x constraints penalize vowels of low sonority, so they select *a* as the vowel of epenthesis in languages like Coos, Takelma, Axininca Campa, and Mekkan Arabic. None of the markedness constraints discussed in §4.2, however, can favor the epenthesis of *ə* or *i* in *all contexts*. *PK_{FT}/x and *MAR_{FT}/x constraints are too sensitive to the prosodic context of the epenthetic vowel; there are plenty of languages (including Lillooet) that insert *ə* indiscriminately, even into the head of the prosodic word.

I propose that in languages like Lillooet, epenthetic vowel quality is determined by a different consideration: the prominence of epenthetic material should be minimized. Material that is prominent in the output should not be inserted; conversely, inserted

⁷⁶ Epenthetic consonants are usually confined to glottals, coronals, and glides formed off neighboring vowels. For some discussion, see de Lacy 2002a, Lombardi 1997, Paradis and Prunet 1991.

material should be minimally intrusive. The constraints that express this ban form a family of constraints I will call RECOVER, or REC for short:

(12) REC/a>>REC/e,o>>REC/i,u

REC/x: “A syllable nucleus with the prominence *x* must have a correspondent in the input.”

The idea expressed by these constraints is related to Alderete’s (1999) HEAD-DEP, which prohibits epenthesis into prosodic heads. Assuming that prominent positions/segments in the output are used as a crutch in reconstructing the input (Beckman 1998), it follows that they should not be epenthetic. Under (17), schwa is the ideal epenthetic vowel: it is the shortest and has the most negligible intensity among vowels (Lehiste 1970, Parker 2002), so its lack of an input correspondent is not a matter of concern for the RECOVER constraint hierarchy. Schwa epenthesis violates DEP_V, of course, but it is the only vowel among the possible epenthetic vowels to incur no violations of RECOVER:

(13) Epenthetic vowel quality and RECOVER

/CC/	REC/a	REC/e,o	REC/i,u	DEP _V
a. CaC	*			*
b. CeC		*		*
c. CiC			*	*
d. CəC				*

*NUC/*x* and the RECOVER hierarchy have partially conflicting demands: *NUC/*x* constraints disprefer nuclei of low sonority, be they epenthetic or not, while RECOVER constraints disprefer *epenthetic* nuclei of high sonority. Depending on the ranking of *NUC/*x* constraints with respect to RECOVER, then, any vowel can surface as epenthetic regardless of its prosodic context.

If ə is inserted in all contexts, all of the RECOVER constraints must dominate

*NUC/ə (and therefore the other *NUC/x constraints, since they are in a fixed ranking).

This is the ranking characteristic of Lillooet, Itelmen, and many others.

(14) Ranking for epenthetic ə

/CC/	REC/a	REC/e,o	REC/i,u	*NUC/ə	*NUC/i,u	*NUC/e,o
a. VCəC				*		
b. CiC			*!		*	
c. CeC		*!				*
d. CaC	*!					

For i to be epenthetic, either *NUC/ə or REC/a and REC/e,o must dominate

*NUC/i,u or REC/i,u. The ideal epenthetic vowel ə is not available because it violates

*NUC/ə, and better nuclei are not available because they violate REC/a and REC/e,o. This

ranking is characteristic of most Arabic dialects, e.g. Lebanese, Palestinian, and Iraqi:

(15) Ranking for epenthetic i

/CC/	*NUC/ə	REC/a	REC/e,o	*NUC/i,u	*NUC/e,o	REC/i,u
a. VCiC				*		*
b. CəC	*!					
c. CeC			*!		*	
d. CaC		*!				

The ranking for epenthetic e is shown in (16). The mid vowel is the next best

nucleus after a , but epenthetic a is ruled out by high-ranking REC/a. Although e is not the

best *epenthetic* vowel, the epenthesis of ə is ruled out by high-ranking *NUC/ə, and the

epenthesis of a high vowel is ruled out by *NUC/i,u. This ranking holds of Spanish.

(16) Ranking for epenthetic *e*

/CC/	REC/a	*NUC/ə	*NUC/i,u	*NUC/e,o	REC/e,o	REC/i,u
a. $\text{[ə]} \text{CeC}$				*	*	
b. CəC		*!				
c. CiC			*!			*
d. CaC	*!					

Finally, for *a* to be epenthetic, all of the *NUC/x constraints must dominate all of the RECOVER constraints: *a* is the worst possible epenthetic segment but an ideal nucleus. This ranking obtains in Mekkan Arabic, Axininca Campa, and others.

(17) Ranking for epenthetic *a*

/CC/	*NUC/ə	*NUC/i,u	*NUC/e,o	REC/a	REC/e,o	REC/i,u
a. $\text{[a]} \text{CaC}$				*		
b. CəC	*!					
c. CiC		*!				*
d. CeC			*!		*	

Thus it is possible for a vowel of any height to be epenthetic *in any context* in this theory. Other constraints can affect the outcome; the epenthetic vowel may be subject to vowel harmony, context-sensitive agreement constraints, and so on (Kitto and de Lacy 2000, Shademan 2003). The theory of epenthetic vowel quality gives us the necessary tools to deal with Lillooet schwa.

4.3.3 Lillooet patterns

Lillooet (a.k.a. St'át'imcets; Interior North Salishan, British Columbia, Canada) has a four-vowel inventory: [i, u, a, ə].⁷⁷ Lillooet syllables may have onset or coda

⁷⁷ Each vowel can be retracted (velarized) or not, though this contrast does not affect deletion/insertion. I will abstract away from retraction in the transcriptions.

clusters of two members but usually not more, with additional restrictions that will be discussed shortly. The generalizations over the distribution of schwa in Lillooet, extracted from the extremely thorough description of van Eijk 1997, can be stated as follows:

(18) Distribution of schwa in Lillooet

- a. Every word must contain at least one vowel.
- b. Sonorant consonants must be adjacent to a vowel.⁷⁸
- c. Tri-consonantal tautosyllabic clusters are banned.⁷⁹
- d. Schwa does not occur unless the above conditions are violated: it is never word-initial or word-final, and it does not occur in adjacent open syllables.

These generalizations are exemplified below. For exposition, I adopt van Eijk's URs, but it should be kept in mind that the distribution of schwa is so regular and predictable in Lillooet that the underlying representations of words with schwa are somewhat indeterminate.

In (19), schwa appears when there is no other vowel in the word, as in *təq*, but is readily elided when there is another vowel present and the resulting cluster consists of obstruents or has rising sonority:

(19) Schwa is the only vowel in the word

- | | | | | | | |
|----|------------------------|------------|-----|--------------------------|---------------------------|-------------------|
| a. | <i>təq</i> | 'to touch' | cf. | /təq-alk'-əm/ | <i>tqalk'əm</i> | 'to drive, steer' |
| b. | <i>ǰ^wəm</i> | 'fast' | cf. | /ǰ ^w əm-akaʔ/ | <i>ǰ^wmakaʔ</i> | 'to do smt. fast' |
| c. | <i>snəmnəm</i> | 'blind' | cf. | /RED-nəm'-əp/ | <i>nəm'ənm'əp</i> | 'going blind' |

⁷⁸ This generalization is violated by the prefixes *ŋ-* '1S poss.' and *l-* 'in, on, at,' which are the only syllabic sonorant consonants in the language.

⁷⁹ This generalization holds of tautomorphemic clusters. Three-consonant clusters can emerge under morpheme concatenation, e.g., with the nominalizer prefix *s-*: *s-k^wzúsəm* 'work, job' (vE:20), *s-kǰ-akaʔ-mín-as=k^wuʔ* 'squeeze-tr.-3subj.=quot.' (vE:246).

Schwa must also break up consonants that would form a falling sonority cluster otherwise, as shown in (20). Whether it is inserted or simply fails to elide, it is always present in these environments:

(20) Syncope of schwa adjacent to sonorant blocked

- | | | | |
|----------------------------|----------------------|---------------------|---|
| a. /nəq ^w -alc/ | nəq ^w alc | ‘warm in the house’ | *nq ^w alc, cf. nəq ^w ‘warm’ |
| b. /ləhac/ | ləhac | ‘otter’ | *lhac |

In (21), schwa seems to elide from one position only to appear in another. One schwa is inserted to break up the obstruent-obstruent clusters word-finally, while another (underlying) schwa elides. These data illustrate another aspect of Lillooet phonotactics: the position of the cluster matters; it seems that word-internal clusters are preferred to peripheral ones.

(21) Epenthesis and syncope

- | | | | |
|--------------------------|----------------------------|-----------------|---|
| a. /RED- <u>l</u> əsp/ | ləs <u>l</u> səp | ‘rash all over’ | *ləs <u>l</u> əsp, ləsə <u>l</u> əsp
cf. <u>l</u> əsp ‘rash on skin,’ <u>l</u> əsp-akaʔ ‘rash on hand’ |
| b. /RED-s- <u>ʔ</u> ətq/ | s- <u>ʔ</u> ət <u>ʔ</u> tq | ‘holes’ | *s- <u>ʔ</u> ət <u>ʔ</u> tq, cf. s- <u>ʔ</u> ətq ‘hole’ |

Schwa is deleted whenever a proper cluster can be formed, but other vowels do not elide even when the resulting cluster is acceptable. In other words, the distribution of non-schwa vowels is unpredictable. Examples (a)-(d) in (22) make this point for vowels in the first syllable, and (e)-(f) show that non-schwa vowels do not elide in the last syllable. The last example shows that vowels also fail to elide medially.

(22) Non-schwa vowels are preserved

- | | | |
|-------------------------------------|---------------------|---|
| a. <u>s</u> utik | ‘winter’ | *stik, cf. stut ‘cricket’ |
| b. <u>s</u> utik-ákaʔ | ‘north wind’ | *stikákaʔ, *sutkákaʔ |
| c. <u>k</u> a-mays-c=a | ‘I will be able to’ | *kmays-c=a, cf. qmut ‘hat’ |
| d. <u>p</u> alaʔ | ‘one’ | *plaʔ, cf. plan ‘already’ |
| e. <u>p</u> un-tam- <u>l</u> kal’ap | ‘we find you folks’ | cf. ʔ’əl’q ^w ‘broken (rope)’ |

- λ'əlp 'lots of noise'
- f. cuł-un'-tam-al'ap-as 'he points at you folks' *...aps, cf. səps 'door'
- g. łap-ən-tumut 'hide us!' cf. tmix^w 'land, weather'

To summarize, schwa appears to have a fully predictable distribution in Lillooet. It shows up to syllabify ill-formed sequences but not otherwise.⁸⁰

4.3.4 Analysis of Lillooet

Two factors result in the cheap vowel pattern: schwa is the worst nucleus and the best epenthetic vowel. The ranking *NUC/ə >> MAXV results in economy of schwa.

Meanwhile the equally high-ranking RECOVER constraints rule out epenthetic vowels other than schwa.

4.3.4.1 Schwa epenthesis and syncope

Epenthesis is required and syncope blocked by phonotactic constraints. Among these are (i) the requirement that every syllable (and therefore word) have a nucleus/head (NUC: "syllables have nuclei," Prince and Smolensky 1993:96), (ii) the prohibition on

⁸⁰ One minor group of exceptions concerns words with the transitive suffix *-ən*, which appears to repel stress. Lillooet stress is fairly complex: it is generally lexical, but there are some elements of sonority-sensitivity (stress retracts from ə onto *i*, *u*, or *a*) and there is an initial default. The suffix *-ən* is odd in that schwa does not delete in roots that precede it even when the segmental conditions allow for schwa deletion, e.g., *təq-ən* 'to touch, tr.' (vE:20) is not **tq-ən*, cf. *tq-álk'əm* 'to drive, steer' (vE19). I assume that the reason for this is that the requirement for *-ən* to be unstressed overrides the prohibition against schwa. This also explains why the schwa in *-ən* itself does syncope when stress can fall elsewhere, e.g., *təq-n-ás* 'he touches it' (vE:20). Compare this to the stress-attracting suffix *-əm*, before which schwa does syncope: */təq-ən-əm/ təqnəm* 'it is touched' (vE:16), not **tqənəm*. Apart from examples like *təqən*, I have found no other examples of the shape C₁əC₂əC₃, where C₁ and C₂ are both obstruents. Note that similar suffix-induced peculiarities have been reported for Moroccan Arabic and Itelmen, where schwa also has a phonotactically determined distribution.

consonantal nuclei, which is expressed by the consonantal part of the *NUC/x hierarchy (Prince and Smolensky 1993); (iii) the prohibition on clusters of more than two consonants, *CCC; and (iv) sonority sequencing constraints that ban clusters of sonorants, falling sonority in onsets, and rising sonority in codas (Baertsch 1998, 2002, Clements 1990, Selkirk 1984a). In tableaux, I will conflate these requirements into a single cover constraint PHONOTACTICS, since they are all inviolable in Lillooet and do not interact with each other. I will identify the phonotactic transgressions of individual candidates for the reader’s convenience.

PHONOTACTICS must dominate DEP_V and *NUC/ə. When confronted with an input that contains no vowels at all, the grammar of Lillooet responds with schwa epenthesis. Something like *nəq^walc* ‘warm in the house’ will surface with a schwa even if the schwa is absent underlyingly:

(23) Epenthesis into illegal clusters

/nq ^w -alc/	PHONOTACTICS	DEP _V	*NUC/ə
a. n nəq ^w alc		*	*
b. nq ^w alc	*!(sonority)		

Epenthesis will likewise apply to the hypothetical inputs /tq/ for *təq* ‘to touch’ or /nq^w/ *nəq^w* ‘warm,’ because faithful ə-less parses of these also violate PHONOTACTICS:

(24) Epenthesis for inputs without vowels

		PHONOTACTICS	DEP _V	*NUC/ə
/nq ^w /	a. n nəq ^w		*	*
	b. n̩q ^w	*!(cons. nucleus)		
/tq/	c. t̩əq		*	*
	d. tq	*!(no head)		

Why is schwa epenthesized rather than some other, less marked nucleus? The answer is provided by the theory of epenthesis outlined in §4.3.2: schwa may be the most marked nucleus in Lillooet, but it is the least marked epenthetic vowel, all other things being equal. The RECOVER constraints, which penalize all non-schwa epenthetic vowels, are ranked above all markedness constraints that might favor less marked nuclei, including *NUC/ə.

(25) Schwa is the least marked epenthetic vowel

/nq ^w -alc/	REC/a	REC/e,o	REC/i,u	*NUC/ə	*NUC/i,u	*NUC/e,o
a. ɪ̯ nəq ^w alc				*		
b. niq ^w alc			*!		*	
c. neq ^w alc		*				*
d. naq ^w alc	*!					

If the input already contains a schwa and it is in the right place, it will be mapped to the output faithfully. If schwas can be deleted without violating PHONOTACTICS, they will be, because *NUC/ə dominates MAXV. Thus the form *təq* ‘to touch’ emerges with just one schwa in the middle even if it had three schwas underlyingly. The loser candidate that deletes all schwas and surfaces without a nucleus, **tq*, is ruled out by PHONOTACTICS.

(26) Deletion of schwas when not blocked by phonotactics

/ətəqə/	PHONOTACTICS	DEPV	*NUC/ə	MAXV
a. ɪ̯ təq			*	**
b. ətəqə			**!*	
c. tq	*!(no head)			***

It is not an accident that the middle schwa is preserved rather than, say, the last one. The clusters in the alternatives, **tqə* and **ətq*, are tolerated in Lillooet, so the fact that *təq*

wins suggests the ranking *COMPLEX >> NOCODA. *COMPLEX itself is ranked below *NUC/ə, because clusters are generally permitted so long as they respect PHONOTACTICS. Despite its low ranking, *COMPLEX will select *təq* over **tqə* and **ətq*, since it dominates NOCODA.

This grammar is able to deal with inputs that have *too many* schwas as well as ones that have too few. The analysis is quite unlike Bobaljik's rule-based analysis of similar facts in Itelmen, which excludes schwa from underlying representations. The economy effect in the ROTB analysis arises because a violable output constraint (*NUC/ə) dominates MAXV; it is not a restriction on the input. Even if such a restriction existed, it is egregiously violated by output forms: schwas are abundant in the language, but their distribution is predictable and tied to phonotactics. The ROTB analysis directly captures this fact because schwa deletion is an active process that is blocked by phonotactics. On the other hand, in restricted input analyses, it is an accident that schwa is both the vowel banned from URs and inserted by rule—this point will be addressed again in §4.3.6.1.

One clarification is in order regarding the goals and assumptions of this analysis. Requiring the grammar to be able to map inputs like /ətəqə/ to *təq* does not amount to the claim that *təq* is underlyingly /ətəqə/. Richness of the Base is not a claim about underlying representations—it is an analytical assumption about how filter grammars work. The underlying representation for *təq* is a matter for the learner to sort out, and in Optimality Theory a strategy for that is called Lexicon Optimization (Prince and Smolensky 1993): the input should be such that it can be mapped to the output with a

minimum of faithfulness violations. The input for *təq* could therefore be /təq/ or even /tq/; the important thing is that the grammar has a principled explanation for the why both **təqə* and **təqalk'əm* are absent in the output.

4.3.4.2 Other vowels

Consider now the other vowels of Lillooet. Neither *i*, *u*, nor *a* syncope—their distribution is not predictable, nor are they ever epenthesized. For syncope, this means that MAXV dominates all constraints that might favor such deletion. These include *NUC/i,u, *MAR_{FT}/i,u, and *MAR_{FT}/a:

(27) The distribution of other vowels is unpredictable

		PHONO	*NUC/ə	MAXV	*NUC/i,u	*MAR/a	*MAR/i,u
/sutik/	a. <i>sútik</i>				**		*
	b. <i>stík</i>			*!	*		
/pálaʔ/	c. <i>pálaʔ</i>					*	
	d. <i>pláʔ</i>			*!			
/sutik-ákaʔ/	e. <i>sutikákaʔ</i>				**		**
	f. <i>stikákaʔ</i>			*!			*

Note that phonotactic constraints do not preclude deletion in these circumstances—clusters like #*st* and #*pl* are perfectly acceptable, as in *stut* ‘cricket’ and *plan* ‘already.’ There is no economy of vowels other than schwa because all the constraints that might favor such deletion are dominated by MAXV.

Something should be said about the effect of *NUC/x constraints on the vowel inventory of Lillooet. Peripheral mid vowels are not allowed in the language—recall that the core inventory contains schwa plus {i, u, a}. Mid vowels are marked with respect to

the constraint *MID (Beckman 1998),⁸¹ which can be seen as an entailment of Dispersion Theory of Flemming 1995. This constraint penalizes peripheral mid vowels but not high and low vowels or ə: mid vowels are insufficiently perceptually distinct from high and low vowels. With *MID undominated, the four vowels {i, u, a, ə} make it to the surface, and ə is permitted only when PHONOTACTICS require its presence.

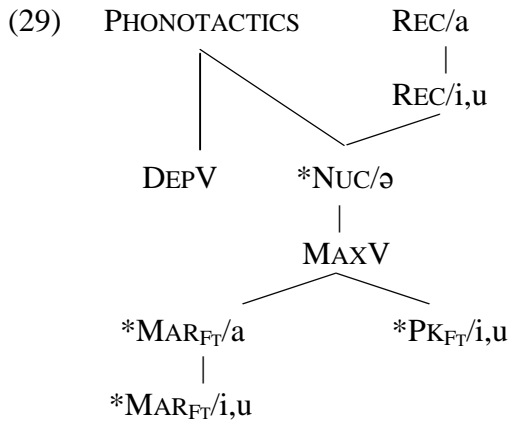
Let us summarize the results. Schwa in Lillooet is “economized” (i.e., deleted) because it is a marked nucleus: *NUC/ə >> MAXV. It is also inserted wherever phonotactic constraints require: {PHONOTACTICS, REC/x} >> *NUC/ə. No other vowels are deleted because MAXV dominates other *NUC/x constraints, and no other vowels are inserted because REC/x constraints dominate *NUC/ə. These rankings are shown in the comparative tableau (28). The tableau shows how the grammar ensures that both inputs with a dearth (/tq/) and a profusion (/ətəqə/) of schwas are mapped to the appropriate winner, *təq*. Syncope applies when phonotactics permit, as in /təq-alk'-əm/ → *tqalk'əm*. In this grammar, there is also no such thing as too many full vowels: even though phonotactically possible, syncope does not apply to *sutik* and *palaʔ*. (I am ignoring hiatus here—hiatus is categorically banned in Lillooet, but it is unclear whether it is avoided through ʔepenthesis or vowel deletion.)

