

CHAPTER 5

CASE STUDY: STRESS AND EPENTHESIS IN DIALECTS OF ARABIC

5.1 Statement of the Problem

Epenthesis has the potential to merge underlying contrasts on the surface. This takes place when identical epenthetic and non-epenthetic segments are found in the same environment and act the same with respect to various phonological processes. Thus surface words in which a given segment is present underlyingly are identical to those in which it is epenthetic. In Southern Palestinian Arabic, for example, (Davis 1995, McCarthy 1997), both epenthetic and underlying *i*'s block spreading of rightward [RTR] harmony, underlying *i* (as in *Tiinak*), and epenthetic *i* as in (*baTinha* from /baTn+ha/). Similarly, Spring (1994) shows that in Axininca Campa both underlying and epenthetic *t*'s undergo palatalization.

But in many cases, identical words with epenthetic and non-epenthetic segments pattern differently with respect to phonological processes (Alderete 1995, 1996; Archangeli 1984, 1988; Archangeli and Pulleyblank 1994; Ito 1989; Kiparsky 1998; Steriade 1995). In Northern Palestinian Arabic (Herzallah 1990), unlike in Southern Palestinian, underlying and epenthetic vowels behave differently with respect to various segmental processes. For example, there is a process of r-de-emphaticization but only underlying *i*'s trigger de-emphaticization. Epenthetic *i*'s do not de-emphaticize. Similarly, underlying *i*'s do not undergo dorsal assimilation while epenthetic *i*'s assimilate.

In this chapter I will discuss the behavior of epenthetic and non-epenthetic vowels with respect to stress assignment in various dialects of Arabic (Broselow 1982, Farwanah

1995). Arabic dialects vary on whether words with epenthetic and non-epenthetic vowels behave the same or different with respect to stress placement. (See also Michelson 1981, 1989 and Piggott 1995 for stress-epenthesis interaction in Mohawk. Piggott also discusses Iraqi Arabic.)

Dialects of Arabic can be divided into onset and coda dialects depending on the site of epenthesis (Selkirk 1981, Broselow 1982). In onset dialects epenthesis into a tri-consonantal cluster creates an open syllable (*ka-tab-t-lu* becomes *ka-tab-ti-lu*). In coda dialects, on the other hand, epenthesis into a tri-consonantal cluster creates a closed syllable (*ki-tab-t-la* becomes *ki-ta-bit-la*). We will look at the following types of dialects:

- (i) dialects in which words with epenthetic and non-epenthetic vowels behave the same with respect to stress in all environments: all onset dialects (Broselow 1992, Farwaneh 1995), some coda dialects – Omani (Shaaban 1977), Abu Dabi (Farwaneh 1995), and epenthesis into quadri-consonantal clusters in all dialects (both coda and onset)
- (ii) dialects in which words with epenthetic and non-epenthetic vowels behave differently with respect to stress in all environments: coda dialects – Levantine (Farwaneh 1995, Kenstowicz 1981), Syrian (Cowell 1964)
- (iii) dialects in which words with epenthetic and non-epenthetic vowels behave differently with respect to stress in case of epenthesis into word-final syllables but the same in case of epenthesis into word-medial syllables: coda dialect – Iraqi (Broselow 1982, Erwin 1963)

To account for the stress-epenthesis interaction, I will propose that when identical words with underlying and epenthetic vowels behave differently with respect to stress assignment, the underlying contrast in presence versus absence of a vowel (the V/\emptyset contrast) is preserved on the surface and realized as stress contrast. In other words, the underlying segmental contrast is transformed into a surface contrast in prosodic prominence. In cases when epenthetic and underlying vowels act the same with respect to

stress assignment, on the other hand, the underlying V/∅ contrast is lost. Arabic dialects differ in ranking of the V/∅ contrast requirement and thus either preserve or neutralize this underlying contrast on the surface.

Contrast transformation is not admitted in classic Optimality Theory (Prince and Smolensky 1993), where the optimal mapping is chosen by the interaction of markedness constraints with standard faithfulness constraints. Standard faithfulness constraints require identity in the underlying-surface mapping and do not allow underlying properties to be transformed into different surface properties. As far as standard faithfulness is concerned, transforming the underlying property into a different surface property is equivalent to the loss of the underlying property altogether. Thus, I argue, phonological phenomena that involve contrast transformation, like contrast-preserving stress-epenthesis interaction in Arabic, require a framework where contrast transformation is captured formally and differentiated from the loss of contrast.

In this dissertation I have proposed such a framework. I call it Contrast Preservation Theory (PC theory for short). As we have seen, PC theory is a modification of Optimality Theory. Unlike standard OT, it admits phonological mappings that require an account in terms of preserving contrasts, like contrast-preserving epenthesis. Moreover, it explains such mappings in the same way in which it explains mappings involving the loss of contrast altogether in some environments (for example final devoicing, or non-contrast-preserving epenthesis). In traditional terms, mappings involving contrast transformation are known as opaque processes, whereas mappings involving the loss of contrast altogether are known as transparent processes. Thus, this

account gives a uniform explanation for both. The next section gives an overview of the analysis of stress-epenthesis interaction in Arabic in PC theory.

5.2 Overview of the Analysis

As already noted, it will be proposed here that when words with and without epenthesis behave differently with respect to stress assignment, the underlying contrast between them is preserved on the surface but expressed differently than in the underlying form. Specifically, the underlying V/\emptyset contrast is transformed into a surface stress contrast.

To explain this particular contrast transformation, I will argue that the need to preserve contrast between words containing epenthetic and non-epenthetic vowels can alter the weight system of the language and consequently change main stress placement.

As has been proposed in the literature, coda consonants in Arabic dialects are moraic (see Hayes 1989, 1995, Farwanah 1995, McCarthy and Prince 1990ab among others). Closed syllables count as heavy for purposes of stress assignment and for other processes sensitive to the moraic structure of a syllable. However, I will argue that in contrast-preserving dialects closed syllables with epenthetic vowels count as light. Therefore, I will propose that coda consonants of such syllables are non-moraic, unlike coda consonants of syllables with underlying vowels in the same dialect. The non-moraic status of coda consonants following epenthetic vowels often leads to a different foot structure of a word, and thus in many circumstances to different stress placement. (The evidence for my proposal comes from stress assignment, but I predict that the non-moraic structure of syllables with epenthetic vowels would have consequences for other processes as well, were they sensitive to mora count.)

This proposal with some additional assumptions on mora continuity (see section 5.4) and a requirement on locality of contrast transformation (see section 5.6) makes correct typological predictions for Arabic dialects.

First, it predicts that there are both contrast-preserving and contrast-neutralizing dialects, as dialects differ in ranking of the contrast preservation requirement with respect to a constraint assigning a mora to a coda consonant. Thus, contrast is either lost or preserved on the surface, depending on the ranking.

Second, this account explains cases like those in Iraqi Arabic (Erwin 1963), where words with and without epenthetic vowels behave differently with respect to stress assignment, but only if they are in word-final syllables. Word-medially they act the same. In my proposal this amounts to saying that coda consonants of word-medial syllables need to be moraic, despite the loss of contrast, whereas coda consonants in word-final syllables can lack a mora and thus result in contrast being preserved.¹ To explain why a medial non-moraic coda is dispreferred to a final non-moraic coda, I will propose that a non-moraic coda medially disrupts continuity at the level of moras. Unlike a medial coda, a non-moraic coda word-finally does not violate moraic continuity and thus is preferred all else being equal. Here I follow Hyman (1985), Zec (1988) and Ito (1989) in assuming that each segment of a syllable is linked to a mora. Onset consonants share a mora with the following vowel. Thus, if a coda consonant lacks a mora medially in the string of segments, mora continuity is disturbed (see section 5.4).

In addition, this proposal makes correct typological predictions with respect to onset dialects (section 5.6.2) and epenthesis into quadri-consonantal sequences (section

¹ This idea is similar to final consonant extrametricality, which has been proposed in the past analyses of Arabic (Hayes 1982).

5.6.3), facts that remained puzzling under previous approaches to this phenomenon (rule ordering, underspecification; see section 5.8). As Farwaneh (1995) observed, epenthesis in onset dialects and epenthesis into quadri-consonantal sequences in all dialects are never contrast-preserving. Those two facts follow naturally from our analysis. Since there is no coda created by epenthesis in onset dialects, there is no possibility of differentiating the weight of the syllable with an epenthetic vowel from the one without an epenthetic vowel. Both syllables are light to begin with. The non-contrast-preserving nature of epenthesis into quadri-consonantal clusters is also predicted since, as we will see, changing the weight of the epenthetic syllable would not change footing and thus would be superfluous. And in Optimality Theory, given strict domination of constraints, we do not violate constraints if nothing is gained in the end.

To capture locality of contrast transformation, I will propose a locality constraint on contrast preservation (see section 5.6) - by which only the coda consonant of the syllable with an epenthetic vowel can be morales. The weight of adjacent syllables is never altered to preserve contrast. In addition, as we will see, the “altered syllable” needs to be incorporated into the main-stressed foot.

Since the surface contrast is a result of a non-moraic coda, I propose here that a structural expression of contrast, the mora-less coda, can be distinct from the surface contrast expression, the locus of prominence. That is, the underlying contrast in presence versus absence of a vowel is transformed into surface stress contrast via a structural change at the level of moras. This distinction between structural and surface contrast expression will be important in the discussion of locality in section 5.6. As we will see, locality holds with respect to both the structural and surface contrast expression.

Another important consequence of this observation is that for contrast to be preserved, it is crucial that the surface contrast expression is distinct for contrasting word pairs. A structural change that does not result in a surface distinction does not preserve contrast (see section 5.6.1).

The difference in the moraic structure between syllables with epenthetic and with non-epenthetic vowels has been previously proposed in the literature by Piggott (1995) primarily on the basis of the analysis of Mohawk and some discussion of Iraqi Arabic. In Piggott's proposal, epenthetic syllables that behave exceptionally to stress assignment are represented as empty segmental slots, thus weightless, at the stage when stress rules apply. The empty slots are filled in at the later stages of derivation and thus, surface with a vowel. This explains why open syllables can be exceptional to stress rules. Closed syllables, the ones that concern us here, are problematic under Piggott's proposal because, according to the so-called Closed Syllable Condition formulated by Piggott, a closed syllable with a moraic coda cannot have an empty nucleus. Therefore, Piggott represents closed syllables with epenthetic vowels that do not count for stress as sequences of two syllables (for example the syllable *bit* as in *ki.ta.bit.la* is realized as *bi.t∅*). The surface coda consonant is realized as an onset consonant of the second syllable in the sequence (here *t∅*). This second syllable contains an empty nucleus at the stage when stress assignment takes place and thus is weightless. The syllable with an epenthetic vowel, the first syllable in the sequence (here *bi*), is assigned a vowel with a mora under the so-called Proper Government Condition, to avoid a sequence of two empty nuclei. Consequently, surface closed syllables count as light for purposes of stress rules.

Despite the shared observation concerning the weight of closed epenthetic syllables in contrast-preserving languages, Piggott’s account differs from my proposal in many respects. In section 5.3.3 I will argue that Piggott’s proposal does not account for stress-epenthesis interaction in a surface approach to phonology, because it is not able to force epenthesis based on the well-formedness of the surface form alone. If we explain the light quality of the epenthetic syllable by allowing its coda consonant to form its own syllable, then there is no cluster within a syllable, and thus nothing forces epenthesis. The markedness constraint that drives epenthesis is satisfied with no repair. The surface form *ka.tab.t∅.la*, with no epenthesis, is optimal. The account also makes different predictions with respect to locality of contrast transformation discussed in section 5.6.

In the next section I present an analysis of dialects which preserve and neutralize contrasts in all environments.

5.3 Contrast Preserving and Contrast Neutralizing Dialects

In this section I discuss two coda dialects: Syrian (Cowell 1964), which preserves contrast in all environments (5.3.1), and Omani (Shaaban 1977), which neutralizes contrast in all environments (5.3.2). I then develop an analysis of both cases in (5.3.3).

Both dialects have Latin stress. As described in Hayes (1981, 1995), in Latin we stress the rightmost heavy syllable, otherwise the antepenult with the additional assumption that final syllables are not stressed (except, of course, in monosyllables).

Some examples are given below:

- | | | |
|-----|--------------|-------------------------------|
| (1) | Latin stress | |
| a. | a(mí:)kus | rightmost heavy (=penult) |
| b. | do(més)tikus | rightmost heavy (=antepenult) |
| c. | (símu)la: | antepenult |

Hayes (1995) proposes that this is a moraic trochee system with final syllable extrametricality and feet assigned from right to left. Main stress falls on the rightmost foot in the Prosodic Word. Degenerate feet are banned absolutely (see also Mester 1994).

In OT terms, to account for Latin stress I will propose that FOOTFORM constraints are undominated. This results in a well-formed moraic trochee, which, according to Hayes, consists of two light syllables with initial prominence, (LL), or a single heavy syllable, (H).

Since in Latin, the final syllable is never stressed, I will assume that a foot cannot be final in a Prosodic Word. I will call this constraints *FINALFOOT. Both FOOTFORM and *FINALFOOT dominate PARSE-SYLLABLE since satisfying foot well-formedness and foot non-finality may leave syllables unparsed. This is represented in the following tableau:

(2) FOOTFORM, *FINALFOOT >> PARSE-SYLLABLE

	/ami:kus/	FOOTFORM	*FINALFOOT	PARSE-SYLLABLE
a. $\mu\sigma$	a(mi:)kus			(*)*
b.	a(mi:)(kus)		*!	(*)
c.	(ami:)kus	*!		(*)


Candidate (a) wins as it satisfies foot well-formedness and foot nonfinality. It does so at the cost of leaving two syllables unparsed but since FOOTFORM and *FINALFOOT both dominate PARSE-SYLLABLE, this multiple violation of parsing is rendered irrelevant.

A note on exposition: In my proposal candidates are sets of mappings and not just individual mappings, but since stress and syllabification are non-contrastive in the input, in the discussion of stress in this section, I present candidates as singletons, that is in a

traditional way. To put it differently, by non-contrastive stress assignment, no meaningful contrasts are merged.²

In addition to the ranking in (2), both FOOTFORM and *FINALFOOT dominate a constraint on main stress placement, demanding that the main-stressed foot be rightmost in a Prosodic Word, ALIGN(Hd(Ft), R; PrWd, R). This is shown below, where only the main-stressed foot is indicated:

(3) FOOTFORM, *FINALFOOT >> ALIGN(Hd(Ft), R; PrWd, R)

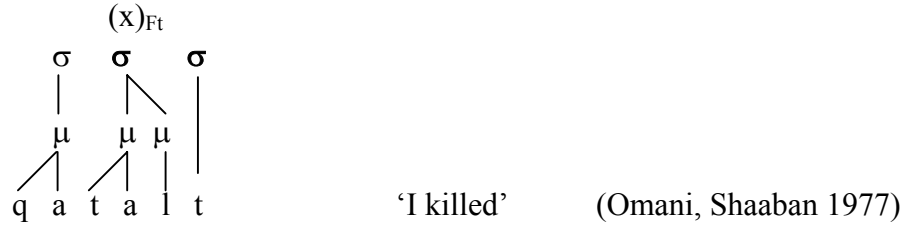
	/domestikus/	FOOTFORM	*FINALFOOT	HD(Ft)-R
a. 	do(mes)tikus			**
b.	domesti(kus)		*!	
c.	domes(ti)kus	*!		*

Candidate (a) satisfies foot well-formedness and foot nonfinality and thus is chosen as optimal. In this candidate, the main-stressed foot is not aligned with the right edge of the Prosodic Word but since the alignment constraint is ranked lower than FOOTFORM and *FINALFOOT, we accept its violation.

To explain why final super-heavy syllables are stressed, despite high-ranking *FINALFOOT, I follow McCarthy and Prince (1990ab) in assuming that final super-heavy syllables consist of two syllables, the first heavy, the second ‘incomplete’, and thus can receive stress when final in a Prosodic Word. When a superheavy syllable is stressed, stress falls on the first syllable in the sequence, the non-final syllable, and thus *FINALFOOT is satisfied. This is represented in the diagram below. The super-heavy syllable is *talt*.

² Formally, this means that a constraint on preserving the stress contrast, PC(stress), is low-ranked. By meaningful contrasts, I refer to contrasts that surface in some forms of the language.

(4) Super-heavy syllables as double syllables



Finally, to account for the right to left foot alignment, I propose that a constraint ALIGN FT-R outranks ALIGN FT-L. In addition, ALIGN FT-R is dominated by PARSE-SYLLABLE as footing more syllables and thus erecting more feet leads to a bigger violation of alignment.