⁸¹ This discussion entails that unlike *LOW and *NONLOW, *MID is not a *STRUC constraint—it is based on the harmonic scale *low, high > mid*: “non-peripheral vowels are marked.” It should be emphasized that context-free markedness constraints are not ruled out in the Lenient theory of CON—only constraints that penalize the least marked things on their harmonic scales are excluded. *LOW and *NONLOW are *STRUC constraints based on their relationship to the peripherality scale and the nucleus sonority scale.

(28) Cheap schwa in Lillooet

/tq/	PHONO	REC/x	*NUC/ə	MAXV	*NUC/i,u	*MAR _{FT} /a	*MAR/i,u
a. təq~tq	W		L				
b. təq~tiq		W	L		W		
c. təq~taq		W	L				
/təq/							
d. təq~tq	W		L	W			
/ətəqə/							
e. təq~ətəqə			W	L			
f. təq~tq	W		L	W			
/təq-alk'əm/							
g. tqalk'əm~təqalk'kəm			W	L			
/sutik/							
h. sútik~stik				W	L		L
/pala?/							
i. pála?~pla?				W		L	

The full ranking is diagrammed in (29).



This pattern might be described as “delete schwa where you can, insert schwa where you must.” As stated earlier, however, not all vowels can have this distribution.

This is discussed in the next section.

4.3.5 Some vowels never come cheap

The present analysis of schwa economy in Lillooet makes a prediction: only vowels on the less prominent end of the sonority scale can act as cheap vowels. It is impossible for *a* to be the only vowel of a language that behaves this way. The reason for this is that the very conditions necessary for *a*-epenthesis and syncope ensure that it cannot be the *only* syncoating vowel—as I show immediately below, no ranking of the sonority constraints is consistent with such a pattern.

The ranking necessary for *a*-epenthesis is shown in (30). Phonotactic constraints (e.g., sonority sequencing) require that the hypothetical /tikn/ map to *tikVn* rather than **tikn*. Epenthetic *a* is selected because it violates no *NUC/x constraints. *NUC/x constraints dominate the RECOVER constraints, which favor the losing candidates with epenthetic *ə* or *i*. Epenthesis in this context also violates *MAR_{FT}/a, because *a* is inserted into the weak branch of a foot. *MAR_{FT}/a is therefore ranked below *NUC/x.

(30) Insert *a* where required by phonotactics

/tikn/	PHONO	*NUC/ə	*NUC/i,u	*MAR _{FT} /a	REC/a	REC/i,u
a. tɪkan~tikn	W			L	L	
b. tɪkan~tɪkən		W		L	L	
c. tɪkan~tɪkin			W	L	L	W

The ranking necessary for differential syncope of just *a* cannot be consistent with (30). The only constraint that can favor differential syncope of *a* is *MAR_{FT}/a. For syncope, *MAR_{FT}/a (as well as IDENT[F] and the various constraints on footing) must dominate MAXV. But MAXV must also dominate all of the *NUC/x constraints, because they favor differential syncope of vowels other than *a*:

(31) Ranking for differential syncope of *a*

		PHONOTACTICS	*MAR _{FT} /a	MAXV	*NUC/i
/takati/	a. (tákti)~(táka)ti		W	L	
/takiti/	b. (táki)ti~(takti)			W	L
/takan/	c. (tákan)~(takn)	W	L		

The ranking in (31) contradicts that of (30): *NUC/i must be ranked below *MAR_{FT}/a for differential syncope of just *a* but above it for *a*-epenthesis. It is therefore impossible in this constraint system for *a* to be the a cheap vowel, i.e. the vowel that is epenthetic in all contexts as well as the sole vowel to syncope.

It is possible for a language with *a*-epenthesis to have syncope, but syncope must affect either low sonority vowels only (as in Mekkan Arabic, §4.5) or all vowels (this is possibly the state of affairs in Coos—see Frachtenberg 1922).

4.3.6 Alternative analyses of schwa economy in Lillooet

The approach presented here differs from alternatives on several points: the source of economy effects, the expression of economy in the grammar, and predictions regarding the cross-linguistic inventories of cheap vowels.

4.3.6.1 Constraints on the lexicon and economy

As was mentioned earlier, the traditional analysis of patterns like that of Lillooet is to exclude them from the inputs by imposing a restriction on the lexicon. The rule of vowel epenthesis then inserts the vowels in the necessary contexts. Bobaljik's (1997) analysis of an almost identical pattern of schwa distribution in Itelmen makes use of the following rule, which inserts schwa before a sonorant (R) that is separated from a vowel or a word boundary by any other consonant.

$$(32) \quad \emptyset \rightarrow \text{ə} / \left\{ \begin{array}{c} \text{C} \\ \# \end{array} \right\} \text{---} \text{R} \left\{ \begin{array}{c} \text{C} \\ \# \end{array} \right\}$$

Bobaljik’s chief concern is different from the focus of this study—he is interested in explaining some peculiarities in the distribution of schwa in suffixes. Suffixation sometimes puts schwa in environments where its presence is not required by phonotactics. (He argues that only a cyclic approach can adequately account for the behavior of these suffixes.) Despite this difference in goals, the rule-based analysis can be compared with the ROTB analysis presented here.

Economy of schwa in the rule analysis is expressed in the lexicon: a constraint is imposed at that level of representation because the lexicon should not contain predictable information. Excluding predictable information from the lexicon is a reasonable goal, but the strategy of excluding schwa from underlying representations raises a question: is schwa the only vowel that can be thus excluded? As far as I know, there is no theoretical limit on such restrictions. Brainard 1994 proposes to exclude *ɨ* from the lexicon of Karao, since its distribution is entirely predictable. The vowel also predictably surfaces as *a* in some environments; yet *a* is not excluded from the lexicon in principle—only when it is “derived” from the banished *ɨ* by rule at some intermediate step. One could imagine the opposite situation, where *a* is banned from the lexicon and is inserted by rule where phonotactic constraints require:

$$(33) \quad \emptyset \rightarrow a / \left. \begin{array}{c} \text{C} \\ \# \end{array} \right\} \text{---} \left. \begin{array}{c} \text{C} \\ \# \end{array} \right\}$$

Something very much like this epenthesis process operates in Coos (de Lacy 2002a, Frachtenberg 1922), but the distribution of *a* in Coos is not otherwise predictable—i.e., underlying /a/ maps to surface [a] faithfully and is not deleted “wherever possible.” If *a* can be banished from the lexicon, though, we would find a

situation that is most likely unattested: *ə*, *i*, and *u* have an unpredictable distribution, whereas *a* is readily inserted and deleted whenever required by phonotactics.

Any restricted input analysis of cheap vowel patterns requires an adequate theory of markedness that delineates the range of things that can be banned from the input. As Lillooet shows, this theory must be separate and different from the theory of markedness that governs rules (Chomsky and Halle 1968:ch. 9). Since there is no theory of what can be excluded from the lexicon and what can be inserted by rule, restricted input analyses make overly rich predictions regarding cheap vowels. The present analysis argues that the real source of schwa economy is its markedness as a syllable nucleus, not a ban on the lexicon—from this it follows that the cheap vowel pattern can only be restricted to the least prominent vowels.

4.3.6.2 Featurelessness, markedness, and economy

Closely related to restricted input analyses is another approach to the behavior of schwa—the view that schwa is a special featureless vowel (see for example Browman and Goldstein 1992, van Oostendorp 1997, and many others). Under this view, one could claim that schwa is banned from the lexicon because input vowels must be specified for features, and it is inserted for the same reasons. The problem with this particular approach towards Lillooet is again the dual status of schwa in the language—it is both marked and unmarked. If the features that schwa is purported to lack are marked, then why do full vowels not lose them? Conversely, if they are unmarked, then why are they not inserted? Furthermore, there is plenty of evidence that schwa is not marked in all contexts—in the Salish language Lushootseed (see §4.6), schwa is actually both marked and unmarked depending on whether it is stressed. If featurelessness is equated with

markedness (or unmarkedness), then the grammar requires an additional non-representational mechanism for dealing with the chameleonic markedness of schwa within and between languages.

Another well-known issue for featureless vowel theories is contrast. Several kinds of vowels have been claimed to be featureless: *a*, *ɛ* (see Spaelti 1997), *i*, and so on. Yet some languages contrast two or even all three of these vowels with each other—a feat impossible to achieve without some featural marking. Furthermore, claiming that unmarked segments are featureless can have broad and often undesirable consequences for the rest of the phonology, especially with regards to assimilation, spreading, and so on (see McCarthy and Taub 1992, Prince and Smolensky 1993, Pulleyblank 1998, Steriade 1995 and others for review and criticism).

Most relevant to the concern of this thesis is the claim inherent in the featureless schwa approach: that features are somehow marked while their absence is not. If features were indeed marked, then their removal is a kind of economy effect, since economy effects target only marked structure. This cannot be true in Lillooet—schwa is the only target of deletion, which means that it is the only vowel that violates a markedness constraint ranked above MAXV in the language. If features themselves were marked (rather than entire vowels in certain contexts), then their removal would be optimal—in other words, *a*, *i*, *u*, and other “full” vowels should reduce to schwa before anything deletes. The fact that *only* schwa deletes in Lillooet signals that this approach is inadequate.

4.3.6.3 Economy constraints and differential syncope

The analysis of Lillooet in terms of *NUC/x and Recover constraints is not the only possible ROTB-compliant OT analysis of the Lillooet pattern. In this section, I review an economy constraint theory of differential syncope (Hartkemeyer 2000, Tranel 1999) and an economy constraint theory of epenthetic vowel quality (Lombardi 2003). The two theories must join forces to deal with the Lillooet pattern; neither is rich enough by itself. Once they are combined, however, their predictions are overly rich—the cheap vowel pattern is no longer limited to low-sonority vowels.

Hartkemeyer 2000 sketches out a theory of differential syncope that makes use of the economy constraint *V and a hierarchy of MAX constraints that protect vowels of different height:

(34) MAX-A >> MAX-E, O >> MAX-I, U

Tranel 1999 independently proposes a similar approach to schwa deletion in French, except that his hierarchy also includes a fourth constraint at the low-ranked end, MAX-SCHWA. Tranel even explicitly ties the hierarchy to Prince and Smolensky's ideas about syllable peak and margin markedness, and both authors argue that the ranking of these MAX constraints is fixed (see §4.4.5 for some arguments against such sonority-sensitive MAX constraints). Similar fixed hierarchies have been used by Casali 1996, Davis and Zawaydeh 1996, Pulleyblank 1998 and others. According to Hartkemeyer and Tranel, the quality of syncoating vowels in differential patterns depends on the ranking of the *STRUC constraint in (35). The language will have either non-differential syncope (1), differential syncope of {ə, i, u, e, o} (2), differential syncope of {ə, i, u} (3), differential syncope of ə, as in Lillooet (4), or no syncope at all, with the ranking in (5).

- (35) MAX-A >> MAX-E,O >> MAX-I,U >> MAX-SCHWA
 ↑ ↑ ↑ ↑ ↑
 (1) (2) (3) (4) (5)

This theory of differential syncope is insufficiently rich. There are languages where only low vowels delete (Lushootseed, §4.6) or only low and mid (Estonian, Georgian), which is the opposite of what is predicted by (35). If syncope in these latter grammars is also a response to economy principles, then the constraints in (35) must be freely permutable—otherwise additional mechanisms are needed.

This is only half the story, however, because schwa is not only the syncope vowel but also the epenthetic vowel in Lillooet. Tranel and Hartkemeyer do not focus on the connection between epenthesis and syncope, so their theory of differential syncope needs to be supplemented with a theory of epenthesis.

4.3.6.4 Epenthesis and syncope in the “everything-is-marked” theory

Such a theory of epenthesis comes from a different implementation of economy in OT—the “everything-is-marked” theory. A recent exposition of this view of vowel markedness is Lombardi 2003. Lombardi’s concern is not with syncope but with epenthesis, but as Lillooet shows, the two are inextricably connected.

The theory of epenthesis Lombardi presents might be seen as an application of an approach to markedness and epenthesis developed by McCarthy and Prince 1994a in their analysis of Makassarese final consonant epenthesis. They note that of the two consonants permitted in coda position in Makassarese, *ʔ* and *ŋ*, *ʔ* is selected by *NASAL. *NASAL is low-ranked in the language but exerts its effects whenever faithfulness constraints cannot break the tie between two candidates, as is the case when the consonants are epenthetic. McCarthy and Prince propose that the identity of epenthetic material is determined by

segmental markedness constraints. This is a development of an idea put forth by Prince and Smolensky (1993/2002:Chs 8,9) and Smolensky 1993: “...segmental markedness is defined by a family of constraints barring *every* feature. Their ranking with respect to each other may be universally fixed” (McCarthy and Prince 1994a:32, fn. 32, emphasis in the original). If the quality of epenthetic vowels is determined by markedness constraints, it follows that the markedness constraints must ban almost the entire range of vowel qualities, since practically any vowel can be epenthetic—moreover, some of these constraints must be freely rankable with respect to each other.

Under Lombardi’s theory of epenthetic vowel quality, every vowel violates at least some constraint. The ranking of some of these constraints is universally fixed: *ROUND>>*NONROUND, *FRONT>>*BACK. Others are freely rankable, e.g. *LOW, *MID, and *NONLOW (Beckman 1998 similarly has *LOW and *HIGH freely ranked). The factorial typology of these constraints is supposed to derive the connection between the structure of vowel inventories and the choice of epenthetic vowel, though it is not obvious (and Lombardi does not show) how the inventories themselves are derived. In (36), I apply Lombardi’s ranking to epenthetic schwa in Lillooet. Lombardi assumes that schwa is a back, nonlow vowel:

(36) Economy alternative: epenthetic schwa in the “everything-is-marked” theory

/tq/	*LOW	*NONLOW	*FRONT	*BACK
a. t̩təq		*		*
b. tiq		*	*!	
c. taq	*!			*

It is clear that these constraints cannot dominate MAXV in Lillooet. If they did, underlying *i* and *a* would syncopate just as *ə* does. As shown in (37), *NONLOW or

*BACK force the deletion of schwa by dominating MAXV, but they also incorrectly compel the deletion of a full vowel, *u* in *sutik*.

(37) Economy alternative: Context-free markedness cannot dominate MAXV in Lillooet

		*LOW	*NONLOW	*FRONT	*BACK	MAXV
/sutik/	a. stik		*	*		*
	b. sutik (actual)		**!	*	*!	
/təq-alk'-əm/	c. $\text{tqalk}'əm$		*		*	*
	d. $\text{təqalk}'əm$		**!		**!	

To maintain this theory of epenthesis, it is necessary to incorporate high-ranking constraints that offer special protection to the “marked” vowels, as in the *STRUC theory of Tranel and Harkemeyer. Tableau (38) presents this alternative in the comparative format. Ranking MAX-A and MAX-I,U above the context-free markedness constraints is a way to ensure that only schwa undergoes deletion. Adding MAX to the analysis does not affect the evaluation of epenthetic vowels, so the results of (36) still stand unchanged.

(38) Economy alternative: context-free markedness plus faith to the marked; schwa syncope

/sutik/	MAX-A	MAX-I,U	*LO	*NLO	*FRNT	*BCK	MAX-ə
a. $\text{sutik} \sim \text{stik}$		W		L		L	
/palaʔ/							
b. $\text{pala}ʔ \sim \text{pla}ʔ$	W		L			L	
/təq-alk'-əm/							
c. $\text{tqalk}'əm} \sim \text{təqalk}'əm$				W		W	L

This analysis works for Lillooet: schwa is correctly selected as epenthetic and is the only vowel to syncopate. Nevertheless, breaking *STRUC(σ) up into *LOW, *NONLOW, *FRONT and *BACK destroys the predictions of Hartkemeyer’s and Tranel’s fixed hierarchy in (35). This constraint set is too rich—with *LOW and *NONLOW freely rankable, it is possible to produce some unattested patterns. One of these is depicted in

(39). This is the ranking for a language where *a* and *ə* syncopate *in all contexts* (as in (a) and (c)), *i* does not syncopate in any context (see (a)), and schwa is the epenthetic vowel (see (d) and (e)).

(39) Economy alternative: differential syncope of low vowels and schwa

		*LO	MAX-A	MAX-I,U	*NLO	*FRNT	*BCK	MAX-ə
/pitiki/	a. pi.ti.ki~pit.ki			W	L	L		
/pitaki/	b. pit.ki~pi.ta.ki	W	L		L			
/pitəki/	c. pit.ki~pi.tə.ki				W		W	L
/pt/	d. pət~pit					W	L	
	e. pət~pat	W						

The only difference between (39) and (38) is the permuted ranking of *LOW and MAX-A. *LOW assigns the same violations as the banished constraint *NUC/a, so its presence in CON would make the same predictions (see §4.2.2). Note that this result is unobtainable if the constraints against *a* are context-sensitive (e.g., *MAR_{FT}/a): they never favor deletion in all contexts, which is a hallmark of cheap vowels. This is a testable point of difference between the Lenient CON theory and the “everything-is-marked” theory: if patterns like (39) exist, the theory presented here will be shown to be insufficient.

Examining this constraint set further reveals another pattern that the “everything-is-marked” theory can produce but the Lenient CON theory cannot. The pattern is depicted in (40). Here, *i* and *a* syncopate in all contexts, while *ə* does not. Schwa is also the epenthetic vowel. This is a pattern where *ə* is the only vowel whose distribution is unpredictable from the phonotactics, since it never syncopates.

(40) Economy alternative: differential syncope of everything but schwa

		*FRNT	*LO	MAX-A	MAX-I,U	MAX-ə	*NLO	*BCK
/pitiki/	a. pit.ki~pi.ti.ki	W			L		W	
/pitaki/	b. pit.ki~pi.ta.ki		W	L				W
/pitəki/	c. pi.tə.ki~pit.ki					W	L	W
/pt/	d. pət~pat		W				L	
	e. pət~pit	W						L

This pattern is impossible in the theory with Lenient *NUC/x, *MAR_{FT}/x and *PK_{FT}/x constraints: there are no constraints that assign violation marks to *i* and *a* in all contexts. Low vowels are only marked in the margin of a foot, and all rankings that imply markedness of *i* also imply the markedness of *ə*.

Let us summarize the argument. Differential syncope and epenthesis in Lillooet are two sides of the same coin, so any theory of differential vowel behavior must be rich enough to account for this pattern. The unadulterated *STRUC(σ) theory with sonority-specific MAXV constraints (Hartkemeyer 2000, Tranel 1999) can account for the differential syncope of schwa, but it requires additional mechanisms to explain ə-epenthesis. Theories of epenthetic vowel quality, however, need to be quite rich to match the wide range of epenthetic vowels observed cross-linguistically. Sonority-specific MAXV constraints must be supplemented with something like Lombardi's (2003) theory, which is also very much in the spirit of economy: every structure violates at least one constraint. While this combined approach offers a workable analysis of Lillooet, its typological predictions are too rich.

The “everything-is-marked” analysis shares a property with the rule-based analyses that impose restrictions on the lexicon. Both approaches lack a principled theory

of what it means for a vowel to be marked. While the “everything-is-marked” analysis relies on markedness, it is so arbitrary as to almost reject the very notion. Restrictions on the lexicon also have a somewhat arbitrary flavor—if any vowel of the set {ə, i, e, a} can be epenthetic cross-linguistically, then why is it that only ə can be excluded from underlying representations? If ə is not the only vowel, then any vowel can be cheap in the rule-based account, and this is not what we find cross-linguistically.