(5) PARSE-SYLLABLE >> ALIGN FT-R

	/katabitla/	PARSE-SYLLABLE	ALIGN FT-R
a. كٲابٲلٲا	(ka.ta.)(bit.)la	(*)	(*)**
b.	ka.ta.(bit.)la	(*)*!*	(*)

In summary, the ranking is as follows:

(6) Constraint ranking for Latin stress
 FTFORM, *FINALFT >> HD(Ft)-R, PARSE-SYLL >> ALIGN FT-R >> ALIGN FT-L

Dialects of Arabic that will be discussed in sections 5.3 and 5.4 show the same stress pattern as Latin. We now have the tools to analyze those dialects.³

5.3.1 Contrast is Preserved Across the Board

In Syrian \emptyset is epenthesized to break up clusters of consonants that cannot form a sequence (for example $l\text{-}kt\bar{a}b \rightarrow l\emptyset kt\bar{a}b$ ‘the book’, $lah\bar{m}\text{-}ba\bar{\gamma}ar \rightarrow lah\emptyset m\text{-}ba\bar{\gamma}ar$ ‘beef’).

Since there are other sources of schwa in the same environments, epenthesis can potentially merge the underlying V/ \emptyset contrast.

³ In the analysis, I assume the theory of Generalized Alignment by McCarthy and Prince (1993). For a different conception of alignment, see McCarthy (2002).

Some other sources of schwa, according to Cowell (1964), are:

- (i) underlying schwas in some dialects (this can be heard in the phrase *ʔəza* *ʔəza* ‘if he comes’, where the two vowels are distinct for some speakers of Syrian),
- (ii) short *e* and *o* both become *ə* when accented (*ʔənsəl* ‘consul’ but *ʔənsəlna* ‘our consul’),
- (iii) high vowels *i* and *u* freely alternate with *ə* in some dialects (*bəthət* = *bithūt*)
- (iv) in a closed syllable unaccented *a* changes to *ə* (*bartált* → *bərtált*)

It is claimed that epenthetic schwas and schwas that come from other sources are pronounced the same (Cowell 1964:28).

As we will see, both in cases of epenthesis into medial clusters and into final clusters, words with epenthetic vowels and words with underlying vowels behave differently with respect to stress assignment.

Let us start with medial epenthesis. In Syrian, words with underlying vowels stress a heavy penult (unless there is a final super-heavy syllable - see the previous section). This is shown below:

- (7) Penultimate stress
 - a. da(ráb)ha ‘he hit her’
 - b. sak(kə́r)ha ‘close it’
 - c. da(rás)tu ‘I studied’

When there is no heavy penult, stress is on the antepenultimate syllable:

- (8) Antepenultimate stress
 - a. (dára)bo ‘he hit him’
 - b. (báda)lo ‘his substitute’, ‘instead of him’
 - c. (fáru)ha ‘her fur, pelt’

Interestingly, when a closed penult is formed by epenthesis, it behaves as if it were a light syllable. Stress is antepenultimate and not, as expected, penultimate. (The epenthetic vowel is in bold type.)

- (9) Medial epenthesis – antepenultimate stress
- | | | | |
|----|--------------------|------------------|---------------------|
| a. | (ʔát ə l)to | ‘she killed him’ | *ʔa(t ə l)to |
| b. | (mǝš ə m)še | ‘an apricot’ | *mǝ(š ə m)še |
| c. | (bǝ h ǝm)lo | ‘I’ll carry it’ | *bǝ(h ǝm)lo |

Under the assumption that in Syrian degenerate feet are banned (in OT terms FOOTFORM constraints are high-ranked), it follows that the epenthetic syllable and the preceding syllable in the examples in (9) must belong to the same foot. To ensure that it is a licit moraic trochee, the syllable with an epenthetic vowel must be light even though it is a closed syllable and therefore expected to be heavy. Thus, we have a (LL) moraic trochee.

Let us now discuss epenthesis into final clusters. As in word-medial epenthesis, a syllable with an epenthetic vowel behaves differently with respect to stress from a syllable with an underlying vowel in the same environment.

In Syrian, when there is a light penult, stress is on the antepenultimate syllable:

- (10) Antepenultimate stress
- | | | |
|----|------------|-----------------|
| a. | (bára)ke | ‘blessing’ |
| b. | (dára)že | ‘degree, step’ |
| c. | (stá?)balu | ‘they welcomed’ |

Interestingly, when a light penult is followed by a syllable with an epenthetic vowel, it receives stress. Thus, in such case stress is penultimate and not antepenultimate, as expected:

- (11) Final epenthesis – penultimate stress
- | | | | |
|----|------------|----------------------|-------------|
| a. | sa(dáʔət) | ‘you told the truth’ | *(sáda)ʔət |
| b. | sta(šárət) | ‘I consulted’ | *(stáša)rət |
| c. | xa(láṣəṭ) | ‘you finished’ | *(xála)ṣəṭ |

As in word-medial epenthesis, with FOOTFORM high-ranked, since stress is on a penultimate light syllable, the following epenthetic syllable must be incorporated into the main-stressed foot. But it can only be incorporated into the foot and form a licit moraic trochee if it is a light syllable. Again, it is a closed syllable and so we expect it to be heavy.

To explain why the epenthetic syllable counts as light, even though it is a closed syllable, I propose that the coda consonant of the epenthetic syllable is non-moraic, unlike other coda consonants in the same dialect. In addition, in word-final epenthesis, by admitting the final syllable into the foot, foot non-finality is violated, as the foot is now final in the Prosodic Word. Thus, I will assume that to preserve contrast, violation of foot non-finality can be forced.

The stress pattern of epenthetic and non-epenthetic forms in Syrian is represented schematically below (the epenthetic vowel is ə):

- (12) Medially – different stress
- | | | | |
|----------------|------------|---|--|
| Non-epenthetic | /CVCVC-CV/ | → | cv(c'vc _μ)cv
penultimate stress |
| Epenthetic | /CVCC-CV/ | → | (c'vcəc)cv
antepenultimate stress |
- (13) Finally – different stress
- | | | | |
|----------------|------------|---|---|
| Non-epenthetic | /CVCVC-VC/ | → | (c'vcv)cvc _μ
antepenultimate stress |
| Epenthetic | /CVCVC-C/ | → | cv(c'vcəc)
penultimate stress |

In both cases, the syllable with an epenthetic vowel counts as light despite the coda consonant. In final epenthesis, in addition, foot non-finality is violated. Consequently, forms containing identical epenthetic and underlying vowels contrast on the surface by different stress placement. The same is true of other coda dialects, such as Levantine (Farwaneh 1995, Kenstowicz 1981) and Libyan (Owens 1984), except that in Libyan words with underlying long vowels behave differently (see Farwaneh 1995:140-41).

There are, of course, other imaginable prosodic analyses of these forms. But none is as good as (12-13) when the full analysis is considered. One alternative would be to assume that the final consonant in *kitábit* constitutes its own syllable outside of the main stressed foot. We would then have footing as in *ki.(tá.bi.)t* with the final consonant unparsed and foot non-finality satisfied. However, if *t* constituted its own syllable, then there would be no cluster within a syllable to be broken up by the epenthetic vowel and thus epenthesis would not be motivated.

In the discussion so far, I have assumed that constraints on FOOTFORM (FOOTBINARITY, WEIGHT-TO-STRESS-PRINCIPLE) are obeyed at the expense of weight, and not the other way around. That is, we always strive to have a licit moraic trochee (a bimoraic foot) by incorporating the epenthetic syllable into the main-stressed foot. To do so, the weight of the epenthetic syllable is altered so that it is a light syllable. However, another alternative would be to assume that weight is obeyed at the expense of FOOTFORM. This would mean that in epenthetic forms, the final consonant retains its mora but feet are degenerate or excessive, mono- or tri-moraic. An example of a monomoraic foot would be with the epenthetic syllable outside of the main-stressed foot

as in *ki(tá)bit_μ*, whereas an example of a tri-moraic foot would be with the epenthetic syllable incorporated into the main stressed foot as in *ki(tábit_μ)* or *ki(tábit_μ)la*.

However, following Broselow (1982), I assume that in Arabic FOOTBINARITY is undominated. Evidence comes from a strict minimal word requirement by which words have to be minimally bimoraic. Therefore, I do not adopt the monomoraic foot alternative. Formally, since FOOTBINARITY is undominated, it outranks WBP, and so we prefer to violate WBP (see (21)) than to create monomoraic feet.