4.3.7 Summary

To conclude, this section examined a pattern of syncope/epenthesis that can be described as “delete where you can, insert where you must.” This behavior is characteristic of low-sonority vowels only: while ə, ɨ, and i are treated as cheap vowels by some languages, a never is. Nor is this pattern equivalent to syllable economy—if anything, this is economy of schwa. CON does not contain any economy constraints such as *STRUC(σ), *NUC/a, or context-free markedness constraints such as *LOW, and *NONLOW. There are constraints that may favor the deletion of low-sonority vowels in all contexts (e.g., *NUC/ə) but there are no constraints that favor context-free deletion of low vowels or all vowels.

It should be emphasized that the prediction does not go in the other direction: it is not the case that deletion of low-sonority vowels is always pervasive and blocked only by phonotactic constraints. Schwa deletion need not look like the Lillooet pattern at all. A much-discussed example of schwa deletion that is clearly not motivated by avoidance of schwa in all contexts is found in Central Alaskan Yupik (Gordon 2001, Hayes 1995, Jacobson 1985, McCarthy 1986, Miyaoka 1985, Woodbury 1987).

In Central Alaskan Yupik, schwa is banned from open stressed syllables, but it is allowed to surface faithfully in closed stressed syllables or in unstressed ones (see (41)). In the language's iambic stress system, stressed syllables are required to be heavy, and this requirement is normally satisfied by vowel lengthening (see (a)). When schwa occurs in the same position where other vowels lengthen, it deletes instead (cf. (a) and (a) or (c)). An interesting twist is that deletion is blocked between identical consonants (this is known as “antigemination”—see McCarthy 1986). In these cases, the consonant following schwa geminates instead (see (d)). All of these processes conspire to ensure that the stressed syllable is heavy while long schwa never emerges in the language.

(41) Central Alaskan Yupik schwa syncope (data from Miyaoka 1985)

a.	/jaquləcuax/	(ja.qú:)(lə.cúax)	‘small bird’	*(jaqúl)(cúax)
b.	/qanɕutəka:/	(qán)(ɕút)ka:	‘he talks about it’	*(qán)(ɕu.té:)ka:
c.	/atə-pik/	(át)pik	‘real name’	*(atəp)pik
d.	/atə-təŋ/	(atət)təŋ	‘their own names’	*(át)təŋ

Gordon 2001 analyzes this pattern as an interplay of SWP and the prohibition on long schwa, both generally obeyed in Central Alaskan Yupik. The context for schwa deletion is clearly metrical: schwa does not delete if it can head the weak branch of a foot (cf. (ja.qú:)(lə.cúax) ~*(ja.qúl)(cúax)), only when it must be in the strong branch. Schwa cannot lengthen, nor can consonant gemination be used unless compelled by the OCP. This is not economy of syllables or schwa: in fact, most of the time the requirement for stressed syllables to be heavy is satisfied by augmentation (vowel lengthening or gemination) rather than deletion. Economy effects are not in any way special—they are just one way out of several to satisfy the language's markedness constraints.

The next section examines a pattern that resembles metrical syncope—the combined effect of *NUC/i and metrical constraints.

4.4 Lebanese Arabic: a differential/metrical hybrid

High vowel nuclei are marked in all contexts with respect to *NUC/i,u, but this doesn't mean that their distribution is always determined by phonotactic constraints. Thus in the grammar of Lebanese Arabic, the constraint ranking selects only those forms that satisfy its foot structure requirements while containing a minimal number of marked high vowel nuclei. The resulting pattern seems to be governed by avoidance of short high vowels in open syllables, but as we will see, this is just a superficial impression. No special constraint against short high vowels in open syllables is necessary—the pattern emerges from the interaction of *NUC/x with prosodic constraints PARSE- σ , SWP, and NONFINALITY. The same general constraints that were seen to be active in Hopi, Tonkawa, and Lillooet account for the pattern of high vowel deletion in Lebanese. To put it another way, constraints need not be *too* context-specific for their interaction to produce intricate patterns.

The next subsection presents the stress pattern of Lebanese Arabic—stress crucially interacts with high vowel syncope, so I will look at stress first. The interaction of syncope and prosody is analyzed in §4.4.2 and §4.4.3, and epenthesis is addressed in §4.4.4.

4.4.1 The patterns

The following descriptions of Lebanese Arabic and data are drawn from Haddad 1984. Lebanese Arabic has three short [i, u, a] and three long [ii, uu, aa] vowels. Mid vowels also surface in a few restricted contexts, such as word-finally in nouns and

adjectives after non-emphatic consonants (*maktabe* ‘library’). Medial syllables can be CVV, CVVC, CVC, or CV. Initial and final syllables can also be CCV... and ...VCC, respectively. CVC and CVV syllables count as heavy in the assignment of stress, which is described and exemplified in the next section.

4.4.1.1 Stress

Stress in Lebanese Arabic is similar to that of Latin (Mester 1994), with the added complication involving the behavior of trimoraic, or “superheavy” syllables. Superheavy syllables (CVVC or CVCC) are special in that they bear main stress in final position, which other syllables cannot do. Stress is on the penult if the penult is heavy (CVV or CVC) and on the antepenult otherwise.⁸²

(42) Stress final superheavy

- | | | |
|----|--------------|------------------|
| a. | ʔa.kált | ‘I ate’ |
| b. | naz.zált | ‘I brought down’ |
| c. | naa.zált | ‘I encountered’ |
| d. | sa.ʔa.lúuk | ‘they asked you’ |
| e. | bi.xal.líik | ‘he lets you’ |
| f. | mak.ta.báat | ‘libraries’ |
| g. | ʕal.lam.náak | ‘we taught you’ |

(43) Otherwise stress penult if heavy

- | | | |
|----|------------|-------------------|
| a. | náz.zal | ‘he brought down’ |
| b. | náa.zal | ‘he encountered’ |
| c. | ma.ʕáa.rik | ‘battles’ |
| d. | mak.táb.ti | ‘my library’ |

⁸² I ignore emphasis in the transcriptions; Haddad’s spelling conventions are modified as follows: his “c” is replaced by “š,” “9” is replaced by “ʕ,” “h” is replaced by “h.”

(44) If penult is light, stress antepenult except in disyllables

- a. ʔá.ka.lit ‘she ate’
- b. sá.ħa.bit ‘she withdrew (tr.)’
- c. mák.ta.be ‘library’
- d. sá.ħab ‘he withdrew’
- e. ʔá.kal ‘he ate’

Lebanese Arabic words never have more than three light syllables in a row at the end (for reasons having to do with syncope, discussed in the next section). In the Lebanese pronunciations of Classical Arabic words, though, main stress tends toward the antepenult (Haddad 1984):

(45) Antepenultimate stress in Lebanese pronunciations of Classical words

- a. da.rá.ba.na ‘he hit us’
- b. ša.já.ra.tun ‘a tree’
- c. saw.má.ʔa.tun ‘a hermitage’
- d. yuz.ʔí.ju.na ‘he annoys us’

These patterns can be summarized as in (46). A trochaic foot (LL, HL or H) is built that encompasses the penult, except when the ultima is superheavy (S).

(46) Stress assignment in Lebanese Arabic

- a. ...($\acute{L}L$) σ #, ($\acute{H}L$) σ # antepenult
- b. ...(\acute{H}) σ # penult
- c. ...(\acute{S})# ultima

Although secondary stress has not been reported for Lebanese Arabic, the indications are that footing is iterative. I will return to this in §4.4.2.1.

4.4.1.2 Syncope

High vowels delete in several environments. First, as in all modern Arabic dialects, deletion applies to medial vowels flanked by single consonants. Deletion does not apply to low vowels here—compare (47) and (48).

(47) Syncope in the two-sided open syllable environment

a. /nizil-it/	níz.lit	‘she descended’	cf. ní.zil ‘he descended’
b. /saaḥib- <u>it</u> -uu/	saa.ḥíb.tu	‘his friend’	cf. sáa.ḥib ‘friend’
c. /saaḥib-it-na/	saaḥ.bít.na	‘our friend’	cf. sáa.ḥib ‘friend’
d. /ʔibin- <u>ii</u> /	ʔíb.ni	‘my son’	cf. ʔí.bin ‘son’
e. /bagil- <u>ii</u> /	bág.li	‘my mule’	cf. bá.gil ‘mule’

(48) No syncope of /a/ in the same environment

a. /ʔakal-it/	ʔá.ka.lit	‘she ate’	*ʔák.lit
b. /saḥab-it/	sá.ḥa.bit	‘she withdrew (tr.)’	*saḥ.bit

High vowels delete not only in the environment shown in (47)—the first vowel of the word can also syncope, as shown in (49). Despite this, there is a restriction on the application of syncope to the first vowel of the word—deletion cannot result in stress on the last syllable (unless the last syllable is already superheavy), so if there are only two vowels underlyingly, they must both surface.

(49) Limits on syncope of /i/ in open initial syllables

a. /nizil-t/	nzíl	‘I descended’	
b. /nizil/	nízil	‘he descended’	*nzíl
c. /fihim-na/	fhímna	‘we understood’	
d. /fihim/	fihim	‘he understood’	*fhím
e. /nisi/	nísi	‘he forgot’	*nís, *nsí

The low vowel does not syncope in this environment, as shown in (50).

(50) No syncope of /a/ in open initial syllables

a. /xazaʔ-t/	xazáʔt	‘I tore’	*xzáʔt
b. /katab-t/	katábt	‘I wrote’	*ktábt

Syncope also never deletes long high vowels, which may occur in positions from which short high vowels are prohibited, such as medial open syllables.

(51) No deletion of long high vowels

- | | | | |
|----|---------|---------|---------|
| a. | jaríide | ‘paper’ | *jar.de |
| b. | ʕarída | ‘wide’ | *ʕar.da |

To summarize, high vowel syncope deletes short high vowels in open syllables, as long as deletion does not result in final stress.

4.4.2 Analysis of stress pattern

I claim that high vowels delete in Lebanese Arabic for non-metrical reasons—deletion reduces the number of marked high vowel syllable nuclei. Whether deletion does or does not apply depends on metrical factors, as Haddad (1984) rightly notes. I will start therefore by analyzing the stress system and then showing how various aspects of high vowel deletion follow from it.

4.4.2.1 Stress assignment and iterative footing

Stress in Lebanese Arabic is assigned on the basis of the trochaic foot. I will assume that footing is iterative, despite the absence of secondary stress. First of all, it is frequently assumed that secondary stress is not a necessary correlate of footing; thus McCarthy 1979 assumes iterative feet in his analysis of main stress placement in Cairene Arabic and Hayes 1995 does the same for tone in Seminole Creek. (See also Hall 2001 for a covert footing analysis of Southeastern Tepehuan.)

Second, there is evidence for iterative footing in Lebanese Arabic that comes from the distribution of long vowels. According to Haddad 1984, they may occur in stressed or unstressed syllables but they never occur in word-final open syllables. Since

word-final open syllables are never stressed, this is the only environment where long vowels cannot be foot heads:

(52) Long vowels barred from final syllables

- | | | | | |
|-----------------|-----------|----------------|--------------------|---------------------|
| a. /darab-uu/ | dá.ra.bu | ‘they hit’ | cf. darab-úu-hun | ‘they hit them’ |
| b. /ħamal-na/ | há.ma.lna | ‘we neglected’ | cf. ħamal-náa-š | ‘we didn’t neglect’ |
| c. /saʔal-t-uu/ | sá.ʔal.tu | ‘you asked’ | cf. saʔal-t-úu-hun | ‘you asked them’ |

Haddad 1984 considers some arguments for the underlying representation of these suffixes and chooses to analyze these vowels as underlyingly short, assuming that they lengthen when followed by clitics like *-hun* and *-š* (Broselow 1976 also assumes this for Cairene Arabic, though Abu-Mansour 1987 takes the opposite stand for Mekkan—see §4.5). For an OT analyst, the absence of long vowels in final syllables (regardless of any alternations) points to a real generalization about the phonology of Lebanese Arabic: long vowels cannot occur word-finally. A final open syllable is never stressed or long, so whether it shortens in the last syllable or lengthens before clitics should follow from the analysis. If iterative footing is assumed, then the environment for shortening in this dialect is straightforward—any non-final long vowel can be parsed into a foot of its own except for the last one, which must undergo shortening. (See the analysis of Tonkawa in chapter 3 for a similar argument for iterative footing from the distribution of long vowels.)

4.4.2.2 Foot shape and placement

Foot shape is determined by the interaction of the following constraints:

- (53) RHTYPE=TROCHEE: “Feet do not begin in unstressed syllables.”
- (54) RHTYPE=IAMB: “Feet do not end in unstressed syllables.”
- (55) FTBIN: “Feet are binary at the moraic or syllabic level.” (Prince and Smolensky 1993)

Harmonic scale:

Ft ,	Ft	γ	Ft
∧			
σ σ	σ _{μμ}		σ _μ

Foot placement is determined by the ENDRULE constraints, PARSE-σ, the NONFINALITY constraints, and WSP_{μμμ}, which are defined as follows:

- (56) WSP_{μμμ}: “No unstressed trimoraic syllables.”
Harmonic scale: σ_μ > σ_{μμ} > σ_{μμμ}
- (57) NONFINALITY(FT): “The head foot of the PrWd is not word-final.” (P&S:45)
- (58) NONFINALITY(σ): “The head of the PrWd does not fall on the word-final syllable.” (P&S:42)

PrWd	HdFt

Harmonic scale: σ#/___ > σ#/___ > σ# (“/” = directly dominated by)

As can be seen from the definitions in (57) and (58), the NONFINALITY constraints are in a stringency relationship. Whenever NONFIN(σ) is violated, so is NONFIN(FT): if the head of the prosodic word falls on the word-final syllable, that syllable is footed. A form can violate NONFINALITY(FT) without violating NONFINALITY(σ), however:

- (59) NONFINALITY constraints

	NONFINALITY(σ)	NONFINALITY(FT)
a. ... (σσ)	*	*
b. ... (σσ)		*
c. ... (σσ)σ		

Feet in Lebanese Arabic are prominence-initial (trochaic), which indicates that RHTYPE=TROCHEE dominates RHTYPE=IAMB:

(60) Feet are trochaic

/ʔakal-it/	RHTYPE=TROCHEE	RHTYPE=IAMB
a. ʔá.ka)lit		*
b. (ʔa.ká)lit	*!	

Feet are built iteratively, with main stress falling on the rightmost foot. This is the result of high-ranking PARSE- σ , which dominates ENDRULE-L (ENDRULE constraints are discussed in chapter 3). ENDRULE-L demands that the main stress foot be the first foot of the word (even if it does not encompass the first syllable), and the main stress foot is not the first foot of the word in the winner (*màk*)(*táb*)*ti*. ENDRULE-L is also ranked below ENDRULE-R, which requires that the main stress foot be the last foot of the word. This can be seen from the failure of *(*mák*)(*tàb*)*ti*.

(61) Footing is iterative; main stress is on the rightmost foot

	ENDRULE-R	PARSE- σ	ENDRULE-L
a. ʔá.(màk)(táb)ti		*	*
b. mak(tàb)ti		**!	
c. (mák)(tàb)ti	*!	*	

So, footing is iterative and trochaic, with the main stress falling on the rightmost foot.

4.4.2.3 The role of NONFINALITY

The NONFINALITY constraints play a central role in the phonology of Lebanese Arabic. As a result of their high ranking, the last syllable is left unfooted, which also sometimes leads to stress lapses, as in (*sáħa*)*bit*. NONFINALITY(FT) must therefore dominate all the constraints that might favor final footing, such as *LAPSE, WSP $_{\mu}$, and

PARSE- σ_{FINAL} (not shown). Its less stringent cousin NONFINALITY(σ) must also be ranked at least above WSP $_{\mu\mu}$.

(62) The foot and the stressed syllable cannot be word-final

	NONFINALITY(σ)	NONFINALITY(FT)	*LAPSE	WSP $_{\mu\mu}$
a. $\text{ʕ}(\text{sáħa})\text{bit}$			*	*
b. $\text{sa}(\text{hábit})$		*!		*
c. $(\text{sáħa})(\text{bít})$	*!	*		

In words with four light syllables, as in the Lebanese pronunciation of the Classical Arabic word *da(rá.ba)na*, it is only possible to build a single foot without violating NONFINALITY(FT); **(dára)(bána)* is impossible. I'll assume that the placement of the single foot is determined by *LAPSE, which must be ranked above all the constraints that might favor initial footing, e.g., PARSE- $\sigma 1$ (a.k.a. ALIGN-L(Wd, Ft). See Chapter 3 and McCarthy to appear).

(63) Antepenultimate stress as avoidance of lapses

	*LAPSE	PARSE- $\sigma 1$
a. $\text{ʕ} \text{da}(\text{rá.ba})\text{na}$	*	*
b. $(\text{dá.ra})\text{ba.na}$	**	

The prohibitions against footing and stressing the last vowel of the word are violated under some circumstances, e.g., when the last syllable is superheavy. The undominated WSP $_{\mu\mu\mu}$ requires that such syllables be stressed even if final.⁸³

⁸³ WSP $_{\mu\mu\mu}$ does not insist that every superheavy syllable bear *main* stress—only that it be the head of a foot. Words with non-final superheavy syllables can have main stress on other syllables, as long as the superheavy is footed: *(saah̄)(bít)na* ‘our friend.’

(64) Trimoraic syllables are stressed even when final

	WSP _{μμμ}	NONFINALITY(σ)	NONFINALITY(Ft)
a. ʔal(lam)(náak)		*	*
b. ʔal(lám)naak	*!		

The last syllable must also be footed if the word is only two syllables long, where violation of NONFINALITY(Ft) is required by the constraint FTBIN, which disallows feet of the shape (CV).

(65) Disyllables are exhaustively footed

	FTBIN	NONFINALITY(Ft)
a. (ʔá.kal)		*
b. (ʔá)kal	*!	

Thus the NONFINALITY constraints are obeyed except when there is a danger of leaving a superheavy syllable unfooted or having to build a monadic foot.

4.4.2.4 Summary of the analysis of stress

To summarize, consider the tableau below, which shows the entire stress system. Only trochaic candidates are included in the tableau, so RHTYPE=TROCHEE and RHTYPE=IAMB are left out. WSP_{μμ} has also been left out to save space—keep in mind that it is violated in cases where the last syllable of the word is a closed heavy (e.g., ʔá.kal or (sáħa)bit).

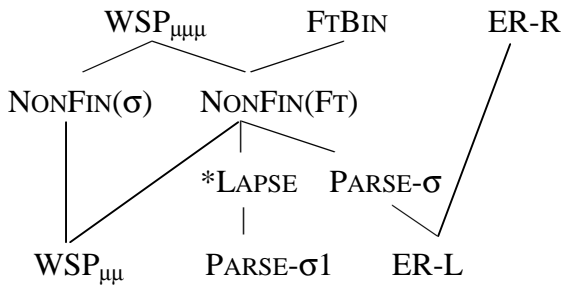
NONFINALITY(σ) is also left out of (66)—it agrees with the more stringent

NONFINALITY(Ft) on most of the comparisons.

(66) Stress in Lebanese Arabic

	FTBIN	WSP _{μμμ}	ER-R	NFIN(FT)	*LAPSE	PARSE-σ	ER-L
a. (màk)(táb)ti~(mák)(tàb)ti			W				L
b. (màk)(táb)ti~mak(táb)ti						W	L
c. (màk)(táb)ti~(mák)tab.ti					W	W	L
d. (sáħa)bit~sa(ħá.bit)				W	L		
e. (sáħa)bit~(sàħa)(bít)				W	L	L	L
f. da(rába)na~(dára)ba.na					W		
g. da(rába)na~(dàra)(bá.na)				W		L	W
h. ?a(kált)~(?á.kalt)		W		L		L	
i. (?á.kal)~(?á)kal	W			L			

(67) Rankings for stress



NONFINALITY constraints play a key role in the ranking in (67): they are obeyed at the expense of less-than-exhaustive footing and stress lapses and violated only in a few select circumstances. We will see more evidence of their activity in the analysis of syncope.

4.4.3 Analysis of syncope: prosodically constrained economy of marked nuclei

4.4.3.1 The basic pattern: deletion as avoidance of high vowel nuclei

High vowels have the lowest sonority in the vowel inventory of Lebanese Arabic.

Recall that the vowel inventory of Lebanese does not even contain schwa—this indicates

that *NUC/ə is undominated. In the absence of alternations, it is not possible to say


whether input schwas map to \emptyset , *i*, *u*, or *a*—schwas are avoided in one way or another.

This means among other things that epenthetic vowels cannot surface as schwa; I will return to this in §4.4.4.

High vowels are allowed to surface sometimes, so *NUC/i,u must be dominated by other constraints. The fact that high vowels syncope at all suggests that *NUC/i,u dominates MAXV. *NUC/i,u cannot wipe out all high vowels because it is crucially dominated by other constraints. The most important of these is NONFINALITY(FT), but SWP and PARSE-σ play a role in determining the site of deletion as well. This is a hybrid syncope system: high vowels are deleted because they are marked nuclei, but the output respects higher-order prosodic constraints.

The ranking *NUC/i,u >> MAXV is shown in (68). The deletion candidate *niz.lit* in (68) violates *NUC/i,u only twice, i.e., to a lesser extent than the faithful loser **ni.zi.lit*.

(68) High vowel syncope reduces the number of marked nuclei

/nizil-it/	*NUC/i,u	MAXV
a.  niz.lit	**	*
b. ni.zi.lit	***!	

The winner in (68) still violates *NUC/i,u twice. The alternatives such as *nzilt* are phonotactically legal in Lebanese Arabic, and yet *nzilt* loses. The reason for this is NONFINALITY, discussed in the next section.

Low vowels do not undergo syncope. They do not violate any *NUC constraints, and all the constraints that might favor their deletion are ranked too low to matter (see § 4.4.3.3).

(69) No deletion of high-sonority nuclei

/ʔakal-it/	*NUC/i,u	*NUC/e,o	MAXV
a. ʔá.ka.lit	*		
b. ʔá.k.lit	*		*!

Long high vowels are immune to deletion as well (the relevant facts are repeated in (70)).

(70) No deletion of long high vowels

- a. ja(ríi)de ‘paper’ *(jár)de
 b. ʔa(ríi)da ‘wide’ *(ʔár)da

Long high vowels violate *NUC/i,u just as short high vowels do, but their deletion is blocked by the undominated MAXLONGV, just as in Tonkawa. I will return to the behavior of long vowels in §4.4.3.3.

This story is incomplete, of course, because it does not explain why any short high vowels at all manage to surface in Lebanese Arabic. The next section addresses this.

4.4.3.2 Prosodic constraints and the locus of deletion

*NUC/i,u differs from other constraints that have economy effects, e.g., SWP and PARSE- σ , in that it is completely indifferent to the site of deletion. In this it is somewhat like *STRUC(σ), since it even has a limited ability to count syllables. The ability is limited because only syllables with high vowel nuclei are counted—*NUC/i,u is particular in a way that *STRUC(σ) is not. In Lebanese Arabic, the relatively context-free demands of *NUC/i,u are curtailed by prosodic constraints.

The first of these requirements is a central one in Lebanese Arabic—NONFINALITY. When the choice is between high vowel nuclei or footing the last syllable, high vowel nuclei are tolerated. For example, /nizil-it/ maps to *níz.lit*, not **nzilt*, even

though *nzilt* is a legal form of the language—it is the output for the input */nizil-t/*. This is because deletion of more than one vowel in the former case must result in final stress:

(71) Deletion does not result in final stress

/nizil-it/	NONFINALITY(FT)	*NUC/I,U	MAXV
a. 𐤍𐤏𐤆𐤋 (níz)lit		**	*
b. (nzílt)	*!	*	**

A third candidate not included in (71) is one that deletes the first vowel, *nzí.lit*. It is also in principle a possible word in Lebanese Arabic, both in terms of syllable and foot structure—cf. *ʔá.kal* and *nzílt*. It fails because there are better options in terms of foot structure. Recall that penultimate stress is tolerated only when FTBIN requires it. Because FTBIN dominates NONFINALITY(FT), the last syllable be footed in disyllables that begin in L, ruling out **(nzí)lit*, and *(nzí.lit)* performs worse on NONFINALITY(FT) than the candidate that deletes the second vowel. All three candidates are tied on *NUC/i,u and MAXV.

(72) Deleting the second vowel creates optimal foot structure

/nizil-it/	FTBIN	NONFIN(FT)	PARSE- σ
a. 𐤍𐤏𐤆𐤋 (níz)lit			*
b. (nzí.lit)		*!	
c. (nzí)lit	*!		

Forms with two underlying vowels, e.g. */nizil/*, do not undergo syncope. Syncope in such words turns things from bad to worse: the faithful parse *(ní.zil)* already violates

NONFINALITY(FT) by footing the last syllable, while the syncope candidate⁸⁴ (*nzíl*) not only foots but stresses the last syllable, incurring violations of both NONFINALITY(FT) and NONFINALITY(σ). NONFINALITY(σ) must therefore also dominate *NUC/i,u: deletion of high vowels does not result in final stress.

(73) Deletion cannot create final stress

/nizil/	NONFINALITY(σ)	NONFINALITY(FT)	*NUC/i,u	MAXV
a. $\text{ni}^{\text{H}}\text{zil}$		*	**	
b. (nzíl)	*!	*	*	*

This analysis predicts that given an input that ends in a superheavy sequence (VVC# or VCC#), syncope should proceed—the violation of NONFINALITY(FT) is unavoidable even in a faithful parse, so it is possible to remove additional high vowels. The winner (*nzíl*) and the faithful loser **ni(zíl)* both violate NONFINALITY(FT) and so the decision between them is passed on to *NUC/i,u, which selects the monosyllabic candidate.

(74) If the superheavy syllable is already there, deletion proceeds

/nizil-t/	NONFINALITY(σ)	NONFINALITY(FT)	*NUC/I,U	MAXV
a. $\text{ni}^{\text{H}}\text{zilt}$	*	*	*	*
b. ni(zílt)	*	*	**!	

The same ranking selects syncope in situations where both the syncope and the faithful candidates satisfy NONFINALITY; thus /fihim-na/ → (*fhím*)na, not **fi(hím)na*.

⁸⁴ A candidate like **nizl* is as ill-formed as **nzil* with respect to NONFINALITY, and it incurs an additional violation of sonority sequencing constraints, which are high-ranked in Lebanese Arabic (Haddad 1983, 1984).

Thus the NONFINALITY constraints impose a limit on high vowel deletion, but deletion is allowed to proceed when it does not worsen the performance on the constraints. This result is summarized in the comparative tableau in (75).

(75) NONFINALITY and high vowel syncope

		WSP _{μμμ}	FTBIN	NF(σ)	NF(FT)	*NUC/i,u	MAXV
/nizil-t/	a. (nzílt)~ni(zílt)					W	L
	b. (nzílt)~(ní)zilt	W	W	L	L	W	L
/nizil-it/	c. (níz)lit~(ní.zi)lit					W	L
	d. (níz)lit~(nzílt)			W	W	L	W
/nizil/	e. (nízil)~(nzíl)			W		L	W
	f. (nízil)~(ní)zil		W	L			

This intricate pattern is due to the interaction between *NUC/i,u and the prosodic constraints, all of which have independent effects in the language. NONFINALITY not only determines the outcome of syncope in /nizil-it/; it also affects stress and footing. WSP_{μμμ} and FTBIN likewise have effects on more than the syncope process. Economy effects do not exist in a vacuum—they are the result of complex constraint interaction.

4.4.3.3 The role of PARSE-σ and SWP

There is an alternative to the *NUC/i,u analysis, of course. Comparing the syncope forms with their more faithful competitors reveals that the winners often satisfy the familiar metrical constraints SWP and PARSE-σ better: (nzílt) improves on ni(zílt) in terms of exhaustive footing, and (níz)lit improves on (ní.zi)lit in having a heavy stressed syllable. This alternative is sketched in the following tableau.

(76) The metrical alternative

		SWP	NONFIN(FT)	PARSE- σ	MAXV
/nizil-t/	a. (nzílt)~ni(zílt)			W	L
/nizil-it/	b. (níz)lit~(ní.zi)lit	W			L
	c. (níz)lit~(nzílt)		W	L	W

The problem with this story is that it is only half true. If SWP and PARSE- σ dominated MAXV, we would expect to see the low vowel deletion in these contexts, and such deletion is patently absent—witness /ʔakal-it/ \rightarrow (ʔá.ka)lit, not *(ʔák)lit, and /katab-t/ \rightarrow ka(tábt), not *(ktábt). PARSE- σ and SWP must be ranked below MAXV in Lebanese Arabic, as shown in the following two tableaux:

(77) Light stressed syllables tolerated

/ʔakal-it/	MAXV	SWP
a. ʔáka(lit)		*
b. (ʔák)lit	*!	

(78) Unfooted syllables tolerated

/katab-t/	MAXV	PARSE- σ
a. ka(tábt)		*
b. (ktábt)	*!	

The failure of *a* to syncopate in these cases is not necessarily a devastating criticism of the PARSE- σ /SWP analysis of Lebanese Arabic—it could be the case that MAX-V is a hierarchy of constraints sensitive to sonority, where more sonorous vowels receive special protection from deletion (see §4.3.6.3). In §4.4.5 I provide some arguments against such constraints.

The output of high vowel syncope sometimes satisfies SWP and PARSE- σ better than the faithful alternatives might, but this is just an accident. High vowel syncope in Lebanese Arabic only looks metrical because some metrical constraints are ranked above *NUC/i,u.

Despite being dominated by MAXV, PARSE- σ has an effect on the outcome of syncope. In some words, more than one high vowel can be deleted without any risk of violating NONFINALITY(FT): consider /saahib-it-uu/ \rightarrow (saa)(hīb)tu ‘his friend,’ not *(sáah)bi.tu. This outcome is consistent with the ranking already established in section §4.4.2.2: there is no foot economy in the language, but there is economy of unfooted syllables. The winner (saa)(hīb)tu satisfies PARSE- σ better than (sáah)bi.tu, but it violates ENDRULE-L, which disfavors multiple feet.

(79) Economy of unfooted syllables

/saahib- <u>i</u> t-uu/	*NUC/i,u	MAXV	PARSE- σ	ER-L
a. ɛ^{h} (saa)(hīb)tu	**	*	*	*
b. (sáah)bi.tu	**	*	**!	

The third option is to delete the first and the last high vowels of the input, yielding *(sáah)bit. This candidate beats its competitors on *NUC/i,u, but it violates the undominated constraint against deleting word-final segments, ANCHOR-EDGE (see the

Tonkawa section of Chapter 3). This constraint also explains the lack of deletion in /nisi/ → *nísi* ‘forget,’ **nís*. Final vowels do not delete in any of the Arabic dialects.⁸⁵

PARSE-σ’s lack of impact is consistent also with the behavior of long vowels in syncope. Recall that medial long vowels do not shorten or syncopate; hence *ja(ríi)de* not *(*jár*)*de* ‘paper.’ Syncope in such words could yield a more exhaustive foot parse, but it is not allowed to apply because MAXLONGV dominates PARSE-σ.

The pattern in (79) follows a generalization that is frequently made about differential Arabic dialects: short high vowels in open syllables are avoided⁸⁶ (Broselow 1992a, Farwaneh 1995). The winner in (79), (*saa*)(*ħíb*)*tu*, has fewer open high vowel syllables, but this does not mean that there is a constraint against such syllables. The dispreference is an epiphenomenon of the interaction of the constraints on footing.

The fact that high vowels delete but low ones do not does not necessarily imply that high vowels are more marked—it could also be the case that low vowels are specially protected by high-ranking faithfulness constraints (these were discussed in the context of Lillooet in §4.3.6.3). There is no real need for such constraints even for Lebanese Arabic—the interaction of *NUC/i,u with metrical constraints accounts for the

⁸⁵ The alternative to this account is that syncope of high vowels is blocked when the result might violate *σ_{μμμ}. This is incorrect, however—outputs of syncope do sometimes violate *σ_{μμμ}, as in /saahib-it-na/ → *saaħ.bít.na* ‘our friend,’ not *(*saa.ħi*)(*bít*)*na*.

⁸⁶ This generalization is also meant to account for some aspects of epenthesis. In some dialects, /CCC/ clusters are broken up by epenthesis between the first two consonants, which creates a closed syllable: /kitab-t-la/ → *ki.ta.bit.la*, **ki.tab.ti.la* (Iraqi). In others, the epenthetic vowel is inserted between the second and the third: /katab-t-lu/ → *ka.tab.ti.lu* (Cairene, Mekkan—see Broselow 1992a).

pattern quite adequately. There are additional reasons to believe that MAXV is not differentiated for vowels at various sonority levels—see §4.4.5.

4.4.3.4 Summary of the analysis of syncope

Let us summarize the main points of this section. I argued that Lebanese Arabic syncope results because the constraint against high vowel nuclei, *NUC/i,u, dominates MAXV: marked high vowel nuclei are deleted. While *NUC/i,u itself is indifferent to the site of deletion, constraints on the placement and shape of feet are not: the output of high vowel syncope must comply with the general prosodic requirements of the language. This is a pseudo-metrical pattern: high vowels delete for essentially non-metrical reasons, but the result is as metrically well-formed as possible because *NUC/i,u is dominated by certain prosodic constraints.

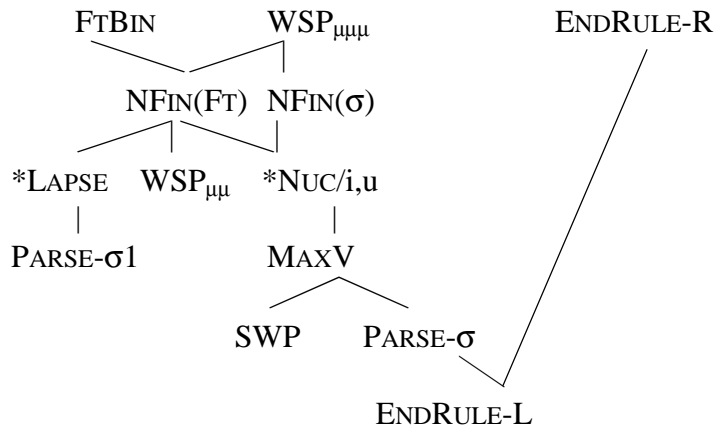
The summary tableau in (80) shows how the prosodic constraints interact with *NUC/i,u and MAXV. The first two comparisons show that there is no non-differential, metrical syncope in Lebanese Arabic because MAXV dominates SWP and PARSE- σ . The next two comparisons show how NONFINALITY(FT) guides and limits high vowel deletion in *(niz)lit*. NONFINALITY(FT) is not decisive in the case of *(nzilt)* and *(fhim)na* since they perform just as well or poorly on the constraint as their competitors; the decision is passed down to *NUC/i,u. Finally, the ranking PARSE- σ >> ENDRULE-L favors the deletion of the second high vowel in /saahib-it-uu/: the number of feet is not limited to one, so the winner has two feet and just one unfooted syllable rather than one foot and two unfooted syllables.

(80) Stress and syncope

		NF(FT)	*NUC/i,u	MAXV	SWP	PARSE-σ	ER-L
/saħab-it/	a. (sáħa)bit~(sáħ)bit			W	L		
/katab-t/	b. ka(tábt)~(ktábt)			W		L	
/nizil-it/	c. (níz)lit~(níz)lit		W	L	W		
	d. (níz)lit~(nzílt)	W	L	L		L	
/nizil-t/	e. (nzílt)~ni(zílt)		W	L		W	
/fihim-na/	f. (fhím)na~fi(hím)na		W	L		W	
/saahib-ít-uu/	g. (saa)(ħíb)tu~(sáaħ)bi.tu					W	L

The following is the complete ranking for Lebanese Arabic stress and syncope.

(81) Rankings for stress and syncope



In both Lebanese Arabic and Lillooet, vowels of low sonority are avoided. Nevertheless, this avoidance plays out very differently in the two languages. In Lillooet, *NUC/ə is dominated by phonotactic constraints but does not interact in a visible way with constraints on foot structure, while in Lebanese Arabic, the pattern is largely controlled by prosodic considerations.

4.4.4 Epenthetic vowel quality

Apart from demonstrating that it is possible for a differential syncope pattern to have metrical properties, Lebanese Arabic syncope raises the important issue of

epenthetic vowel quality. Lebanese Arabic is like Lillooet in that its syncope vowel is also its epenthetic vowel. The theory of epenthetic vowel quality outlined earlier in this chapter (§4.3.2) suggests an explanation: while high vowels are marked as syllable nuclei, they are unmarked as epenthetic vowels, because they are the least marked vowels with respect to the epenthesis prominence constraints of the RECOVER hierarchy.

The contexts for epenthesis in Lebanese Arabic include coda clusters with flat or rising sonority and triconsonantal clusters.⁸⁷ If sonority falls, as in *kalb* ‘dog,’ then *i* is optional.

(82) Epenthesis into rising sonority clusters

a.	/nasl/	nasil	‘progeny’	*nasl	cf.	kalb~kalib	‘dog’
b.	/ʔasr/	ʔasir	‘palace’	*ʔasr		nasp~nasib	‘fraud’
c.	/ʔidm/	ʔidim	‘old (pl.)’	*ʔidm		wizg~wizik	‘victory’

A full analysis of epenthesis raises issues too tangential to the main topic of economy effects, so I will provide an account of epenthetic vowel quality only. For some discussion of epenthetic vowel placement in Arabic dialects, see Abu-Mansour 1995, Broselow 1992a, b, Davis and Zawaydeh 1996, Farwaneh 1995 and the references cited within those works.

In languages where epenthetic vowel quality is constant across contexts, the quality of epenthetic vowels is determined by the relative ranking of *NUC/x and RECOVER. RECOVER constraints favor epenthetic vowels of low sonority, and the *NUC/x

⁸⁷ Unfortunately, Hassad does not give any examples of epenthesis into medial triconsonantal clusters, but he states that the epenthetic vowel is positioned “after the first consonant in a sequence of three consonants or a sequence of two consonants at the end of the word.” (Haddad 1984) This makes Lebanese a “coda dialect” in Broselow’s (1992a) classification: the epenthetic vowel heads a closed rather than an open syllable. See also fn. 86.

hierarchy favors vowels of high sonority regardless of source or stress. Since epenthetic vowels are always high in Lebanese Arabic regardless of context, epenthetic vowels are high because REC/a, REC/e,o and *NUC/ə dominate REC/i,u and *NUC/i,u:

(83) Epenthetic vowels are high

/nasl/	*NUC/ə	REC/a	REC/e,o	REC/i,u	*NUC/i,u	*NUC/e,o
a. nasil				*	*	
b. nasəl	*!					
c. nasel			*!			*
d. nasal		*!				

*NUC/ə is undominated in Lebanese Arabic, so the ideal epenthetic vowel schwa (which violates no RECOVER constraints) is not available. The next best option is a high vowel—the less marked, sonorous nuclei *e*, *o*, and *a* are ruled out by high-ranked REC/a and REC/e,o.

The REC constraints do not interact with any of the constraints in (81) apart from *NUC/i,u, so this concludes the analysis of Lebanese Arabic.

4.4.5 Excursus: an argument against the differentiated MAXV hierarchy

The analyses of Lillooet and Lebanese Arabic do not *require* a differentiated hierarchy of MAXV constraints, but this does not by itself prove that there are no such constraints in CON. In this subsection, I argue that these constraints are not only unnecessary but potentially dangerous.