Trimoraic feet as in *ki.(tá.bit)*, in turn, violate the WEIGHT-TO-STRESS-PRINCIPLE (WSP) as heavy syllables do not receive stress. I take WSP as part of the FOOTFORM constraints. Evidence for undominated WSP comes from epenthesis into onset dialects, which is never contrast-preserving. If we allow trimoraic feet, then epenthetic *bin_μtina* in Egyptian should come out as *(bín_μtí)na* with antepenultimate stress, thereby preserving contrast with a non-epenthetic form where stress is penultimate. (See section 5.6.3 for discussion.)

We have seen, then, that additional approaches to the prosodic structure of epenthetic syllables are not as satisfactory as (12-13). Additional evidence for my proposal of limiting the weight of epenthetic syllables and against the degenerate foot alternative comes from the typological predictions my proposal makes with respect to quadri-consonantal clusters, and also from hybrid cases as in Iraqi Arabic (see section 5.4).

5.3.2 Contrast is Merged Across the Board

In this section I contrast Syrian with another coda dialect - Omani (Farwaneh 1995, Shaaban 1977), where words with epenthetic and non-epenthetic vowels behave

the same with respect to stress assignment in all environments, both medially and finally. In Omani the high vowel *i* is epenthesized to break up clusters that violate sonority of the syllable.⁴

Examples of medial epenthesis are given in (14) and (15). In all cases shown here, epenthesis is into the penultimate syllable and the final syllable is either heavy or light. We expect stress to fall on the penult and it does so in both epenthetic and non-epenthetic words:

- (14) Medial epenthesis
- | | | | |
|----|------------|-------------------|------------|
| a. | ʔa(kīl)hum | ‘their (m.) food’ | /ʔakl+hum/ |
| b. | qa(bīr)he | ‘her grave’ | /qabr+ha/ |
| c. | qa(bīl)ne | ‘before us’ | /qabl+na/ |
-
- (15) Corresponding non-epenthetic words
- | | | | |
|----|------------|--------------------|--|
| a. | (gār)rak | ‘he dragged you-m’ | |
| b. | mix(tīl)fa | ‘different (f.)’ | |
| c. | ma(lík)ne | ‘our King’ | |

Let us now look at final epenthesis. All forms shown here are two syllables long with a final heavy syllable. Thus, we expect main stress to fall onto the penult. This is true of both epenthetic and non-epenthetic forms:

- (16) Final epenthesis
- | | | | |
|----|-------|----------|--------|
| a. | gísim | ‘body’ | /gism/ |
| b. | ʔákil | ‘eating’ | /ʔakl/ |
| c. | láhin | ‘tune’ | /lahn/ |
-
- (17) Corresponding non-epenthetic words
- | | | | |
|----|-------|-----------|--|
| a. | málik | ‘king’ | |
| b. | ṣāhib | ‘friend’ | |
| c. | qálit | ‘he said’ | |

⁴ For a detailed discussion of conditions for epenthesis, see chapter 3 in Shaaban (1977).

Schematically, this is represented below. In both medial and final epenthesis, epenthetic and non-epenthetic words are stressed the same.

- (18) Medial epenthesis – penultimate stress
 Non-epenthetic /CVCVC-CVC/ → cv(c'vc_μ)cvc_μ
 Epenthetic /CVCC-CVC/ → cv(c'vc_μ)cvc_μ
- (19) Final epenthesis – antepenultimate stress
 Non-epenthetic /CV-CVCVC/ → (c'vcv)cvc_μ
 Epenthetic /CV-CVC-C/ → (c'vcv)cvc_μ

In terms of contrast, there is surface neutralization of the underlying contrast between epenthetic and non-epenthetic words. The next section presents the proposal.

5.3.3 The Proposal

When contrast is preserved, coda consonants of syllables with epenthetic vowels count as light:

- (20) Syrian recalled (cf. (12))
 Non-epenthetic /CVCVC-CV/ → cv(c'vc_μ)cv
 L(H)L penultimate stress
- Epenthetic /CVCC-CV/ → (c'vcv)cv
 (LL)L antepenultimate stress

Thus I propose that in case when contrast is preserved, coda consonants of syllables with epenthetic vowels are non-moraic, unlike other codas in the language.

Formally, contrast is preserved by means of violating an otherwise high-ranked requirement in the language, by which each coda consonant is assigned a mora, WEIGHT-BY-POSITION (Hayes 1989, 1992, Hyman 1985, Zec 1988). In OT terms:

- (21) WEIGHT-BY-POSITION (WBP)
 A coda consonant must bear a mora, and this mora belongs exclusively to this consonant (i.e., it is not shared with a vowel).

WEIGHT-BY-POSITION is violated to preserve contrast between words that differ underlyingly in presence versus absence of a vowel. The contrast preservation constraint that compels violation of WBP is defined below.⁵

- (22) $PC_{IN}(V/\emptyset)$ (see chapter 1, (15), for a definition)
 For each pair of inputs, in_1 and in_2 , contrasting in V/\emptyset , where in_1 has V and in_2 lacks V in the same position in a string, that map onto the same output, assign a violation mark.
 “Words that differ underlyingly in the presence/absence of a vowel must be distinct on the surface (not necessarily in V/\emptyset).”

This constraint is violated by vowel deletion or vowel insertion in one of the inputs.

In contrast-preserving dialects, the PC constraint outranks WEIGHT-BY-POSITION:

- (23) Contrast-preserving dialects
 $PC_{IN}(V/\emptyset) \gg WBP$

With this ranking, WBP is violated to preserve contrast.

As explained in chapter 1, in the PC proposal candidates are sets of mappings, called scenarios. Scenarios in a candidate set are of the same size. In a tableau only a subset of mappings from a scenario is shown. The mappings included in the following tableaux are minimally contrastive in presence vs. absence of the vowel in the input.

In the tableau below, I compare a contrast-preserving scenario to a contrast-neutralizing scenario. The relevant contrast dimension is presence versus absence of a vowel in the input. In each of the mappings, the main-stressed syllable is underlined. The epenthetic vowel is in bold type.

⁵ Forms that violate $PC_{IN}(V/\emptyset)$ also violate $PC_{OUT}(V/\emptyset)$. Since the role of input- and output-PC is the same here, in the tableaux in this chapter I will only include input-oriented PC, $PC_{IN}(V/\emptyset)$.

(24) Medial epenthesis – contrast is preserved

Scenarios		PC _{IN} (V/∅)	WBP
A. Contrast is preserved (Syrian) ١٣٥	/CVCC-CV/ → (c'vcvc)cv /CVCVC-CV/ → cv(c'vc _μ)cv		*
B. Contrast is merged (Omani)	/CVCC-CV/ → cv(c'vc _μ)cv /CVCVC-CV/ → cv(c'vc _μ)cv	*!	

In scenario A, contrast is preserved at the expense of violating WBP. In scenario B, on the other hand, contrast is lost but WBP is satisfied. Scenario A wins in Syrian as it preserves the contrast between epenthetic and non-epenthetic vowels.

With the opposite ranking, WBP >> PC_{IN}(V/∅), scenario B would be the winner as in Omani. It would be more important to satisfy WBP than to preserve contrast. For final epenthesis to be contrast-preserving, we also need to assume that *FINALFOOT is ranked lower than PC. Thus, to ensure that final epenthesis is contrast-preserving the ranking is as follows: PC_{IN}(V/∅) >> WBP, *FINALFOOT.

(25) Final epenthesis – contrast is preserved

Scenarios		PC _{IN} (V/∅)	WBP	*FINALFOOT
A. Contrast is preserved (Syrian) ١٣٥	/CVCVC-C/ → cv(c'vcvc) /CVCVC-VC/ → (c'vcv)cvc _μ		*	*
B. Contrast is merged (Omani)	/CVCVC-C/ → (c'vcv)cvc _μ /CVCVC-VC/ → (c'vcv)cvc _μ	*!		
C. Contrast is merged (harmonically-bounded)	/CVCVC-C/ → (c'vcv)cvc /CVCVC-VC/ → (c'vcv)cvc _μ	*!	*	

Scenario A is the winner because it preserves contrast. The other two scenarios are ruled out on the preserve-contrast constraint. In scenario B, as in Omani, stress is antepenultimate and so contrast is merged with comparable words that contain non-epenthetic vowels in the same environment. Scenario C can never come out optimal. In

scenario C, contrast is also merged and in addition the coda consonant is deprived of a mora, thus both PC and WBP are violated.

This example raises a question of the difference between structural (purely phonological) vs. surface (phonetic) contrast expression. I assume that the PC constraint is satisfied only when the distinction between words is realized phonetically in the output. Thus, it is a prediction of PC theory that the mere presence/absence of a μ in the output, without visible effect on stress, as in scenario C, is not enough to preserve contrast. Candidate C violates the $PC_{IN}(V/\emptyset)$ constraint.