The theory of differential vowel behavior presented here assumes that there are two kinds of constraints that refer to sonority. First, there are markedness constraints governing the relation of sonority and positional prominence (cf. Crosswhite 1999a, de Lacy 2002a, Kenstowicz 1996b, Prince and Smolensky 1993). Second, there are

faithfulness constraints that require prominent vowels to have input correspondents (cf. Alderete 1999, Steriade 1995). Thus, constraints that refer to sonority are necessarily surface-oriented—either because they are markedness constraints or because they are quasi-positional faithfulness constraints of the DEP family. There are no constraints that offer special protection for highly sonorous input vowels—in other words, MAXV is not differentiated. The reason for this is that sonority and prominence are viewed here to be properties of the output. Being prominent by itself does not merit special protection (though being marked may—see de Lacy 2002a, Kiparsky 1994), but it does come with certain “responsibilities”: if *x* is prominent, it must occur in a prominent position and not be epenthetic. There are no other privileges associated with prominence, because it is not equal to markedness.

Apart from such theoretical considerations, there is a typological reason for excluding differentiated MAXV constraints from CON. The argument builds on another syncope pattern: anti-antigemination. Anti-antigemination (Odden 1988) is a pattern whereby vowels delete only between identical or homorganic consonants, as in Mussau:

(84) Mussau anti-antigemination (Blust 2001)

- | | | | | |
|---------------|-----------------------|-------------------|-----|-----------------------------|
| a. /papasa/ | ppása | ‘outrigger poles’ | cf. | papása (older generation) |
| b. /ŋaŋaŋala/ | ŋaŋaŋála | ‘to weep’ | cf. | ŋaŋaŋála (older generation) |
| c. /gagaga/ | gágga | ‘tidal wave’ | cf. | gagága (older generation) |
| d. bilíki | ‘skin’ | | | *bilki, *blik |
| e. karása | ‘whet, grind a blade’ | | | *karsa, *krasa |

The pattern is widely attested—Odden discusses anti-antigemination in Koya (Taylor 1969), Telugu (Krishnamurti 1957), Yapese (Jensen 1977), and Nukuoro (Carroll and Soulik 1973); to this we can add Blust’s (1990) Trukese, Tuvaluan, and Iban of Sarawak, and Blevins’ (2003) Dobel. The curious thing about this pattern of deletion is that of the

many cases reported in the literature, not one is differential—i.e., no language deletes only a subset of its vowels between identical consonants.⁸⁸

Rose 2000b argues for a specific prohibition against sequences of identical consonants; a variety of an OCP constraint (see also Fukazawa 1999, McCarthy 1986, Myers 1997, Suzuki 1998, Yip 1988, 1998).

(85) OCP: “No C_1VC_2 , where $C_1 = C_2$.” (adapted from Rose 2000b⁸⁹)

When this constraint dominates MAXV, the vowel deletes and the consonants automatically merge into a geminate (Keer 1999):

(86) Anti-antigemination syncope

/papasa/	OCP	MAXV
a. ɪ ppasa	✓(pp=geminate)	*
b. papasa	*!(p..p)	

Under this assumption, syncope is blocked between identical consonants not by the OCP but by constraints against geminates, as in Tonkawa, Afar and Yupik (cf. McCarthy 1986). Rose’s analysis thus explains how it is possible for there to be two opposite syncope patterns: one where syncope applies only between identical consonants, and one where syncope applies except between identical consonants (Yip 1988, Zoll 1996).

⁸⁸ Odden also cites Maliseet-Passamaquoddy (Sherwood 1983) as an example of anti-antigemination. Maliseet-Passamaquoddy is said to delete only short *a* and *ə* between identical consonants, which seems like a potential counterexample to this generalization. According to Sherwood, schwa deletes in other contexts, as well—not just medially, as in the example Odden cites (/tep-ǎpi-w/ → *teppo* ‘he sits inside,’ /mækwət-ǎpi-w/ → *kw’ətəpo* ‘he sits alone.’) Overall, though, Sherwood’s description is strongly influenced by his rather abstract analysis, which make it difficult to assess the value of this evidence.

⁸⁹ Rose assumes that two consonants are adjacent irrespective of intervening vowels, and that any surface identical CC sequence is a geminate. The definition in (85) is a close approximation of her OCP.

The patterns do not exactly mirror each other, though: while antigemination syncope can be differential (Yupik schwa deletion is—see §4.3.7), anti-antigemination syncope never is. This asymmetry can only exist if MAXV is a single constraint rather than the hierarchy MAX-A>>MAX-E,O>>MAX-I,U>>MAX-SCHWA. The reason is that no ranking of *NUC/x constraints, MAXV, and the OCP can produce a differential anti-antigemination pattern.

*NUC/x and the OCP do not really conflict—the OCP is violated when a vowel of any kind separates two identical consonants, while *NUC/x constraints are violated by vowels of a particular kind in all contexts. Their demands do not conflict—they overlap. Thus even if both the OCP and *NUC/x dominated MAXV, the result is not differential syncope between identical consonants—it’s differential syncope everywhere plus non-differential syncope between identical consonants:

(87) Factorial typology without differentiated MAXV constraints

OCP>>MAXV>>*NUC/x	syncope between identical consonants only
MAXV>>{OCP,*NUC/x}	No syncope
{OCP,*NUC/x}>>MAXV	differential syncope in all contexts, plus non-differential syncope between identical consonants

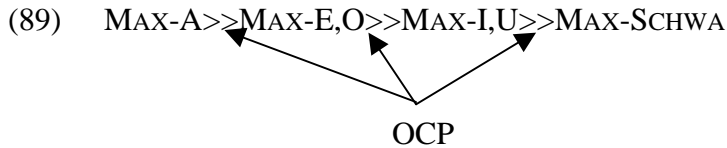
Consider the last ranking in (87), which is expanded in the tableau below. Under this ranking, syncope will apply to a low vowel between identical consonants, as in the first input. It will also apply to a high vowel between identical consonants, as in /pipasa/. Moreover, high vowels also syncopate between non-identical consonants. This pattern is like a hybrid between Lebanese Arabic and Mussau:

(88) Differential syncope plus anti-antigemination

		OCP	*NUC/i,u	MAXV
/papasa/	a. $\text{p}^{\text{h}}\text{papasa}$			*
	b. papasa	*!		
/pitasa/	c. $\text{p}^{\text{h}}\text{ptasa}$			*
	d. pitasa		*!	
/pipasa/	e. $\text{p}^{\text{h}}\text{ppasa}$			*
	f. pipasa	*!	*!	

The only possible differentiation in this theory comes from the ranking of MAXLONGV: if these constraints dominate the OCP, long vowels will not delete between identical consonants but short ones will (as in Afar—see Bliese 1981).

In the differentiated MAXV theory, the prediction does not pan out. If the OCP is ranked somewhere within the hierarchy rather than above or below it, as in (89), the anti-antigemination pattern can be differential.



For example, the tableau below shows a ranking under which high vowels syncope only between identical consonants. This is an unattested pattern:

(90) Wrong prediction of differentiated MAXV theory: differential anti-antigemination

		MAX-A	MAX-E,O	OCP	MAX-I,U
/papasa/	a. $\text{p}^{\text{h}}\text{papasa}$			*	
	b. ppasa	*!			
/pipasa/	c. $\text{p}^{\text{h}}\text{ppasa}$				*
	d. pipasa			*!	

The differentiated MAXV theory predicts that deletion between identical consonants can affect only vowels of a particular height, but this prediction does not

follow if MAX constraints do not refer to vocalic height or sonority. For this reason, the hierarchy in (89) should be excluded from CON.⁹⁰

For cases like Lebanese, this means that differential *has to be* the effect of some markedness constraint against low sonority vowels rather than of SWP or PARSE- σ . Once the constraints in (89) are excluded from CON, then MAX-A cannot protect *a* from deletion in metrically determined contexts while allowing *i* to delete there. Nevertheless, differential syncope can appear metrical without being a differential clone of a true metrical pattern, e.g., Hopi or Tonkawa—the richness of constraint interaction allows for this possibility.

4.4.6 Section summary

Lebanese Arabic high vowel syncope is a metrical/differential hybrid pattern: only marked high vowel nuclei are deleted, yet the locus of deletion is determined by prosodic constraints. The output must obey the same prosodic requirements that hold of words with low vowels: stress cannot be final in *ʔá.ka.lit*, so high vowel syncope cannot apply to more than one vowel in */nizil-it/* → *niz.lit*, **nzílt*. The prosodic character of this pattern was noted by Haddad 1984, who casts his syncope rule in metrical terms. In his account, vowels are deleted after foot structure is assigned, but they must be high, non-final and not dominated by strong foot branches. The analysis presented here does not assume an intermediate level at which foot structure is assigned but high vowels are not deleted; the

⁹⁰ Pulleyblank argues that these constraints are necessary to analyze *r*-deletion in Yoruba (Akinlabi 1993, Pulleyblank 1998) because *r* sometimes deletes together with neighboring high vowels but non-high vowels never delete. This pattern could be analyzed in other ways, though—e.g., by using context-specific constraints against *r* next to vowels of a specific height rather than a general **r*.

entire output is evaluated at once for its foot structure and the quality of its syllable nuclei. This allows for rather intricate interaction of diverse constraints, the outcome of which is the optimal and often most economical output.

We have now seen two grammars where economy effects are a response to the markedness of low sonority vowel nuclei. In these grammars, low sonority vowels have a dual status: they are marked as nuclei but unmarked as epenthetic vowels. I next turn to a case where *NUC/i,u does more than require syncope of high vowels—it also determines the quality of epenthetic vowels.

4.5 Avoidance of marked nuclei in Mekkan Arabic

No constraints have only economy effects. For example, SWP, which under some circumstances can favor syncope, can also be satisfied by syllable augmentation.

Likewise, PARSE- σ can be satisfied either by removing unfootable vowels or by footing them, i.e., by adding structure. The sonority constraints on syllable nuclei are no different. In Lillooet and Lebanese Arabic, deletion of low sonority nuclei is the only option for satisfying *NUC/x constraints, but in Mekkan Arabic, they have an additional effect: they determine the choice of epenthetic vowel. The pattern is all the more interesting because high vowel syncope and low vowel epenthesis coexist in this dialect of Arabic, so *NUC/x constraints do double duty.

4.5.1 The patterns

The following generalizations about Mekkan Arabic phonology are based on the work of Abu-Mansour 1987. Mekkan Arabic has the same vowel inventory as Lebanese, but it differs somewhat in syllable structure. Its syllables can be light (CV), heavy (CVC, CVV), or superheavy (CVVC). Tautosyllabic two-consonant clusters are permitted word-

initially and word-finally but not medially; in other words, there are generally no CCC sequences (except in fast speech; see fn. 93).

4.5.1.1 High vowel deletion

High vowels only rarely occur in open syllables in Mekkan. Underlying high vowels syncopate wherever it is possible to do so without creating a tautosyllabic CC cluster, as shown in (91). A verb with two low vowels (e.g., *katab* ‘write’) never loses its vowels throughout its paradigm. A verb with two high vowels (e.g., *kibir* ‘grow up’) loses its second vowel in the two-sided open syllable environment (VC__CV).

(91) High vowel deletion (Abu-Mansour 1987:129-130)

a.	/kibir/	ki.bir	‘he grew up’	cf.	ka.tab	‘he wrote’
b.	/kibir-t/	ki.birt	‘I, you (m.) grew up’		ka.tabt	‘I, you (m.) wrote’
c.	/kibir-at/	kib.rat	‘she grew up’		ka.ta.bat	‘she wrote’
d.	/kibir-na/	ki.bir.na	‘we wrote’		ka.tab.na	‘we wrote’
e.	/kibir-uu/	kib.ru	‘they grew up’		ka.ta.bu	‘they wrote’

Syncope is blocked by high-ranking syllable structure constraints (Abu-Mansour 1995). For example, there is no syncope after geminates or after CC sequences, as shown in (92) and (93).

(92) No syncope after geminates (Abu-Mansour 1987:136-137)

a.	ti.dár.ris	‘she teaches’	*ti.darrs
b.	ti.dár.ri.si	‘you (f) teach’	*ti.dárr.si
c.	mu.dár.ris	‘a male teacher’	*mu.darr.s
d.	mu.dár.ri.sa	‘a female teacher’	*mu.dárr.sa

(93) No syncope in CC__C (Abu-Mansour 1987:136)

a.	ʔák.tu.bu	‘I write it (m.)’	*ʔakt.bu
b.	yík.si.ru	‘they break’	*yiks.ru
c.	ʔák.ri.mi	‘you (f.) honor!’	*ʔakr.mi

Likewise, although word-initial two-consonant clusters are tolerated, high vowels are not deleted in initial syllables—syncope there is blocked by *COMPLEX. Recall that Lebanese

Arabic does have syncope in this environment, e.g. /fihim-na/ → *fhim.na*. This option is not available in Mekkan because syllable structure constraints take precedence over *NUC/x (in fact, as we will see shortly, underlying initial clusters must undergo epenthesis).

(94) No deletion in the word-initial syllable

- a. mu.dar.ris ‘a male teacher’ *mdar.ris
 b. ti.raa.sil ‘you (m.) correspond’ *traa.sil

Another constraint on high vowel syncope is that it does not apply between identical consonants in the verbal morphology—it is blocked by a constraint against geminates (Rose 2000b; see also §4.4.5).⁹¹ This is shown in (95); compare (a) with (b-c), where syncope fails to apply.

(95) No high vowel syncope between identical consonants (Abu-Mansour 1987:151)

- a. /ʔa-kaatib-u/ ʔa.kaat.bu ‘I write to him’ cf. ʔa.kaa.tib.ha ‘I write to her’
 b. /yi-ʃaarir-u/ yi.ʃaa.ri.ru ‘he fights with him always’ *yi.ʃaar.ru
 c. /ʔa-ħaaʒiʒ-u/ ʔa.ħaa.ʒi.ʒu ‘I argue with him’ *ʔa.ħaa.ʒ.ʒu

To summarize, high vowels delete in Mekkan Arabic in two-sided open syllables, which happen to be the only environment where syllable structure constraints permit deletion.

4.5.1.2 Low vowel epenthesis

Vowels are inserted for reasons of syllable structure: to avoid medial superheavy syllables and tautosyllabic consonant clusters. When a consonant-initial suffix is added after a geminate (96), a sequence of two consonants (97), or a VVC sequence (98), *a* is

⁹¹ Syncope does apply in non-verbal forms, /daabib-at/ → *daabba* ‘animal’ (see Abu-Mansour 1987, Bakalla 1979, McCarthy 1986 and Rose 2000a for related discussion).

inserted before the suffix.⁹² This vowel is absent otherwise, thus /ʔa-kaatib-ha/ surfaces as *ʔa.kaa.tib.ha* ‘I write to her,’ not as **ʔa.kaa.ti.ba.ha*.

(96) Epenthesis after geminates (Abu-Mansour 1987:165)

- | | | | |
|----|------------|------------|-------------------|
| a. | /ʔumm-na/ | ʔum.ma.na | ‘our mother’ |
| b. | /ʔadd-hum/ | ʔad.da.hum | ‘he counted them’ |

(97) Epenthesis into medial consonant clusters (Abu-Mansour 1987:163-171)

- | | | | | |
|----|--------------------|--------------------|------------------------|--------------------------------|
| a. | /ʔumr-ha/ | ʔum.ra.ha | ‘her age’ | *ʔ <u>umr</u> .ha: no clusters |
| b. | /kalb-kum/ | kal.ba.kum | ‘your (pl.) dog’ | |
| c. | /katab-t-ha/ | ka.tab.ta.ha | ‘I wrote it (f.)’ | |
| d. | /katab-t-l-kum/ | ka.tab.tal.kum | ‘I wrote to you (pl.)’ | |
| e. | /ʔaʕtaree-t-l-hum/ | ʔaʕ.ta.ree.tal.hum | ‘I bought for them’ | |
| f. | /ʔaddeet-l-ha/ | ʔad.dee.tal.ha | ‘I counted for her’ | |

(98) Epenthesis after long vowels (Abu-Mansour 1987:163-164)

- | | | | | |
|----|---------------|----------------|-----------------|---|
| a. | /muftaaḥ-kum/ | muf.taa.ḥa.kum | ‘your (p.) key’ | *muf. <u>taah</u> .kum: *σ _{μμμ} |
| b. | /saab-hum/ | saa.ba.hum | ‘he left them’ | |
| c. | /naay-ha/ | naa.ya.ha | ‘her flute’ | |

Epenthesis also applies to words that have two consonants initially. Mekkan is unusual among onset dialects in having prothesis in such situations rather than epenthesis; this will be analyzed as a contiguity effect.

(99) Word-initial epenthesis (Abu-Mansour 1991, Abu-Mansour 1987)

- | | | | | |
|----|-----------|------------|------------------|------------------------|
| a. | /t-rafaz/ | ʔat.ra.faz | ‘to be kicked’ | |
| b. | /ktub/ | ʔak.tub | ‘Write!/I write’ | cf. ni-ktub ‘we write’ |
| c. | /n-katab/ | ʔan.ka.tab | ‘was written’ | |

⁹² I am ignoring the pattern of “prepausal” epenthesis, where the epenthetic vowel is not [a] but usually a copy of the preceding vowel: /kusr/ → *kusur* ‘break,’ /kizb/ → *kizib* ‘lying,’ /ʃiʕr/ → *ʃiʕir* ‘poetry,’ /ʃahr/ → *ʃahar* ‘mouth.’ This pattern is not entirely regular; the quality of the epenthetic vowel sometimes depends on the preceding consonant, as in /ʔamr/ → *ʔamur* ‘command’ (Jastrow 1980:107-108) and sometimes is unpredictable.

To sum up, high vowels syncopate but low vowels are epenthesized. High vowels are marked as syllable nuclei in all contexts, whether they are epenthetic or not.

4.5.2 Analysis

High vowels make poor syllabic nuclei because they are low in sonority, so syncope is used to get rid of them wherever possible. These nuclei are avoided in epenthetic contexts for the same reason. *NUC/i,u has two effects in the grammar of Mekkan Arabic. The first is an economy effect: it causes syncope by dominating MAXV. The second is not an economy effect: it determines the quality of epenthetic vowels by dominating the RECOVER constraints. I start with the analysis of syncope.

4.5.2.1 Syncope

Syncope is the result of *NUC/i,u dominating MAXV. High vowels are deleted in /kibir-at/ → *kibrat* ‘she grew up,’ but low ones are not /katab-at/ → *katabat* ‘she wrote.’ IDENT[high] must also dominate MAXV, because lowering of *i* to *a* is impossible (candidate (c) shows this):

(100) No low-sonority nuclei

/naajifi-a/	*NUC/i,u	IDENT[hi]	MAXV
a. naaj.ħa			*
b. <i>naa.ji.ħa</i>	*!		
c. <i>naa.ja.ħa</i>		*!	

Low vowels do not delete under any circumstances, so MAXV must dominate all other constraints that favor syncope: PARSE-σ, SWP, *MAR_{FT}/x, etc. Thus there is no syncope of *a* in the weak branch of a foot in *ká.ta.bu*, which means that MAXV dominates *MAR_{FT}/a. By transitivity, MAXV also dominates all the other *MAR_{FT}/x constraints, which are universally ranked below it.

(101) No deletion of *a* in the weak branch of a foot

/katab-u/	MAXV	*MAR _{FT} /a	SWP
a. كَات (ká.ta)bu		*	*
b. (kát)bu	*!		

Lebanese Arabic syncope is primarily blocked by metrical constraints, but in Mekkan Arabic syllable structure constraints take precedence over *NUC/i,u. As shown in (102), *COMPLEX prevents the deletion of the first vowel in *ki.birt*. This is in contrast to Lebanese, where *COMPLEX is ranked below *NUC/i,u—initial clusters are created by syncope in such words.⁹³ This same ranking explains the lack of syncope after two-consonant sequences in *ʔák.tu.bu* (*ʔákt.bu) and in the first syllable in /mudarris/ → *mdarris.⁹⁴

(102) Syncope cannot create a cluster

/kibir-t/	*COMPLEX	*NUC/i,u
a. كِبِرْ kī.birt		*
b. kbirt	*!	