With the opposite ranking, $WBP \gg PC_{IN}(V/\emptyset)$, codas would be required to be moraic at the cost of losing contrast. Scenario B would win, as in Omani:

(26) Final epenthesis – contrast is merged

Scenarios		WBP	$PC_{IN}(V/\emptyset)$	*FINAL FOOT
A. Contrast is preserved (Syrian)	$/CVCVC-C/ \rightarrow cv(c\acute{v}cvc)$ $/CVCVC-VC/ \rightarrow (c\acute{v}cv)cvc_{\mu}$	*!		*
B. Contrast is merged (Omani)	$/CVCVC-C/ \rightarrow (c\acute{v}cv)cvc_{\mu}$ $/CVCVC-VC/ \rightarrow (c\acute{v}cv)cvc_{\mu}$		*	
C. Contrast is merged (harmonically-bounded)	$/CVCVC-C/ \rightarrow (c\acute{v}cv)cvc$ $/CVCVC-VC/ \rightarrow (c\acute{v}cv)cvc_{\mu}$	*!	*	

Scenarios A and C are ruled out on WBP.

Also, if *FINALFOOT dominated PC, even with PC dominating WBP, we would not deprive the final coda consonant of a mora since nothing would be gained by it, as the following tableau shows. Therefore, in Syrian it is important that *FINALFOOT is ranked lower than PC.

(27) Final epenthesis - contrast is merged

Scenarios		*FINAL FOOT	PC _{IN} (V/∅)	WBP
A. Contrast is preserved (Syrian)	/CVCVC-C/ → cv(cvcvc) /CVCVC-VC/ → (cvcv)cvc _μ	*!		*
B. Contrast is merged (Omani)	/CVCVC-C/ → (cvcv)cvc _μ /CVCVC-VC/ → (cvcv)cvc _μ		*	
C. Contrast is merged (harmonically-bounded)	/CVCVC-C/ → (cvcv)cvc /CVCVC-VC/ → (cvcv)cvc _μ		*	*!

Scenario A is ruled out as it violates foot non-finality. Scenario C violates WBP unnecessarily. It deprives the final consonant of a mora but does not preserve contrast. Scenario B is the winner. It satisfies foot non-finality and WBP.

Under Richness of the Base (ROTB), inputs show multiple stress patterns that neutralize onto the actual stress pattern in the output. Since in Arabic in most cases stress is predictable, stress contrasts are neutralized in many instances. Formally, PC(stress) is ranked lower than constraints regulating stress assignment. Due to low-ranking of PC(stress), stress seems like a good choice to represent other contrasts and epenthesis takes advantage of it. The contrast in presence vs. absence of a vowel is manifested as surface stress contrast. Furthermore, transforming the V/∅ contrast into surface stress contrast is predictable since Arabic is weight-sensitive. Stress assignment correlates with mora-hood, which in turn correlates with the presence vs. absence of a vowel.

There is another possible scenario that comes out optimal given PC theory. In the discussion so far, I have assumed that in a scenario, the non-epenthetic form always receives regular stress, and it is the epenthetic form that surfaces with irregular stress to preserve contrast. This is by no means assured. The reason is that there is a possible

contrast-preserving scenario in which inputs and outputs are permuted, and it is otherwise identical to the contrast-preserving scenario in (27a). For discussion see section 5.7.

Contrast could also be preserved by simply not epenthesizing a vowel. To rule it out, I will assume that in all dialects you have to epenthesize. In OT this means that a constraint forcing epenthesis, *CLUSTER (avoid sequences of consonants), dominates PC_{IN}(V/∅). Otherwise, we could preserve the V/∅ contrast by simply not epenthesizing a vowel. In addition, to ensure that we do not satisfy the *CLUSTER constraint by deleting a consonant, we need a high-ranking PC_{IN}(C/∅) constraint. By deleting a consonant we would avoid a cluster but we would also merge a contrast with a comparable word that does not have the cluster in the underlying form.

- (28) Epenthesis is required
 *CLUSTER, PC_{IN}(C/∅) >> PC_{IN}(V/∅)

Let us take an example from a contrast-neutralizing dialect, Omani, /ʔakl+hum/ → ʔakilhum ‘their food’.

- (29) Epenthesis takes place

Scenarios		*CLUSTER	PC _{IN} (C/∅)	PC _{IN} (V/∅)
A. Epenthesis ʔ	/ʔakl –hum/ → ʔakilhum /ʔakil-hum/ → ʔakilhum /ʔak –hum/ → ʔakhum			*
B. Identity	/ʔakl –hum/ → ʔaklhūm /ʔakil-hum/ → ʔakilhum /ʔak –hum/ → ʔakhūm	*!		
C. Deletion	/ʔakl –hum/ → ʔakhūm /ʔakil-hum/ → ʔakilhum /ʔak –hum/ → ʔakhūm		*!	

The epenthetic scenario, scenario A, is the winner. Scenario B, the one without epenthesis and without deletion, satisfies both PC constraints but violates the high-ranking *CLUSTER markedness constraint. Scenario C, the one with deletion, satisfies *CLUSTER but violates the high-ranking PC_{IN}(C/∅) constraint. The ranking of PC_{IN}(C/∅) over PC_{IN}(V/∅) is a central property of Arabic – vowels come and go, but consonants abide.

An alternative explanation for why a coda consonant does not count as moraic would be to assume that the coda consonant of an epenthetic vowel does not belong to a syllable. For example, we could assume that it is directly adjoined to a prosodic word node (see Rubach 1996, Rubach and Booij 1990) or to a foot. This alternative, however, would not explain why epenthesis takes place at all since if a consonant is not in a syllable, then there is no violation of the *CLUSTER constraint that forces epenthesis. Similarly, Piggott (1995) proposes that the coda consonant forms its own syllable and thus is not part of the syllable with an epenthetic vowel. Again, the same problem arises. If it belongs to a separate syllable, no cluster is formed and so nothing forces epenthesis (Piggott 1995:313).

It is possible that a dialect will preserve one contrast but neutralize another contrast, both of which could be preserved in the same way. For example, Omani neutralizes the contrast in presence versus absence of the vowel. Words with and without epenthesis have the same stress. However, in Omani the underlying contrast between geminates and singletons, unlike the V/∅ contrast, is preserved and realized as different stress placement (Shaaban 1977:80). The form with an underlying geminate surfaces with final stress (/saKat+t/→saKát ‘I was silent’), while the form with an underlying singleton

has penultimate stress (/saKat/ → sáKat ‘he was silent’). Thus the underlying geminate/singleton contrast is manifested as surface stress contrast.

I will assume that the form with an underlying geminate is footed *sa(Kát_μ)*, and the form without a geminate is footed as (*sáKat*), both violating *FINALFOOT. Since I have argued that degenerate and apparently excessive feet are not allowed in Arabic, I will propose that the final consonant in (*sáKat*) is non-moraic to satisfy FTFORM. Thus, FTFORM outranks WBP and *FINALFOOT (FTFORM >> WBP, *FINALFOOT). It can force violations of both constraints.

The geminate/singleton contrast is preserved by footing fewer syllables in the form with an underlying geminate. In OT, the fact that in Omani the underlying geminate/singleton contrast is preserved on the surface, but the underlying V/∅ contrast is merged in the same position follows from the difference in ranking of those two PC constraints with respect to PARSE-SYLLABLE. The PC_{IN}(geminate/singleton) constraint outranks PARSE-SYLLABLE, whereas the constraint PC_{IN}(V/∅) is dominated by it. The ranking is as follows: PC_{IN}(geminate/singleton) >> PARSE-SYLL >> PC_{IN}(V/∅). (PC_{IN}(V/∅) is also dominated by WBP (see (27)).) A tableau for the geminate/singleton contrast is given below:

(30) Geminate contrast is preserved

		PC _{IN} (gem/singleton)	PARSE-SYLL
A. Contrast is preserved سك	/saKat-t/ → sa(Kát _μ) /saKat/ → (sáKat)		*
B. Contrast is merged	/saKat-t/ → (sáKat) /saKat/ → (sáKat)	*!	

This provides support for the proposal that PC constraints are relativized to different input properties. Various contrasts are of different importance in a language, and only certain contrasts compel violation of a particular markedness constraint.

In the next section I will discuss a dialect where the same contrast compels violation of markedness but only under certain conditions. The example comes from Iraqi Arabic.