Just as in Lebanese, high vowel deletion does not apply word-finally in Mekkan Arabic in words like *nísi* and *kátabu*, which is due to the high-ranking positional

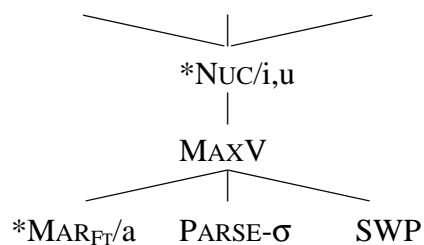
⁹³ This explanation is incomplete, because the ranking *NUC/i,u >> *COMPLEX predicts that syncope will create medial clusters in Lebanese Arabic, which is not the case. It is possible that in Lebanese Arabic, initial two-consonant sequences are actually not monosyllabic—the first consonant could be a minor syllable or an appendix to PrWd.

⁹⁴ In fast speech, the opposite ranking applies. Vowel deletion applies optionally in *yistaʕigiru* ~ *yistaʕigru* ‘they despise,’ *tigarbi ʕu* ~ *tigarb ʕu* ‘you (pl.) make noises,’ *tinʕulu* ~ *tinʕlu* ‘you (pl.) steal’ (Abu-Mansour 1987:142). The resulting consonant clusters must obey sonority sequencing; the first consonant in the coda cluster must be more sonorant than the second (cf. *ti ʕriʕi*, **ti ʕr.fi* ‘you (f.) know,’ *tis.li.mi* not **tisl.mi* ‘you (f) become a muslim.’)

faithfulness constraint ANCHOR-EDGE. Abu-Mansour (1995) uses FTBIN to block deletion in *nísi*, observing that words are always binary, but there is no apocope in longer words either.

To summarize, high vowels never lower in Mekkan Arabic but they syncopate whenever possible to do so without violating high-ranking syllable structure and faithfulness constraints. The following rankings are crucial to this interaction:

(103) *COMPLEX IDENT[Hi] ANCHOR-EDGE



This analysis does not address the locus of deletion in longer words. Abu-Mansour does not discuss longer words, but it is likely that syncopate in longer words is controlled to a large extent by prosodic constraints, just as in Lebanese or Cairene Arabic (Kenstowicz 1980, though cf. Davis and Zawaydeh 1996, Mester and Padgett 1994).

Deletion is an economy effect of *NUC/i,u: because it dominates MAXV, deletion is preferred to the faithful and less economical parsing of marked high vowel nuclei. The next section addresses another effect of *NUC/i,u that is not related to economy: its influence on the selection of the epenthetic vowel.

4.5.2.2 A-epenthesis

Mekkan Arabic epenthesizes vowels into consonant clusters and after superheavy syllables, i.e., epenthesis is a way to satisfy *COMPLEX and *σ_{μμμ}. While most dialects of Arabic are like Lebanese in that they choose *i* as their epenthetic vowel (Farwanah 1995), Mekkan and Sudanese have epenthetic *a*. The quality of the epenthetic vowel in these

dialects is determined by the same constraints that favor high vowel syncope. From the standpoint of markedness (not faithfulness), *a* is the best epenthetic vowel, since it alone violates no *NUC/x constraints. The tableau below shows the markedness violations of various epenthetic vowels with respect to *NUC/x and *MID, which bans mid vowels from the core vowel inventory of Mekkan Arabic.

(104) Low vowel epenthesis favored by the *NUC hierarchy

/katab-t-ha/	*NUC/ə	*MID	*NUC/i,u	*NUC/e,o
a. [katabtaha]				
b. katabteha		*!		*
c. kabtīha			*!	
d. kabtəha	*!			

The difference between Mekkan Arabic and *i*-dialects, then, is the relative ranking of *NUC/x and RECOVER. In *i*-dialects, REC/a dominates *NUC/i,u, while in Mekkan the opposite ranking holds.

This effect of *NUC/i,u is not structural economy—the winner in (104) does not contain any fewer syllables or vowels than its competitors. Indeed, under a certain definition of economy, *a* is less economical than *i*, *ə*, or *e*, since it is phonetically longer and therefore requires more articulatory effort. In his discussion of vowel reduction, Lindblom claims that “...speech production appears to operate as if physiological processes were governed by a *power constraint* limiting energy expenditure per unit of time” (Lindblom 1983:231). This “power constraint,” however it is formally expressed, cannot apply in Mekkan, since its least “effortful” short high vowels are clearly avoided in favor of the longer-winded low vowels. The reason for this is markedness—high vowels are doubly marked in that they are deleted and not epenththesized.

Why not simply delete all the marked high vowel nuclei and replace them with the unmarked low ones? The answer is faithfulness. Epenthetic vowels can only appear between morphemes in Mekkan Arabic (/naay-ha/ → *naa.ya.ha* ‘her flute’), which drastically limits the possibilities for such vowel swapping.

Morpheme-internal epenthesis is blocked by a morphologically sensitive version of the correspondence constraint O-CONTIG (see (105)). This epenthesis pattern is similar to that of Chukchee, where CC+C → CCəC but C+CC → CəCC (Kenstowicz 1994).

(105) O-CONTIG_M (No Intrusion into morphemes): “If S₂ stands in correspondence with S₁, where S₁ is a morpheme, S₂ forms a contiguous string” (adapted from Kenstowicz 1994, McCarthy and Prince 1995).

Deleting high vowels and replacing them with low ones violates O-CONTIG_M whenever epenthesis has to intrude into a morpheme. In /kibir/, high vowel deletion is blocked by *COMPLEX and lowering is ruled out by IDENT. Deleting and epenthesizing to *kabar* instead of lowering to *kabar* is not prohibited by either *COMPLEX or IDENT; instead, O-CONTIG_M must rule out this type of unfaithfulness. Violating *NUC/i,u ends up being the least of four evils:

(106) Deleted high vowels are not replaced by inserted low ones

/kibir/	IDENT[hi]	O-CONTIG _M	*COMPLEX	*NUC/i,u	DEPV	MAXV
a. ɪ kibir				**		
b. <u>kabar</u>		*!			**	**
c. kbir			*!	*		*
d. <u>kabar</u>	*!*					

One environment in particular shows the effect of O-CONTIG_M. Although surface medial superheavy syllables can be created by high vowel syncope, underlying /VVC+C/ sequences undergo epenthesis:



(107) Superheavy syllables, epenthesis and syncope

- a. /naajih-a/ → naaǰ.ħa *naa.ji.ħa
 b. /naay-ha/ → naa.ya.ħa *naay.ha

Contiguity allows epenthesis only in the second case. O-CONTIG assigns a violation mark to the mapping /naajih-a/ → *naa.ja.ħ-a but not to /naay-ha/ → naay-a-ha. In *naa.ja.ħ-a, the output segments of the root morpheme do not form a contiguous string because the epenthetic *a* intervenes. It does not matter that these segments are not adjacent in the input because O-CONTIG only evaluates the contiguity of output strings of correspondents. (Syncope violates I-CONTIG, but it is ranked low in Mekkan.) Conversely, in naay-a-ha, all of the tautomorphic correspondents form contiguous strings, because the epenthetic vowel is between them.

The non-concatenative morphology of Mekkan Arabic never gives rise to monomorphemic CVVCC strings (Abu-Mansour 1987:155), so syncope is the only source of surface medial superheavy syllables. This means that *σ_{μμμ} must be dominated by O-CONTIG and by *NUC/i,u: output superheavy syllables are tolerated (see (a)) when the alternative is epenthesis into a morpheme (see (b)) or a marked high vowel nucleus (see (c)). On the other hand epenthesis between morphemes is acceptable (see (d-e)).

(108) Contiguity prevents morpheme-internal epenthesis in -CVVC- strings

		O-CONTIG _M	*NUC/i,u	*σ _{μμμ}	DEPV	MAXV
/n ₁ aa ₂ j ₃ i ₄ ħ ₅ -a ₆ /	a.  n ₁ aa ₂ j ₃ .ħ ₅ -a ₆			*		*
	b. n ₁ aa ₂ .j ₃ i ₄ .ħ ₅ -a ₆		*!			
	c. n ₁ aa ₂ .j ₃ a.ħ ₅ -a ₆	*!			*	*
/n ₁ aa ₂ y ₃ -h ₄ a ₅ /	d.  n ₁ aa ₂ y ₃ a-h ₄ a ₅				*	
	e. n ₁ aa ₂ y ₃ -h ₄ a ₅			*!		

There is evidence that the non-morpheme-specific version of O-CONTIG is active in Mekkan, as well: recall that in words with initial consonant clusters, the epenthetic vowel is positioned to the left of the cluster even when the cluster is heteromorphemic: /t-rafaz/ → *ʔat.ra.faz* ‘to be kicked’ not **ta.ra.faz*. Prothesis here is accompanied by ʔ-epenthesis, since onsetless syllables are categorically prohibited in the language. Only *ʔat.ra.faz* satisfies O-CONTIG and ONSET, which suggests that O-CONTIG dominates DEP-C: inserting the consonant would not be necessary if epenthesis could break up the output consonant sequence.

Other factors contribute to the positioning of the epenthetic vowel as well. As is well-known, epenthesis in the so-called onset dialects is generally between the second and the third consonant in a cluster, regardless of morphological structure: alongside *kal.ba.kum*, we get /katab-t-ha/ → *ka.tab.ta.ha* ‘I wrote it (f.).’ The simplest analysis of this is metrical: epenthesis between the first and the second consonant here creates an open light syllable in unstressed position (as in (*ʔúm*)*ra.ha*), which is better than the alternative where the epenthetic vowel is in an unstressed heavy syllable (as in (*ʔú.már*)*ha*) or is itself the head of the prosodic word, violating Alderete’s HEAD-DEP constraint (see §4.3.2): *(*ʔú.már*)*ha*. But this sort of analysis cannot be readily extended to coda dialects, where epenthetic vowels head unstressed closed syllables (Broselow 1992a). A full analysis of epenthetic vowel positioning would take me too far off the topic of economy—the reader is referred to the works cited in this section.

*NUC/i,u is implicated in two separate processes in Mekkan Arabic. The first of these, syncope, results in structural economy. The second, however, does not: epenthetic

vowel quality and economy are not directly related. If anything, low vowel epenthesis results in *increasing* articulatory effort, since low vowels arguably take more energy to produce. The result could be argued to be anti-economy—high, shorter vowels are deleted but low, longer vowels are inserted. This pattern is consistent with a markedness analysis but not with this sort of economy reasoning.

4.5.3 Summary of the analysis of Mekkan Arabic

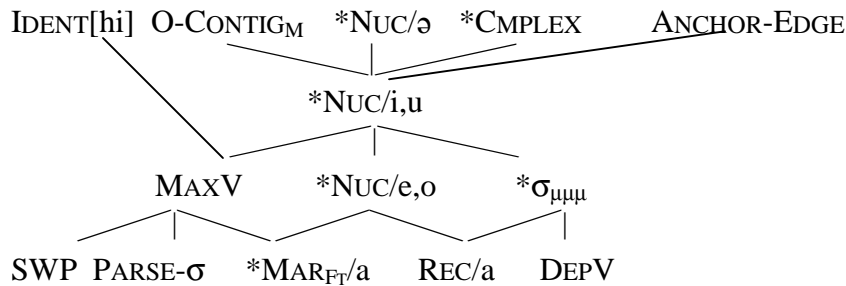
Mekkan Arabic shows that *NUC/i,u is not just an economy constraint, even though it can have economy effects. Because of its high ranking in Mekkan Arabic, high vowels are doubly marked: they are removed by syncope and they are avoided in epenthesis. Nevertheless, various faithfulness and markedness constraints prevent wholesale deletion of high vowels and their replacement with low ones.

The grammar is shown in action in the comparative tableau (109). The first two candidates show why deletion is impossible in CVCVC words—such candidates violate either *COMPLEX or O-CONTIG_M. (IDENT and all the candidates that violate it have been left out from the tableau for reasons of space—only the syncope/epenthesis candidate is considered.) Next, the grammar's output for the input /naay-ha/, *naa.ya.ha*, is selected because it satisfies *σ_{μμ} at the expense of violating DEP_V: underlying morpheme-final CVVC- sequences must surface with epenthesis. The candidates for the input /tiraasil-u/ show that -CVVC- syllables derived by syncope are acceptable because the alternative, epenthesis, violates the undominated O-CONTIG_M. Finally, the last group of candidates shows why the epenthetic vowel is low: the constraints that favor a less prominent epenthetic vowel (i.e., *MAR_{FT}/a (not shown) and REC/a) are ranked below the *NUC/x constraints, which uniformly disfavor everything but *a*.

(109) Mekkan epenthesis and syncope

/kibir/	OCONTIG _M	*CMLPX	*NUC/i,u	*σ _{μμμ}	DEPV	MAXV	REC/a
a. ki.bir~kbir		W	L			W	
b. kibir~ <u>ka</u> bar	W		L		W	W	W
/naay-ha/							
c. naa. <u>ya</u> .ha~naay.ha				W	L		L
/tiraasil-u/							
d. ti.raas.lu~ti.raa.si.lu			W	L		L	
e. ti.raas.lu~ti.raa. <u>sa</u> .lu	W			L	W		L
/ʕumr-ha/							
f. ʕum. <u>ra</u> .ha~ʕumr.ha		W		W	L		L
g. ʕum. <u>ra</u> .ha~ʕum.r <u>i</u> .ha			W				L

(110) Ranking for Mekkan Arabic



Avoidance of high vowel nuclei is so pervasive in Mekkan Arabic that syncope is used to remove them and epenthesis never creates them. Syncope, an economy effect, is just one aspect of this tendency—not an end goal in itself.

4.5.4 Alternative analysis: no short [i] in open syllables

High vowel syncope has received a lot of attention in the phonological literature—there are many rule-based and OT analyses of the Mekkan pattern as well as of other Arabic dialects. I do not know of any analyses that have focused specifically on the quality of the syncope and epenthetic vowel, so this is the chief contribution of this analysis to that body of work. In this section, I will consider the differences between the predictions of the *NUC/x analysis and of other analyses.

The traditional practice in the literature is to assume that deletion obeys the fairly specific prohibition on short high vowels in open syllables, $*\text{ɪ}_\sigma$ (Kager 1999, Kenstowicz 1996a and others). Most analysts simply adopt the constraint for convenience, but Farwaneh 1995 offers some justification for it—she argues that high vowels in open syllables are not prominent enough and that closing off the syllable by syncope to $[\text{CiC}_\sigma]$ makes it as prominent as a $[\text{Ca}_\sigma]$. She notes that *a*-epenthesis is only found in onset dialects, and argues that even those dialects have *i*-epenthesis in closed syllables in prepausal epenthesis (e.g., $/\text{kizb}/ \rightarrow \text{kizib}$ ‘lying,’ see fn. 92). Abu-Mansour 1987 and Jastrow 1980 make it clear that this is not the case, however—the epenthetic vowel in prepausal epenthesis sometimes is *a*. More importantly, in the productive epenthesis pattern of the kind discussed in this section, *a* is inserted throughout, whether the resulting syllable is open or closed (e.g., $/\text{katab-t-l-kum}/ \rightarrow \text{katabtalkum}$ ‘I wrote to you (pl).’ If $*\text{ɪ}_\sigma$ were active in the process, we would expect high vowels to be inserted in closed syllables. Only a fairly general constraint like $*\text{NUC}/x$ can explain this, since it favors low vowels in open or closed syllables.

I argue that *i* is avoided in Mekkan not just in open syllables but throughout—its marked status derives from its being a low-sonority nucleus, not from its being in a closed or open syllable. The seeming markedness of *i* in open syllables is just an artifact of the overall grammar.

The usefulness of $*\text{ɪ}_\sigma$ is put further into question when we look to other dialects of Arabic. The $*\text{NUC}/i,u$ analysis of high vowel syncope matches the success of the $*\text{ɪ}_\sigma$ analysis in all the relevant ways without the undesirable predictions that come with introducing $*\text{ɪ}_\sigma$ into CON. This constraint is somewhat odd in its formulation; for one

thing, it predicts the lowering of /i/ in open syllables but not in closed ones under the ranking $*\check{i}_\sigma \gg \text{IDENT}[\text{hi}]$. In fact the opposite happens in Bedouin Arabic: low vowels raise in open syllables but not in closed ones. In Bedouin Arabic, /katabat/ maps to *ktíbat*. If high vowels are marked in open syllables, why not go to *katbat* or *kitbat*? The pattern cannot be explained in terms of *NUC constraints, either, but at least *NUC constraints do not prefer the losers *katbat* and *kitbat* to the winner *ktibat*, unlike $*\check{i}_\sigma$. (The reader is referred to McCarthy 2003 for further discussion of this complex pattern).

The *NUC/x hierarchy gives the quality of the epenthetic vowel for free, without additional mechanisms. Abu-Mansour 1995 does not discuss this issue, but it is clear that the constraint $*\check{i}_\sigma$ cannot explain why the epenthetic vowel is *a* generally, not just in open syllables (recall *katabtalkum*). In short, the *NUC/x hierarchy offers a more general account without the need to resort to constraints like $*\check{i}_\sigma$.

The constraint $*\check{i}_\sigma$ also predicts consonant gemination after high vowels but not elsewhere. Patterns where consonants geminate after vowels of a particular height are attested: one famous example comes from Central Alaskan Yupik, where consonants geminate following a stressed [ə] (see §4.3.7). But the Yupik pattern is really the result of avoidance of long schwa, not of schwa in an open syllable⁹⁵ (Gordon 2001). In other

⁹⁵ Brainard 1994 describes a similar pattern in Karao: [i] must be followed by a geminate consonant (unless it is the last syllable, where a non-geminate coda is required): /man-saxet/ → *mansaxet*, /mín-saxet/ → *mínnaxet*, /ʔi-saxet-an/ → *ʔissaxetan*, cf. *saxet* ‘to get sick.’ This is the only environment where geminates occur in the language. This is a curious pattern, but it does not provide evidence for $*\check{i}_\sigma$. There is clearly something odd about this environment for gemination but there is no reason to think that it is driven by the requirement on [i] to be in a closed syllable—a non-geminated coda would satisfy this requirement just as well, /mín-saxet/ → **mínsaxet*. I leave this for future research.

words, this is not a general post-schwa gemination pattern. The constraint $*\check{i}_\sigma$ can favor a post-*i* gemination pattern and indeed predicts it; $*\text{NUC}/x$ constraints do not.

An even stranger prediction of $*\check{i}_\sigma$ is non-differential syncope of any vowel after an *i* in an open syllable: e.g., /pataka/ → *pa.ta.ka* but /pitaka/ → *pit.ka*. While the quality of neighboring vowels can sometimes affect whether syncope applies or not (Sorvacheva 1977 argues that it does in the Lower Vychegda dialect of Komi-Zyrian), what matters in such patterns is the sonority of foot heads and margins, not whether the syncope vowel is preceded by a high vowel in an open syllable. The problem here is that the markedness constraint $*\check{i}_\sigma$ does not give any instructions on how to remove the marked structure—both gemination of the following consonant and syncope of the following vowel are options available to GEN. The constraint $*\check{i}_\sigma$ is not equivalent to the rule /i/ → ∅ /C__CV, and it should be kept in mind that in OT there is a wealth of alternatives for any marked structure.

Generality is a virtue for a constraint—constraints should not be *too* context-specific in OT because constraint interaction produces much of the needed complexity. The various factors involved in high vowel syncope conspire to create the illusion that a high vowel in an open syllable is somehow more marked than a high vowel in a closed syllable or a low vowel in any syllable, but this markedness relationship does not necessarily imply that this preference is encoded in a harmonic scale in CON: $\{Ca, CaC, CiC\} \succ Ci$. Mekkan Arabic shows that constraint interaction can derive this harmonic relationship without overly context-specific constraints.

4.6 Avoidance of marked foot heads in Lushootseed

This case study continues the theme of the previous section: no constraint has just economy effects; the same output goal can be met through a variety of means, even in a single grammar. Mekkan Arabic showed that apart from having economy effects, *NUC/i,u also affects the quality of the epenthetic vowel. Lushootseed shows a similar complexity in its pattern of low vowel syncope. In one sense, Lushootseed is the opposite of Mekkan Arabic: in Lushootseed, low vowels syncope but high ones do not, and the epenthetic vowel in Lushootseed is high, not low. Yet in another sense, Lushootseed is just like Mekkan Arabic: in both languages, vowels in marked contexts are avoided through a variety of means; economy effects are part of a larger system.