5.4 Contrast is Preserved Only Word-Finally: Iraqi Arabic

In this section we will look at a coda dialect Iraqi Arabic (Erwin 1963, Broselow 1982) in which epenthesis is contrast-preserving only word-finally. That is, epenthetic vowels behave the same with respect to stress assignment as non-epenthetic vowels in word-medial epenthesis (see (31)) but they contrast in epenthesis into word final syllables (see (32)). Consider medial epenthesis:

- (31) Epenthesis into non-final clusters – regular stress
- | | | |
|----|----------------|------------------|
| a. | (kita)(bft)la | ‘I wrote to him’ |
| b. | ki(tab)(tfl)ha | ‘I wrote to her’ |
| c. | (fd)rus | ‘study!’ |
| d. | ič(láab) | ‘dogs’ |

As expected, in examples (31a-c), stress is on the rightmost heavy syllable, which is penultimate in all the cases shown here, and in (31d) it falls on the final super-heavy syllable.

Let us now look at stress in words with epenthesis into word-final clusters. In those forms, stress consistently falls on the penultimate syllable, even though it is light:

- (32) Epenthesis into final 2-consonant clusters – penultimate stress
- | | | |
|----|------------|-------------------------|
| a. | tar(jámit) | ‘you M/I translated’ |
| b. | dar(rásit) | ‘you M/I taught’ |
| c. | fti(kárit) | ‘you M/I thought’ |
| d. | xaa(bárič) | ‘he phoned you F’ |
| e. | qa(lámič) | (variation on this one) |

This is different from comparable words with underlying vowels in word-final position, where stress is as expected. In all examples below, stress is antepenultimate as the penultimate syllable is light:

- (33) Underlying vowels
- | | | |
|----|-------------|--------------|
| a. | (ʔába)dan | ‘never’ |
| b. | (mád)rasa | ‘school’ |
| c. | mu(sá:)ɛada | ‘assistance’ |

Summarizing, the V/∅ contrast is merged in word-medial epenthesis (shown in (31)), but preserved in word-final epenthesis (shown in (32)-(33)).

In my proposal the V/∅ contrast is preserved on the surface by creating a mora-less coda consonant, which affects the foot structure of a word and, consequently, main-stress placement. Since in Iraqi contrast is preserved word-finally but not word-medially, we need to explain why a mora-less coda is permitted word-finally but banned from a word-medial position. If a mora-less coda is not permitted word-medially in the string of segments, contrast cannot be preserved in case of epenthesis into word-medial syllables. Conversely, if a mora-less coda is admitted word-finally, contrast can and is preserved in case of word-final epenthesis. Thus, there must be a difference in well-formedness of segmental strings with mora-less codas medially as opposed to at the edges of a string.

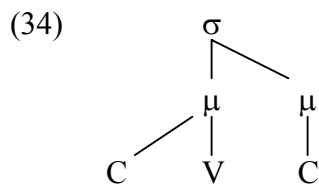
It has been observed that prosodic constituents (i.e., segments, syllables, feet) at the periphery of a prosodic or a morphological domain (i.e., prosodic word, stem, phrase)

have special status. They can be deficient in structure or different in affiliation from identical constituents trapped within a string. This special property of edge-most constituents is captured in the theories of incomplete syllabification (McCarthy and Prince 1990ab), extrametricality (Lieberman and Prince 1977, Hayes 1982, 1995, Kager 1995) or extrasyllabic consonants (Rubach and Booij 1990). Prince and McCarthy (1990), for example, propose that edge-most consonants in Arabic, unlike medial consonants, can form incomplete syllables. Rubach (1996), Rubach and Booij (1990) observe that in Polish word-initial extrasyllabic consonants behave differently from non-initial consonants with respect to segmental processes, i.e., final devoicing, voice assimilation, degemination. They capture this difference formally by proposing separate PrWd-adjunction processes for word-initial versus non-word-initial consonants. Since the two adjunction processes can occur at different stages of the derivation process, segments are predicted to behave differently with respect to segmental processes depending on their position in a PrWd. For other accounts of extrasyllabicity see Halle and Vergnaud (1987), Ito (1982), Borowsky (1986).

In a number of accounts ‘incomplete’ or deficient prosodic constituents are universally only admitted at the edges of a string (see the McCarthy and Prince (1990) for a discussion). But some researchers (Rubach 1996, Rubach and Booij 1990) observe that both medial- and edgemo- deficient constituents are admitted under certain circumstances, though it is necessary to distinguish between the two. Thus, based on this research, we can conclude that medial incomplete constituents are marked, but they do occur, and we should be able to capture this fact formally.

We have already seen that mora-less codas are allowed both finally and medially in Syrian but only finally in Iraqi. To capture this observation, I propose a constraint called MORACONTINUITY that does not allow word-medial mora-less codas, as such consonants disrupt continuity at the level of moras. Like other OT constraints, moraic continuity is a violable constraint and thus mora-less codas are permitted when compelled by higher-ranked constraints.

Following Hyman (1985), Zec (1988) and Ito (1989), I assume that in weight-sensitive languages each segment of a syllable bears a mora. Onsets share a mora with the following vowel. Thus, a CVC syllable in a weight-sensitive language has the following moraic structure:



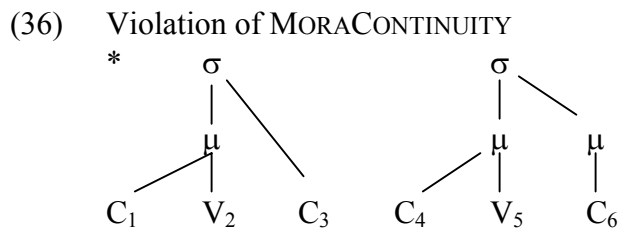
This structure finds motivation in tonal processes (Hyman 1984), language games where onsets act as constituents (Katada 1990), and in the theory of epenthesis (Ito 1989).

Assuming the above syllable structure, MORACONTINUITY is defined as follows:

- (35) Def. of MORACONTINUITY
 In $\alpha\beta\delta$, if $\alpha \in \mu$ and $\delta \in \mu$, then $\beta \in \mu$.

Informally, this constraint enforces moraic continuity over continuous strings of segment.

It is violated whenever continuity is disrupted, as illustrated below:




In (36), there is a mora-less coda, C_3 , medially in the string of segments, and so continuity is disrupted.

If MORACONTINUITY outranks $PC_{IN}(V/\emptyset)$, the weight of a medial syllable with an epenthetic vowel cannot be altered to preserve contrast. Thus, under this ranking, word-medial epenthesis is non-contrast-preserving as in Iraqi:

- (37) No medial epenthesis
 MORACONTINUITY >> $PC_{IN}(V/\emptyset)$

This is illustrated in the following tableau:

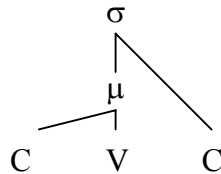
- (38) Contrast is merged word-medially

		MORA CONTINUITY	$PC_{IN}(V/\emptyset)$	WBP
A. Non-moraic coda (Syrian)	$/CVCC-CV/ \rightarrow (c\acute{v}cvc)cv$ $/CVCVC-CV/ \rightarrow cv(c\acute{v}c_{\mu})cv$	*!		*
B. Moraic coda (Iraqi) 	$/CVCC-CV/ \rightarrow cv(c\acute{v}c_{\mu})cv$ $/CVCVC-CV/ \rightarrow cv(c\acute{v}c_{\mu})cv$		*	

Scenario B is the winner as it satisfies moraic continuity, even though it merges the V/\emptyset contrast on the surface.

Given the definition of MORACONTINUITY, a non-moraic coda word-finally does not violate moraic continuity, as it is edge-most in the string of segments.

- (39) No violation of MORACONTINUITY



Thus, provided that *FINALFOOT is low-ranked and PC dominates WBP, word-final epenthesis is still contrast-preserving, even when MORACONTINUITY is high-ranking.

This is illustrated in the following tableau.

(40) Contrast is preserved word-finally

Scenarios		MORA CONTINUITY	PC _{IN} (V/∅)	WBP
A. Non-moraic coda (Iraqi) ١٤٥	/CVCVC-C/ → cv(c'vcv) /CVCVC-VC/ → (c'vcv)cvc _μ			*
B. Moraic coda (Omani)	/CVCVC-C/ → (c'vcv)cvc _μ /CVCVC-VC/ → (c'vcv)cvc _μ		*!	

Scenario A is the winner as it preserves contrast. Continuity is not violated.

In the next section I summarize the rankings obtained so far.