Lushootseed also raises an issue for theories of differential vowel behavior. Low vowel syncope in the absence of high vowel syncope puts in question fixed rankings of MAX constraints of the sort proposed by Hartkemeyer 2000 and Tranel 1999 (see §4.3.6.3). At the very least, the fixed MAX hierarchy theory is insufficient: without further adjustments of some sort, differential syncope of low vowels simply is not possible in this approach. Adding context-free markedness constraints (Lombardi 2003, see §4.3.6.4) expands the power of the *STRUC/MAX hierarchy theory, but it expands it a bit too far: *LOW, for example, favors the deletion *a* in all contexts, which is not what we find in Lushootseed. To correctly analyze its pattern, *PK_{FT}/X and *MAR_{FT}/X need to be introduced, while context-free markedness constraints are demoted to the point where they pay no role in the analysis. This variety of economy constraints thus proves to be as unnecessary as *STRUC(σ) was in analyzing metrical syncope (chapter 3).

4.6.1 The patterns

The discussion of Lushootseed (Central Salish, Puget Sound, Washington State) presented in this section closely follows the description and analysis of Urbanczyk 1996, supplemented by data from Bates et al. 1994 and Hess 1998. Lushootseed has a four-vowel system [i, u, a, ə] with a length distinction. The syllable structure of Lushootseed is somewhat controversial (see Urbanczyk 1996, ch. 3), but not in ways that are crucially relevant to syncope or stress. The stress system is sonority-sensitive. The generalizations can be stated as follows:

(111) Lushootseed stress and syncope generalizations:

- a. Default leftmost stress moves onto the next full vowel to avoid stressed ə.
- b. When *a* cannot be stressed, it syncopates.
- c. If the resulting cluster has rising sonority, *a* reduces to ə instead of deleting.

The patterns are exemplified in (112)-(116) (the data are from Urbanczyk 1996 unless otherwise indicated). As shown in (112), default stress is leftmost when all vowels in the word are of equal sonority or when the first is more sonorous than the second.

(112) Stress pattern: default left

- a. jəsəd ‘foot’
- b. ʔítut ‘sleep’
- c. sáliʔ ‘two’
- d. sáx^wil ‘grass, hay’

When the first vowel is schwa, stress moves onto the leftmost non-schwa vowel (113).

(113) Avoid stressed ə

- a. təyíl ‘to go upstream’
- b. čəg^wás ‘wife’
- c. k’ədáyu ‘rat’
- d. čəláq ‘ask permission’ (Bates et al. 1994: 63)

In about 50% of the cases, stress also moves to avoid unstressed *a*, as shown in (114).

This suggests that high and low vowels are not fully conflated in the sonority-sensitive stress system of Lushootseed (see de Lacy 2001, 2002a and Prince 1997a, b on conflation).

(114) Avoid unstressed *a*

- | | | | |
|----|------------------------|----------------------------------|---|
| a. | biłáʔ | ‘have more than enough’ | *bíłaʔ |
| b. | yuwáł | ‘the very’ | *yúwał |
| c. | q ^w uwádbəč | ‘an owl of unidentified species’ | *q ^w úwadbəč (Bates et al. 1994:194) |

Relatively rare are words that have more than one *a*, especially in a row. CV-

reduplication is one morphological context where such words are expected, but here the second of two low vowels syncopates, as shown in (115). High vowels generally do not

syncopate in this position.⁹⁶ In (116) syncope is impossible because the resulting

sequence of a voiceless obstruent followed by a voiced obstruent is illegal. Instead of syncopating, *a* reduces to ə there:

(115) Delete *a* from unstressed positions, keep *i*

- | | | | |
|----|------------------------------|--------------------------|--|
| a. | /RED-caq’/ | cácq’ | ‘to spear big game on salt water’ |
| b. | /RED-walis/ | wáwlis | ‘little frog’ *wáwālis |
| c. | /RED-laq-il/ | láʔlqil | ‘be a little late’ *laʔlaqil |
| d. | /s-RED-tiqiw/ | stítiqiw | ‘pony, foal’ *títqiw (Bates et al. 1994:226) |
| e. | /RED-hiqəb/ | híhiʔəb | ‘too, excessively’ (Bates et al. 1994:110) |
| f. | /RED-wiliq’ ^w id/ | wíwiliq’ ^w id | ‘quiz someone’ (Hess 1998:5/Bates et al. 1994:248) |

⁹⁶ There are some exceptions to this, most of which involve high vowels syncopating in unstressed positions. E.g., *kupi* ‘coffee’ → *kukupi*, **kukupi*, and *pišpiš* ‘cat’ → *pipšpiš*, **pipišpiš*. Urbanczyk tests the generalization with chi-square tests on dictionary word counts, which show that the higher propensity of *a* to syncopate is non-accidental. Possibly relevant is the fact that *kupi* is a loan from English, while *pišpiš* is from Chinook Jargon (Adam Werle, p.c.).

(116) When syncope is blocked by cluster condition, reduce *a* to *ə*

- | | | | | |
|----|--------------------------------------|---|---|----------------------------------|
| a. | /s-RED- <u>l</u> ag ^w id/ | s- <u>l</u> á <u>l</u> əg ^w id | *s- <u>l</u> á <u>l</u> g ^w id | ‘little mat’ |
| b. | /RED-tabəc/ | táʔtəbəc | *taʔ <u>t</u> bəc | ‘slowly, softly’ |
| c. | /RED-čaləs/ | čáčələs | *čáč <u>l</u> əs | ‘little hand’ |
| d. | /RED-saliʔ/ | sáʔsəliʔ | *saʔsliʔ | ‘two little items’ (Hess 1998:7) |

There is a further twist in the reduplication pattern. When the base contains a low vowel or a short non-schwa vowel, it appears in the reduplicant without alternations, as in (115) and (116). When the base contains a *ə*, a consonant cluster, or a long vowel (not shown), the reduplicant “overwrites” the base vowel with *i*:

(117) *Ci* reduplication with schwa (Alderete et al. 1999:340)

- | | | | |
|----|---------------------|--------------------------------------|--------------------------------|
| a. | təláw-il | tí-təlaw’-il | ‘run’/ ‘jog’ ⁹⁷ |
| b. | g ^w ədíl | g ^w í-g ^w ədil | ‘sit down’/ ‘sit down briefly’ |

To summarize, the distribution of vowels in Lushootseed is to a large extent determined by the sonority-sensitive stress system: low and high vowels are preferred in stressed positions, while *ə* is preferred in unstressed positions. Syncope, reduction, and overwriting are the strategies used to ensure these output goals.

⁹⁷ According to the transcription in the *Lushootseed Dictionary*, the third vowel in *tí-təlaw’-il* does not syncopate or reduce to schwa, contrary to Urbanczyk’s generalizations. It may be that this is an exceptional form, but it is even more likely that there is a secondary stress on the *a*. Secondary stresses (or primary stresses, for that matter) are not consistently transcribed in the dictionary, but forms like *ʔá-ʔəgwələb* ‘yawn-LG’ (cf. *ʔəgwələb* ‘yawn’) indicate that non-initial *a* does sometimes bear secondary stress.

4.6.2 Analysis

4.6.2.1 Stress

I follow Urbanczyk 1996 in assuming that Lushootseed feet are trochaic—the language has initial default stress. Departures from the default pattern (ignoring lexically stressed suffixes, etc.) arise as a result of the conflict between PARSE- $\sigma 1$ “the first syllable is footed”⁹⁸ and the $*PK_{FT}/X$ constraints. When all vowels in the word are of the same sonority, as in (*jəsəd*), stress is initial— $*PK_{FT}/ə$ is violated whether stress is moved or not, so PARSE- $\sigma 1$ breaks the tie. PARSE- $\sigma 1$ is violated when the first syllable contains a schwa but the second contains a more sonorous vowel, as in *k'ədáyu*. Finally, in about half of the cases, *a* pulls the stress away from high vowels, as in *bi(łáʔ)*.

(118) Stress low vowel, else leftmost

	$*PK_{FT}/ə$	$*PK_{FT}/i,u$	PARSE- $\sigma 1$
a. $\text{ɪ}^{\text{ə}}(\text{jəsəd})$	*		
b. $\text{jə}(\text{sód})$	*		*!
c. $\text{ɪ}^{\text{ə}}\text{k'ədáyu}$			*
d. $(\text{k'ədə})\text{yu}$	*!		
e. $\text{ɪ}^{\text{ə}}\text{bi}(\text{łáʔ})$			*
f. (bíłáʔ)		*!	

Stress retraction is the first effect of sonority-sensitive stress constraints in Lushootseed: foot placement deviates from the normal pattern so that high sonority matches the stressed position. There are other ways to achieve the same goal, e.g., reduction and deletion. It is in principle possible to place the foot at the left edge of the word while

⁹⁸ Urbanczyk uses the gradient alignment constraint ALIGN-L (FT, PRWD).

avoiding stress on schwa by deleting one of the vowels. In a word like *čəláq* ‘ask permission,’ the low vowel could be reduced to schwa without moving stress from the preferred initial position, as in **čələq*. It could also be deleted yielding **čəlq* without violating high-ranking constraints on resulting clusters—*lq#* is a possible cluster; cf. , *hucədálq* ‘where will I take this game.’ (This is true in general, although as we will see in the next section, *a* does reduce to schwa or delete when it cannot be stressed.) The lack of reduction and deletion indicates that MAXV and IDENT dominate PARSE-σ1:

(119) No reduction and deletion in general

/čəlaq/	IDENT	MAXV	PARSE-σ1
a. $\text{[}^{\text{[}}\text{čə(láq)}$			*
b. (čələq)	*!		
c. (čəlq)		*!	

Reduction and deletion are not available regardless of the direction of change: underlying *a* cannot become schwa, and underlying schwa does not lower to *a* in the first syllable, as in */jəsəd/* → **jásəd*. IDENT must dominate **PK_{FT}/ə* to select the marked *jásəd* over the unfaithful **jásəd*:

(120) No stressed schwa lowering

/jəsəd/	IDENT	*PK _{FT} /ə	PARSE-σ1
a. $\text{[}^{\text{[}}\text{(jásəd)}$		*	
b. (jásəd)	*!		

In short, the preferred fix for situations where prominence and position are mismatched is to move the foot away from the default left edge rather than to be unfaithful to the input.

4.6.2.2 Syncope and reduction of *a* to schwa

A mismatch of prominence and position occurs not only when schwa is a foot peak but also when a low vowel is a foot margin—this violates *MAR_{FT}/x constraints. Low vowels syncope and reduce to schwa when simply changing the footing is not an option.

Such situations arise when bases with low vowels in the first syllable are reduplicated. It is impossible to build a foot around both low vowels, as in *(wá)(wális), so the second vowel deletes instead. Words with *a* in the first syllable of the base exhibit syncope in the second syllable, but words with high vowels generally do not. The reason for this lies in the ranking of the *MAR_{FT}/x constraints, as shown in (121). *MAR_{FT}/a dominates MAXV but *MAR_{FT}/i,u does not. Furthermore, IDENT dominates MAXV, so deletion is preferred to reduction, all else equal:

(121) Syncope of unstressed *a* but not of unstressed *i*

		*MAR _{FT} /a	IDENT	MAXV	*MAR _{FT} /i,u
/RED-walis/	a. (wáw.lis)~(wá.wa)lis	W		L	L
	b. (wáw.lis)~(wá.wə)lis		W	L	L
/s-RED-tiqiw/	c. (stí.ti)qiw~(stít.qiw)			W	L
	d. (stí.ti)qiw~(stí.tə)qiw		W		L

Urbanczyk 1996 does not discuss what rules out parses like *(wá)(wális), but reasons are not hard to find: this sort of parse violates *CLASH. The *CLASH hypothesis was confirmed by my own search of the *Lushootseed Dictionary*, which did not unearth any words with clashing stresses.⁹⁹

⁹⁹ Another possible reason for the unavailability of *(wá)(wális) is that its first foot is not binary, although the FTBIN hypothesis is harder to verify in the absence of evidence for

There are situations when neither syncope nor refooting are available. If syncope would produce a cluster with rising sonority (i.e., one with a voiceless obstruent followed by a voiced one or with an obstruent followed by a sonorant), syncope is blocked and the vowel reduces to ə instead. The instrumental constraint here is SYLLCON: “sonority cannot rise between a coda and the following onset.”¹⁰⁰ Schwa in unstressed position does not violate any *MAR_{FT}/x constraints, so it is the ideal choice for that position, though this particular way of being unfaithful is not ideal in Lushootseed.

(122) Reduction of unstressed *a* where syncope is impossible

/RED-čaləs/	*MAR _{FT} /a	SYLLCON	IDENT	MAXV
a. [ʔ̚ (čá.čə)ləs]			*	
b. (čá.ča)ləs	*!			
c. (čáč.ləs)		*!(č.l)		*

Reduction to schwa and syncope are both used only in very specific circumstances: when identical vowels are found in neighboring syllables. Low vowels do not generally reduce to schwa or delete, as might be expected if they were inherently marked with respect to the economy constraint *LOW (Beckman 1998, Lombardi 2003). Lushootseed provides the relevant evidence (see (115)). In *sáx^wil*, the low vowel does not delete because it is stressable. Forms like *sx^waʔ* indicate that deletion is not blocked by a

consonant weight. It does appear that most Lushootseed words meet a minimum size requirement of CVC or CVV, so the FTBIN analysis may also be right.

¹⁰⁰ The formulation given here is simplified—for more elaborate theories of Syllable Contact and the harmonic scale that it is based on, see Baertsch 2002, Davis 1998, Davis and Shin 1999, Gouskova 2002a, b, Rose 2000c.

cluster condition. Furthermore, where it is possible to assign secondary stress to *a*, this is done—compare *ʔá-ʔəgwələb* and *ʔágwələb*.

(123) No general deletion of low vowels (all forms from Bates et al. 1994)

- a. /sa^ɰ-il/ (sá.ɰ^wil) not *sɰ^wil ‘grass, hay’ cf. sɰ^waʔ ‘urinate’¹⁰¹
 b. /ʔá-ʔag^waləb/ (ʔá-ʔə)(g^waləb) ‘yawn-LG’
 c. /ʔag^waləb/ (ʔá.g^wə)ləb ‘yawn’ (reduction is optional)

This behavior is predicted by the analysis. In non-reduplicated forms like *sáɰ^w-il* ‘grass, hay,’ deletion does not apply because nothing of value is gained: stress in the faithful candidate is already leftmost, and deleting the vowel removes a violation of the low-ranked constraint *MAR_{FT}/i,u at the expense of high-ranked MAXV:

(124) No deletion of *a* from stressable position

/sa ^ɰ -il/	*MAR _{FT} /a	MAXV	*MAR _{FT} /i,u
a. [sá.ɰ ^w il]	✓		*
b. (sɰ ^w il)	✓	*!	

In derivational terms, this pattern may be described as deleting *a* from unstressed position: “assign stress to the most sonorous vowel on the left, and then delete unstressed *a*.” In parallel terms this kind of description is nonsensical: the choice is really between having an unstressed *i* or not, and since unstressed *i* is no great evil in Lushootseed, syncope does not apply.

So far, we have seen three effects of the foot peak and margin constraints in the same grammar: departure from the default footing pattern, syncope, and reduction to

¹⁰¹ This word itself may be derived by schwa deletion; the Lushootseed dictionary gives *sɰ^waʔ* as an alternate form of *sʔəɰ^waʔ*. Schwa is somewhat elusive in Lushootseed in voiceless obstruent clusters—see Urbanczyk 1996, ch. 3 for discussion (also Hess 1998).

schwa. The next section is concerned with the fourth effect of these constraints, selection of the default vowel in reduplication.

4.6.2.3 Default vowel in the reduplicant is *i*

Although *a* is copied into the reduplicant faithfully, some vowels are not: *ə* and long vowels are replaced with *i*. Since the diminutive reduplicant is stressed and there is a strong preference in Lushootseed for stressed vowels to be low (recall *biʔáʔ~*bíʔaʔ*), the question arises why the default vowel is *i* and not *a*. The reason is that this vowel has no correspondent in the reduplicant, and therefore it is subject to REC/x constraints: inserted vowels should not be highly prominent. Schwa, the least sonorous epenthetic vowel, is ruled out by *PK_{FT}/ə, so *i* is the next best thing. This is a variation on the analysis developed by Alderete et al. 1999.

Alderete et al. argue that the faithful copying of the base schwa is prohibited by the constraint against stressed schwa, *PK_{FT}/ə, which dominates MAX-BR and DEP-BR.

The base vowel is deleted in the reduplicant, and an *i* is inserted instead:

(125) Schwa cannot be reduplicated faithfully

/RED-g ^w ədil/	*PK _{FT} /ə	MAX-BR	DEP-BR
a. $\text{g}^w\text{í-g}^w\text{ədil}$		****	*
b. $\text{g}^w\text{ǝ-g}^w\text{ədil}$	*!	***	

To this, we can add that the choice of epenthetic vowel is a matter for the BR versions of the REC constraints. Epenthetic *i* is the next best choice after epenthetic schwa. REC/a must dominate *PK_{FT}/i,u, because Lushootseed settles for a less-than perfect stressed *i* so as to avoid an overly prominent epenthetic *a*. The winner in (126) satisfies REC/a and *PK_{FT}/ə, which offsets its poor performance on *PK_{FT}/i,u and REC/i,u.

(126) Choosing the vowel for the reduplicant

/RED-g ^w ədil/	REC/a	*PK _{FT} /ə	*PK _{FT} /i,u	REC/i,u
a. $\text{ᑭᑭ}(\text{g}^{\text{w}}\acute{\text{i}}.\text{g}^{\text{w}}\text{ə})\text{dil}$			*	*
b. $(\text{g}^{\text{w}}\acute{\text{a}}.\text{g}^{\text{w}}\text{ə})\text{dil}$	*!			
c. $(\text{g}^{\text{w}}\acute{\text{ɔ}}.\text{g}^{\text{w}}\text{ə})\text{dil}$		*!		

This analysis also explains why high vowels reduplicate faithfully (*s-duk^w ~ s-dú-ʔ-duk^w*)—there simply isn’t a way to improve on a stressed high vowel without violating REC/a.

(127) High vowels reduplicate faithfully

/s-RED-duk ^w /	REC/a	*PK _{FT} /ə	*PK _{FT} /i,u	REC/i,u
a. $\text{ᑭᑭ} \text{s-dú-ʔ-duk}^{\text{w}}$			*	
b. $\text{s-dá-ʔ-duk}^{\text{w}}$	*!			

4.6.2.4 Alternatives to the RECOVER analysis for Lushootseed

Alderete et al. use the constraint REDUCE (“Minimize the duration of short vowels,” Kirchner 1996) to select *i* over *a*. While REDUCE is useful in Emergence-of-the-Unmarked situations as in Lushootseed, it cannot be used to determine epenthetic vowel quality in languages like Lillooet, where the shortest vowel is the only vowel to syncopate or be epenthesized.

The reason REDUCE cannot be used to determine epenthetic vowel quality generally is the following. For *ə* or *i* to be selected as epenthetic, all the relevant *NUC constraints must be dominated by REDUCE, because *NUC constraints favor low nuclei. But if this is the case, then schwa or *i* cannot be the only vowel to syncopate: REDUCE prefers *i* and *ə* to *a*, and it is ranked higher than *NUC. For the cheap vowel pattern, it is

necessary that the constraints determining epenthetic vowel quality be faithfulness constraints. REC constraints are that, but REDUCE isn't.