5.5 Rankings

So far I have accounted for cases where (i) contrast is merged across the board as in Omani, (ii) contrast is preserved across the board as in Syrian, and (iii) contrast is preserved word-finally but merged word-medially as in Iraqi.

To account for cases where contrast is merged across the board, I proposed that WBP outranks PC. As a result, preserving contrast cannot compel having a non-moraic coda consonant.

(41) Contrast is merged ATB (Omani)⁶ (section 5.3.2)
WBP >> PC_{IN}(V/∅)

To explain cases where contrast is preserved across the board, the opposite ranking has been established. Thus, contrast preservation is satisfied at the expense of having a non-moraic coda consonant.

(42) Contrast is preserved ATB (Syrian) (section 5.3.1)
PC_{IN}(V/∅) >> WBP, *FINALFOOT, MORACONTINUITY

⁶ And there is no higher-ranked constraint that forces violation of WBP.

To account for Iraqi Arabic, where contrast is preserved only finally, a high-ranked constraint on moraic continuity outranks PC, and thus medial non-moraic codas are ruled out:

- (43) Contrast is preserved only finally (Iraqi) (section 5.4)
 *MORACONTINUITY >> PC_{IN}(V/∅) >> WBP, *FINALFOOT

There is one more case that has not been found so far but is possible, given ranking permutations of the constraints proposed so far. This is the case when final epenthesis is non-contrast-preserving, but medial epenthesis preserves contrast. A case like this would be obtained when *FINALFOOT outranked PC, thus not allowing for a final foot, but MORACONTINUITY was ranked lower than PC, thus allowing for medial non-moraic codas:

- (44) Contrast is preserved only medially (not found so far but possible)
 *FINALFOOT >> PC_{IN}(V/∅) >> WBP, MORACONTINUITY

This argument holds only under the assumption that there is no other way to satisfy both PC and *FINALFOOT at the same time in word-final epenthesis.

5.6 Locality of Contrast Preservation

To explain stress-epenthesis interaction in contrast-preserving dialects, I proposed that the underlying V/∅ contrast (contrast in presence vs. absence of a vowel) is preserved on the surface by creating a mora-less coda in the epenthetic syllable. This alters the foot structure of a word and thus has an effect on main stress placement. In this proposal the surface contrast expression (i.e., stress placement) is mediated via a structural change (i.e., a mora-less coda).

Both the structural and surface contrast expression is subject to locality. We can make the following observations concerning locality in contrast-preserving dialects in Arabic.

(45) Locality in Arabic

- (i) In epenthetic forms, main stress always falls on the syllable preceding the epenthetic syllable (it is local to the site of epenthesis).
- (ii) To preserve contrast, we always alter the weight of the syllable with an epenthetic vowel and never the weight of adjacent syllables.
- (iii) In all cases, the syllable with an epenthetic vowel is incorporated into the main stressed foot.

This section will account for those observations formally.

Since in Arabic epenthesis takes place, the underlying V/\emptyset contrast cannot be expressed on the surface in the same way as in the underlying form. Instead, it is transformed into surface stress contrast and dislocated in the string of segments. I observe that in all cases contrast dislocation is minimal. Stress falls on the syllable preceding the epenthetic vowel and never further away from the site of epenthesis. For example, in penultimate epenthesis, an underlying form /katab-t-la/ maps onto *ka(tābī)la* with stress on the antepenult. This preserves contrast with a minimally distinct non-epenthetic form /katab-it-la/ that surfaces as *(kata)(bī_μ)la* with penultimate stress.

However, another way to preserve contrast would be to move stress further away from the site of epenthesis without altering the weight of the epenthetic syllable. For example, the epenthetic form /katab-t-la/ could surface as *(káta)(bī_μ)la*, with pre-antepenultimate stress. Yet, this does not happen and our account should predict this result. (A similar problem arises in word-final epenthesis.)

To account for minimal contrast dislocation, I will propose a locality constraint demanding that the surface expression of the underlying V/∅ contrast, that is stress placement in Arabic, is located as close to the original locus of contrast as possible. In effect, the underlying contrast is signaled locally. This will be formulated as a correspondence constraint between minimally contrasting input-output word pairs, PC-LOCAL.

In addition, I will discuss epenthesis in onset dialects and in quadri-consonantal sequences in all dialects. As observed in Farwaneh (1995), those two types of epenthesis are never contrast-preserving in Arabic. This fact has not received a principled explanation under previous approaches to stress-epenthesis interaction, but I will show that my account together with a locality constraint on contrast expression predicts this result.

Since in onset dialects epenthesis creates an open syllable, there is no coda in the epenthetic syllable to deprive of a mora. Therefore, under the assumption that we can only alter the weight of the epenthetic syllable, stress is not altered and contrast is not preserved. In quadri-consonantal sequences, on the other hand, I will show that depriving the coda consonant of the epenthetic syllable of a mora does not lead to a different foot structure of a word and so would be superfluous.

But in both onset dialects and in quadri-consonantal sequences, to preserve contrast we could alter the weight of some other syllable than the epenthetic syllable. Since this possible repair does not take place, I will take it as evidence for another locality constraint, PC-DOMAIN. This constraint demands that the structural expression of a given underlying contrast, a non-moraic coda in Arabic, is contained within the

domain of the original contrast, that is, in the same syllable as the epenthetic vowel. When ranked above general PC, this constraint requires that contrast not be moved out of the original domain. Again, this will be formulated as a correspondence constraint between contrasting input-output word pairs. PC-DOMAIN, when high-ranked, makes correct typological predictions with respect to onset dialects and quadri-consonantal sequences.

5.6.1 Local Dislocation

In this section I discuss contrast preservation in longer words. Such cases provide a strong argument for the locality constraint on contrast preservation.

Consider epenthesis into word-final clusters. In contrast-preserving dialects, as we have seen, stress in epenthetic words is penultimate, thus the epenthetic syllable is incorporated into the final foot (Syrian, Iraqi). Stress in non-epenthetic words, on the other hand, is antepenultimate with the final syllable unparsed.

- (46) Word-finally (Iraqi)
- | | | | |
|----------------|---------------|---|---------------------------|
| Epenthetic | /CVCVC-VC-C/ | → | (cvcv)(c'vcv) |
| Non-epenthetic | /CVCVC-VCV-C/ | → | cv(c'vcv)cvc _μ |

This has been accounted for by ranking the PC constraint above WBP and *FINALFOOT. In other words, contrast preservation enforces violation of WBP and foot nonfinality.



- (47) Contrast is preserved word-finally
 $PC_{IN}(V/\emptyset) \gg WBP, *FINALFOOT$ (cf. (25))

But under this ranking, there is another scenario that comes out optimal. This is a scenario that satisfies all of the constraints in (47). It preserves contrast by moving main stress leftwards, without depriving the coda consonant of a mora and without violating foot nonfinality. In this scenario, stress in the epenthetic word is pre-antepenultimate. This is shown in (48).

- (48) Optimal but incorrect scenario
 Epenthetic /CVCVC-VC-C/ → (cʋcv)cvcvc_μ
 Non-epenthetic /CVCVC-VCV-C/ → cv(cʋcv)cvc_μ

The following tableau shows the problem formally:

- (49) Incorrect result

Scenarios		PC _{IN} (V/∅)	*FINAL FOOT	WBP
A. Actual 	/CVCVC-VC-C/ → (cʋcv)(cʋcvc) /CVCVC-VCV-C/ → cv(cʋcv)cvc _μ		!!	!!
B. Incorrect 	/CVCVC-VC-C/ → (cʋcv)cvcvc _μ /CVCVC-VCV-C/ → cv(cʋcv)cvc _μ			

Both scenarios preserve contrast. The incorrect scenario comes out optimal as it satisfies all of the above constraints.

To choose the actual scenario as optimal, we need a constraint ranked higher than *FINALFOOT and WBP so that violations of those two constraints are rendered irrelevant. This constraint needs to prefer scenario A to scenario B.

I propose that it is a constraint on locality, which prefers local displacement of contrast to a non-local one and thus favors the actual scenario. This constraint compares pairs of mappings whose inputs contrast minimally in P. It requires that if two inputs are distinct in P, and their corresponding outputs are distinct in Q, then Q is local to P in the corresponding string of segments (contrast is signaled locally).

This is similar to traditional faithfulness constraints. However, to locate the P and Q properties, mappings are compared against each other. First let us recall the definition of correspondence (McCarthy & Prince 1995):

- (50) Correspondence (McCarthy & Prince 1995)
 Given two strings S₁ and S₂, correspondence is a relation \mathfrak{R} from the elements of S₁ to those of S₂. Segments $\alpha \in S_1$ and $\beta \in S_2$ are referred to as correspondents of one another when $\alpha \mathfrak{R} \beta$.