REC constraints can also subsume the function of REDUCE in Yoruba reduplication, where *i* is the default in reduplication and the epenthetic vowel (e.g., *gírámà* 'grammar,' Pulleyblank 1988). It may not be possible to eliminate REDUCE from the grammar altogether, though. Kirchner 1996 and McCarthy 2003 use REDUCE to motivate raising in Bedouin Hijazi Arabic, where underlying /a/ maps to *i* in all open syllables, even when stressed: /katab-at/ → *ktíbat* 'she wrote,' /samiʕ/ → *símiʕ* 'he heard,' but /samiʕ-at/ → *sámʕat* 'she heard.' None of the markedness constraints discussed here can produce such raising, and the REC hierarchy is irrelevant since the vowels are underlying.

Urbanczyk 1996 analyzes default vowel quality in Lushootseed using the Place Markedness hierarchy:

(128) *PL/LAB, *PL/DORS >> *PL/COR (Smolensky 1993)

If one assumes a specific version of vowel feature theory under which *a* is dorsal, *u* is labial, and *i* is coronal, *i* is selected as the default vowel in the reduplicant. As Urbanczyk herself notes, though, it could be argued that *a* is actually less marked than coronals because it is pharyngeal. This issue is avoided in the REC hierarchy analysis.

4.6.3 Summary of the Lushootseed analysis

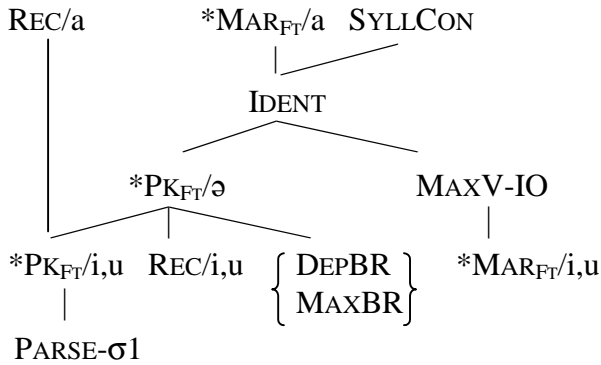
The phonology of Lushootseed vowels is to a large extent controlled by the constraints on foot heads and non-heads: they determine the placement of stress, require the deletion and reduction of unstressed *a*, and prevent faithful reduplication. The rankings for Lushootseed are as follows:

(129) *Ranking for stress*: IDENT >>*PK_{FT}/ə>>*PK_{FT}/i,u>>PARSE-σ1

(130) *Ranking for syncope/reduction*: *MAR_{FT}/a, SYLLCON>>IDENT>>MAXV

(131) *Rankings for reduplication*: *PK_{FT}/ə>>MAX-BR, DEP-BR, *PK_{FT}/i,u, REC/i,u

REC/a>>*PK_{FT}/i,u, REC/i,u



(132) Lushootseed stress, syncope, reduction, and reduplication

		R/a	*M/a	SC	ID	*PK/ə	MXV	R/i,u	*PK/i,u	*M/i,u	P-σ1
/k'ədayu/	a. k'ə(dá.yu)~(k'ə.da)yu		W			W					L
/təyil/	b. tə(yíl)~(tóyil)					W		L	W		L
/biʔaʔ/	c. bi(ʔáʔ)~(bí.ʔaʔ)		W					W			L
/jəsəd/	d. (jəsəd)~(jásəd)				W	L					
/čəlaq/	e. čə(láq)~(čə.ləq)				W						L
/RED-walis/	f. (wáw.lis)~(wá.wə)lis		W				L			L	
	g. (wáw.lis)~(wá.wə)lis				W		L			L	
/s-RED-tiqiw/	h. (stí.ti)qiw~(stí.tə)qiw				W					L	
	i. (stí.ti)qiw~(stít.qiw)						W				
/RED-čaləs/	j. (čáčə)ləs~(čáč.ləs)			W	L		W				
/sač ^w -il/	k. (sá.č ^w il)~(sč ^w íl)						W	W	W		
/RED-g ^w ədil/	l. (g ^w í.g ^w ə)dil~(g ^w á.g ^w ə)dil					W	L	L			
	m. (g ^w í.g ^w ə)dil~(g ^w á.g ^w ə)dil	W					L	L	L		

Tableau (132) summarizes the analysis. The first three candidate comparisons demonstrate the workings of the sonority-sensitive stress system: stress retracts away

from *ə* onto *a* and *i* and from *i* onto *a*. The crucial ranking here is $*PK_{FT}/ə \gg \text{PARSE-}\sigma 1$, although $*MAR_{FT}/a$ also plays a role. The candidates for /jəsəd/ and /čəlaq/ show that neither stressed schwa lowering nor unstressed reduction to schwa are available options if default footing or stress retraction are possible. When dealing with an input like /RED-walis/, it is impossible to avoid violations of $*PK_{FT}/x$ and $*MAR_{FT}/x$ without some kind of unfaithfulness (recall that footing every low vowel, as in $*(wá)(wá.lis)$, is ruled out by $*CLASH$). Syncope is the preferred way of avoiding a violation of $*MAR_{FT}/a$ here—reduction is deployed only when SYLLCON blocks deletion (witness $*čáč.ləs$). High vowels do not undergo deletion in the weak branches of feet, as shown by $(stí.ti)qiw$. The form $(sá.č^wil)$ shows that there is no deletion of low vowels when they can head their own feet—in other words, deletion is not general avoidance of *a* but avoidance of *a* in the weak branches of feet. Finally, in diminutive reduplicants, schwa is not copied faithfully but replaced by *i*—again because of $*PK_{FT}/ə$. Schwa is not replaced with the the least marked peak, *a*, because REC/a prevents this. The high vowel is a compromise between avoiding stressed schwa and avoiding epenthetic *a*.

The effects of $*MAR_{FT}/x$ and $*PK_{FT}/x$ constraints are so varied that syncope is but a minor player in the grammar of Lushootseed. Most of the time, no structural economy results from the interaction of the constraints: feet are moved around, vowel quality changes, and only in some circumstances is syncope allowed to apply. Economy is an epiphenomenon of the sonority-sensitive stress system, it is not in any sense an output goal.

The Lushootseed pattern clearly points to a need for rethinking the context-free markedness theory: *a* is not marked in all contexts but only when there is no other way to avoid placing it in the weak branch of a foot. Differential low vowel syncope patterns are (arguably) all context-sensitive in this way. For example, in Estonian verbal morphology, low and mid vowels are deleted only when preceded by a long or “overlong” syllable, but not when preceded by a short syllable. High vowels are not deleted in any environments:

(133) Estonian low/mid syncope (Tauli 1973:99-100, Silvet 1965, Kiparsky 1994)

a. Low and mid vowels delete after a long or “overlong” syllable			
/sa <u>at</u> ta-ma/	(saátt)ma	‘send’	cf. <i>sáa.tan</i>
/tapp <u>a</u> -ma/	(tápp)ma	‘kill’	cf. <i>táp.pan</i>
/jook <u>s</u> e-ma/	(jóoks)ma	‘run’	cf. <i>jóok.sen</i>
b. High vowels do not delete after a long or “overlong” syllable			
/ka <u>al</u> u-ma/	(káa)(lùma)	‘weigh’	cf. <i>káa.lun</i>
/sall <u>i</u> -ma/	(sál)(lìma)	‘tolerate’	cf. <i>sál.lin</i>
/rentt <u>i</u> -ma/	(rént)(tìma)	‘rent’	cf. <i>rén.tin</i>
c. No deletion of anything after a short syllable			
/te <u>k</u> e-ma/	(téke)ma	‘do, make’	not <i>ték.ma</i>
/sat <u>a</u> -ma/	(sáta)ma	‘fall (rain, snow)’	not <i>sát.ma</i>
/lat <u>u</u> -ma/	(látu)ma	‘pile up’	not <i>lát.ma</i>
/küs <u>i</u> -ma/	(kúsi)ma	‘ask’	not <i>kús.ma</i>

The environment for syncope is clearly related to foot structure and stress—the vowel deletes only in the position where it can bear secondary stress (Prince 1980). This is not avoidance of *a* in the margin of a foot, as in Lushootseed, but it is also not context-free deletion blocked by syllable structure constraints. It can only be so—no constraint assigns violations to *a* in all contexts in the Lenient theory of CON.

The next section continues the discussion of prosodic hierarchy-referring constraints and context-free markedness constraints that was started in §§4.3.6.3-4.3.6.4.

4.6.4 Alternative analysis of Lushootseed: context-free markedness

The biggest challenge presented by Lushootseed lies in explaining why the markedness status of *ə*, *i*, and *a* is so apparently inconsistent—they appear to be marked in some contexts but unmarked in others. This directly suggests a context-sensitive markedness analysis: without some reference to context, how else to explain the fact that schwa is marked in reduplicants (**g^w ɔ̣-g^w ədil*) and stressed syllables (*tə.yil* > **tɔ̣.yil*) but unmarked in unstressed syllables (*čá.čələs*)? High vowels are relatively unmarked in reduplicants (*s-dú-ɔ̣-duk^w*), in unstressed syllables (*stí.ti.qiw*), and in stressed syllables (*tə.yil*), but when a low vowel comes along later in the word, high vowels lose stress to it as though they are marked (*bíɬa?* ~ **bíɬa?*). Low vowels are unmarked in reduplicants (*čá.čələs*), but clearly are the most marked vowels in unstressed syllables, where they are the only vowels to syncopate or reduce to *ə*.

A pure economy analysis of Lushootseed in terms of *STRUC constraints cannot capture these nuances because economy principles disregard context. To an economy principle, any structure is going to be marked, and the only way to aid the situation is to remove the structure, not to move feet around or change the quality of vowels. If deletion happens to be differential, it is not because one vowel is somehow more marked than another—they are *all* marked. Deletion is differential because faithfulness constraints protect certain vowels more than others.

The Lushootseed pattern of low vowel deletion in the absence of high vowel deletion goes against the predictions of the Hartkemeyer-Tranel MAX hierarchy, which can only deal with patterns of low-sonority vowel deletion. Recall that in this theory, the

extent of differential syncope depends on the ranking of the *STRUC constraint in (134). Non-differential syncope corresponds to the ranking in (1), differential syncope of {ə, i, u, e, o} is (2), differential syncope of {ə, i, u} is (3), differential syncope of ə is (4), and (5) is no syncope at all.

(134) MAX-A >> MAX-E,O >> MAX-I,U >> MAX-SCHWA
 ↑ ↑ ↑ ↑ ↑
 (1) (2) (3) (4) (5)

Under (134), syncope of *a* entails the syncope of all other vowels. So, if this ranking is to be maintained, (134) needs to be augmented with other mechanisms to deal with Lushootseed, such as an articulated theory of context-free markedness discussed in §4.3.6.4.

The ranking for differential deletion of *a* under context-free markedness is given in (135). *LOW dominates MAX-A, and because *LOW does not assign violation marks to either *i* or ə, its high ranking does not prevent other vowels from surfacing. The articulated MAX hierarchy is ranked above the rest of the markedness constraints so that *i* does not undergo deletion.

(135) Economy alternative: differential syncope of low vowels with context-free markedness

		*LO	MAX-A	MAX-I,U	MAX-ə	*NLO	*FRNT	*BCK
/s-RED-tiqiw/	a. stí.ti.qiw~stít.qiw			W		L	L	
/RED-walis/	b. wáw.lis~wá.wa.lis	W	L					

This analysis cannot be extended to default segmentism in reduplication. In Lushootseed diminutive reduplication, *a*, *i* and *u* are copied faithfully but ə is replaced with *i*. This means that *i* is the least marked vowel in the reduplicant, and this conclusion is inconsistent with the ranking in (135).

In Lombardi's theory, the ranking of *FRONT>>*BACK is universally fixed to capture the universal that in languages with both *i* and *ə*, *ə* is always the epenthetic vowel (assuming, as Lombardi does, that *ə* is [back]). This clearly does not hold of Lushootseed reduplicants, where *i* is less marked than *ə*. The reason for this is that this position is obligatorily stressed and stressed *ə* is marked in Lushootseed in general. To capture this connection, it would be necessary to include *PK_{FT}/ə in the analysis, because only *PK_{FT}/ə prefers the winning candidate in the comparisons $g^w i-g^w ədil \sim *g^w ə-g^w ədil$ and $wáw.lis \sim *wəw.lis$. The latter was not an issue in the contextual markedness analysis, because substituting *a* with *ə* in this particular context is not favored by *any* constraint.

(136) Economy alternative: default segmentism in reduplication; *PK_{FT}/ə required

		*PK/ə	*LO	MX-A	MX-I,U	MX-ə	*NLO	*FRNT	*BCK
/s-RED-tiqiw/	a. stí.ti.qiw~stít.qiw				W		L	L	
	b. stí.ti.qiw~stót.qiw	W			W			L	W
/RED-walis/	c. wáw.lis~wá.wa.lis		W	L					
	d. wáw.lis~wəw.lis	W	L	L			W		
/RED-g ^w ədil/	e. g ^w i-g ^w ədil~ g ^w ə-g ^w ədil	W				L		L	W

*PK_{FT}/ə explains why *a* is not replaced with *ə*, but the ranking above still predicts that *a* should be replaced with *i*: *PK_{FT}/ə does not distinguish $wáw.lis$ and $*wíw.lis$, while the high-ranking *LOW favors the loser $*wíw.lis$. To help *a* beat *i* in reduplicants (but not in bases, where *a* does syncope), *PK_{FT}/i,u must be added:

(137) Economy alternative: default segmentism in reduplication; *PK_{Fr}/i,u required

		*PK/ə	*PK/i,u	*LO	MAX-A	MAX-I,U	MAX-ə	*NLO
/RED-walis/	a. wáw.lis~wá.wa.lis		W	W	L			
	b. wáw.lis~wów.lis	W	L	L	L			W
	c. wáw.lis~wíw.lis		W	L	W			W

There is yet another hole to plug. The ranking in (137) predicts that low vowels should delete whenever the phonotactic constraints permit, because they are marked regardless of context. This is wrong: if *a* occurs in a position where it can head its own foot, as in *sáx^wil*, deletion does not apply. To prevent deletion here, *LOW must be replaced with a constraint that penalizes *a* only in the correct contexts, or else supplemented with such a constraint while being demoted below MAXV. It is impossible to block deletion here—clusters like #s^w are not illegal in Lushootseed (witness *s^wa?* ‘urinate’), and since *a* is not initial in the word, it cannot be protected by a positional faithfulness constraint like ANCHOR-LEFT.¹⁰²

(138) Blocking deletion of stressable *a*

		*PK/ə	*PK/i,u	*MAR/a	MAX-A	*LO
/sa ^w -il/	a. sáx ^w il~s ^w il		W		L	W
/RED-walis/	b. wáw.lis~wá.wa.lis			W	L	W

Once these complexities are dealt with, it appears that the crucial choices between losers and winners in the analysis are made not by the context-free markedness

¹⁰² A hypothetical constraint MAX-σ1 might seem like an intuitively attractive analysis, but it is impossible to formalize. The constraint cannot look to the output position since the thing it refers to is not present in the output (it’s been deleted), and it cannot be input-oriented since *a* is not necessarily the nucleus of the first syllable there (=Richness of the Base).

constraints but by *PK_{FT}/ə, *PK_{FT}/i,u and *MAR_{FT}/a. The context-free markedness constraints are no longer doing any work in the analysis. This is without even attempting to analyze another aspect of the Lushootseed system, stress assignment, where context-sensitive markedness constraints are irreplaceable.

Can context-free markedness constraints simply stay at the bottom of the hierarchy? The answer is no, because they are anything but harmless. Recall that their free ranking comes with some dangerous predictions for differential syncope and epenthesis (these were discussed in §4.3.6.4). These predictions will not go away unless these constraints are excluded from CON altogether.

Excluding *LOW and *NONLOW from CON is a fairly trivial matter—there are no legitimate scales for these constraints to be grounded in. Until a substantial markedness relationship can be established between low and nonlow vowels, membership in CON is closed to these constraints.

4.7 Chapter summary

This chapter was mainly concerned with situations where certain vowels are marked in certain contexts. For example, low sonority vowels (such as ə) are marked as syllabic nuclei and as heads of feet, while high sonority vowels (such as a) are marked when they occur in weak branches of feet. The constraints that encode these markedness relationships appear in hierarchies:

(139) Constraints on syllabic nuclei

*NUC/ə >> *NUC/i,u >> *NUC/e,o

Nucleus harmony scale: nuc/a > nuc/e,o > nuc/u,i > nuc/ə

(140) Constraints on the sonority of vowels in strong branches of feet

$*PK_{FT}/\emptyset \gg *PK_{FT}/i,u \gg *PK_{FT}/e,o$

Foot Head (peak) scale: $Peak_{FT}/a \succ Peak_{FT}/e,o \succ Peak_{FT}/u,i \succ Peak_{FT}/\emptyset$

(141) Constraints on the sonority of vowels in weak branches of feet

$*MAR_{FT}/a \gg *MAR_{FT}/e,o \gg *MAR_{FT}/i,u$

Foot NonHead (margin) scale: $Mar_{FT}/\emptyset \succ Mar_{FT}/u,i \succ Mar_{FT}/e,o \succ Mar_{FT}/a$

The $*NUC/x$ hierarchy is of particular interest because in its original, non-lenient form it has the potential to duplicate the effect of $*STRUC(\sigma)$: if there is a constraint against every kind of syllable nucleus, altogether these constraints ban *all* nuclei and therefore all syllables. Without the constraint $*NUC/a$, this gang-up effect of the $*NUC/x$ hierarchy is diminished: only the less sonorous vowels violate $*NUC/x$ constraints. Even with the addition of $*PK_{FT}/x$ and $*MAR_{FT}/x$ constraints, the effects of $*STRUC(\sigma)$ cannot be duplicated: GEN can always supply at least some forms that do not violate any of the sonority constraints on vowels.

Another issue addressed in this chapter was the so-called *cheap vowel pattern*, where vowels of low sonority are inserted wherever required by phonotactic constraints and deleted otherwise. I presented a detailed OT analysis of such a pattern in Lillooet (§4.3): regardless of what the input looks like, underlying schwa must be deleted wherever phonotactic constraints permit, but if there are no underlying vowels, they must be supplied by the grammar in all the right environments. This economical pattern of schwa distribution and the relative ease with which it is epenthesized stem from its dual status: it is the most marked nucleus but the least marked epenthetic vowel. The latter property was attributed to a universally fixed hierarchy of positional faithfulness

constraints that prohibit overly prominent epenthetic material, related to HEAD-DEP of Alderete 1999:

(142) REC/a>>REC/e,o>>REC/i,u

REC/x: “A syllable nucleus with the prominence *x* it must have a correspondent in the input.”

Just like metrical syncope of Chapter 3, differential syncope is not one process but many. Depending on what is ranked above *NUC/*x*, the pattern may look essentially phontactically driven (as in Lillooet) or it may resemble metrical syncope (as in Lebanese Arabic, §4.4). This range of variation is expected when constraints of different kinds are allowed to interact freely.

Syncope is by no means the only effect of *NUC/*x* constraints: in Mekkan Arabic (§4.5), syncope of marked high vowel nuclei goes hand in hand with epenthesis of unmarked low vowel nuclei. The same point was explored in Lushootseed (§4.6). Lushootseed displays not one but four different effects of vocalic sonority constraints: foot placement, reduction of unstressed *a* to *ə*, default segmentism in reduplicants, and syncope. The fact that syncope is an economy effect is in in no way special here: it is just one of four ways to meet the demands of the constraints on foot peaks and margins.

Finally, I argued against economy analyses of differential syncope. The classic economy constraint *STRUC(σ) is too general for differential syncope since it penalizes nuclei of all sorts. For cases like Lillooet, it must be supplemented with a theory of epenthetic vowel quality that is consistent with *ə*-epenthesis and *ə*-syncope. Yet when this component is added, the theory becomes too rich; patterns are predicted that are neither observed nor plausible. Once the theory is applied to Lushootseed, where

additional markedness considerations are clearly at play, it becomes redundant—the context-specific markedness constraints do all the work. Nihilistic markedness, whether expressed as a single constraint *STRUC(σ) or as *LOW, *NONLOW, *FRONT, *BACK, and so on, once again has failed to shed light on economy.