As first approximation, we can formulate the locality constraint as follows:

(51) PC-LOCAL(P)

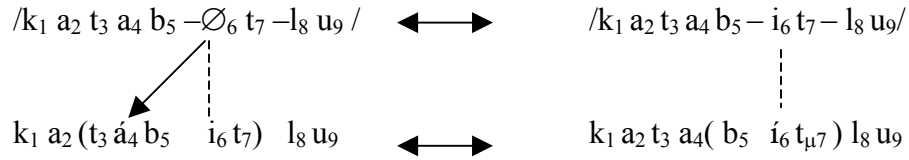
Let there be two inputs, In_1 and In_2 , that are minimally distinct in P. Then $In_1 = /...in-seg_i.../ (seg_i \in P)$ and $In_2 = /...in-seg_j.../ (seg_j \in \neg P)$. Let $In_1 \rightarrow Out_1$ and $In_2 \rightarrow Out_2$. If Out_1 and Out_2 are distinct in some property Q (so $Out_1 = /...out-seg_k.../ (seg_k \in Q)$ and $Out_2 = /...out-seg_z.../ (seg_z \in \neg Q)$, and $in-seg_i \mathcal{R} out-seg_i$, then $k=i$ (for $In_1 \rightarrow Out_1$). Assign one violation mark for each segment intervening between $out-seg_k$ and $out-seg_i$ (same for $out-seg_z$ and $out-seg_j$).

That is, one violation is assigned for each segment intervening between the output segment that bears the Q property and the output correspondent of the input segment that bears the P property. The P and Q properties referred to in the definition of this constraint can be positive, indicating the presence of a property, as well as negative, indicating the lack of it.⁷

In Arabic, we compare inputs minimally contrastive in the presence versus absence of a vowel. The constraint requires that stress fall as close to the site of epenthesis as possible. I will assume here that stress is affiliated with a segment, and thus locality of stress can be evaluated in a segmental string.

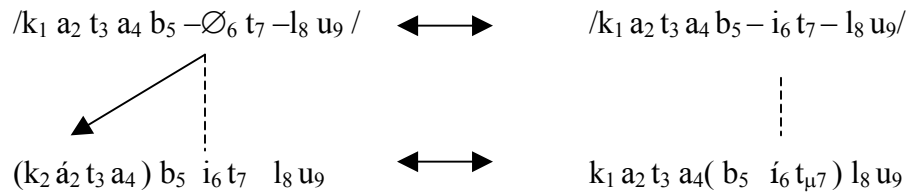
In scenario A, as was shown in tableau (49), PC-LOCAL is violated minimally, as stress is dislocated by one segment from the site of epenthesis (we only take into account segments that can bear stress). This is recalled below:

(52) PC-LOCAL(P) is violated minimally (*)



In comparison, scenario B violates this constraint twice, as contrast is dislocated from its original locus by two segments that provide a legitimate locus for stress:

(53) PC-LOCAL(P) is violated twice (**)



We assume that the non-epenthetic form has regular stress (see discussion in section 5.9).

The constraint ranking in a contrast-preserving dialect is as follows:

(54) PC_{IN}(V/∅) >> PC-LOCAL(V/∅) >> *FINALFOOT

The following tableau illustrates the role of locality in word-final epenthesis:

⁷ This constraint evaluates inputs that are minimally distinct in P but it does not require that their outputs are minimally distinct. That is, outputs corresponding to minimally distinct inputs may differ in more than one property. For now, I will assume that this constraint assigns violation marks for any Q property by which outputs are differentiated that is displaced from the original P position. That is, if outputs are distinct in more than one Q property, and each of them is displaced from the original locus of P, then for each of them the constraint assigns violation marks. In the examples discussed in this chapter, this question does not arise as outputs as well as inputs are minimally distinct, but it is crucial to PC theory and will be further investigated in this dissertation.

I will also assume that Q refers to the surface contrast between outputs, like stress assignment. The notion of surface contrast needs to be encoded formally in the theory. For now I assume that Q is what makes the two outputs phonetically distinct.

(55) The role of PC-LOCAL

Scenarios		PC _{IN} (V/∅)	PC-LOC (V/∅)	*FINAL FOOT
A. Actual	/CVCVC-VC-C/ → (cvcv)(cʰcvc) /CVCVC-VCV-C/ → cv(cʰcvc)cvc _μ		*	*
B. Non-local	/CVCVC-VC-C/ → (cʰcvc)cvcvc _μ /CVCVC-VCV-C/ → cv(cʰcvc)cvc _μ		**!	
C. Merger	/CVCVC-VC-C/ → cv(cʰcvc)cvc _μ /CVCVC-VCV-C/ → cv(cʰcvc)cvc _μ	*!		

Scenario C is ruled out as it merges the contrast between words with epenthetic and non-epenthetic vowels. Scenario B, the incorrect scenario, loses on locality. In this scenario, contrast is dislocated too far in the string of segments from the site of epenthesis. Scenario A is the winner - contrast is dislocated only minimally.

Consider now word-medial epenthesis. In contrast-preserving dialects (Syrian), stress is antepenultimate in epenthetic words and penultimate in non-epenthetic words.

(56) Actual scenario

Epenthetic	/katab-t-lu/	→	ka(tábit)lu	antepenultimate
Non-epenthetic	/katab-it-lu/	→	kata(bít _μ)lu	penultimate

But we could also move stress further away from the epenthetic syllable onto the pre-antepenult. Contrast would then be preserved without making the coda consonant of the epenthetic syllable non-moraic.

(57) Hypothetical scenario

Epenthetic	/katab-t-lu/	→	(káta)bít _μ lu
Non-epenthetic	/katab-it-lu/	→	kata(bít _μ)lu

As in word-final epenthesis, the scenario in (57) is ruled out by LOCALITY of contrast preservation. The contrast property is dislocated too far away in the string of segments from its original locus.

(58) Locality in medial epenthesis

Scenarios		PC _{IN} (V/∅)	PC-LOCAL(V/∅)	WBP
A. Actual ᵀᵀ	/katab-t-lu/ → ka(tábit)lu /katab-it-lu/ → kata(bít _μ)lu		*	*
B. Non-local	/katab-t-lu/ → (káta)bit _μ lu /katab-it-lu/ → kata(bít _μ)lu		**!	
C. Merger	/katab-t-lu/ → kata(bít _μ)lu /katab-it-lu/ → kata(bít _μ)lu	*!		

The actual scenario incurs a minimal violation of locality and thus is chosen the winner.

In word-medial epenthesis, the non-local scenario is also non-optimal on stress constraints. It violates WBP (weight by position) and WSP (the weight to stress principle). Thus, in some cases, the effect of locality can be also achieved by constraints on stress placement as long as they are ranked lower than PC (see the stress ranking in (6)).

In the discussion so far, I have implicitly assumed that to preserve contrast, mappings in a scenario need to be pronounced differently. It is not enough for them to be distinct in phonological structure only to preserve contrast. As for epenthesis into word-final clusters, I have not considered scenarios where stress would be on the same syllable in both mappings but mappings would be different structurally. For example, we could have a pair of mappings where stress is antepenultimate, as expected, but the final consonant in one of the mappings lacks a mora. Thus, we would have $cv(cvcv)cvc_{\mu}$ and $cv(cvcv)cvc$ as outputs of non-epenthetic and epenthetic strings. My assumption is that contrast preservation is satisfied only when the structural distinction is realized overtly on the surface.

In the next section I will show how my proposal explains the fact that epenthesis in onset dialects is never contrast-preserving unlike epenthesis in coda dialects.

5.6.2 Onset Dialects

It has been observed that in onset dialects words with epenthesis behave the same with respect to stress assignment as words with no epenthesis (Farwanah 1995). In terms of contrast preservation, onset dialects merge the V/∅ contrast in all environments. Egyptian (Broselow 1976, Harrell 1957) provides an example. As shown below, in Egyptian epenthetic and non-epenthetic words behave the same with respect to stress placement:

- (59) Egyptian - contrast is merged
- Epenthetic words
- a. (bin)(tína) ‘our daughter’
 - b. (ʔar)(Dína) ‘our land’
 - c. ka(tab)(tílu) ‘I wrote to him’
- Non-epenthetic words
- d. (mad)(rása) ‘school’
 - e. ka(táb)na ‘we wrote’

Egyptian has a different stress pattern from dialects discussed so far. As described in Hayes (1995), it is a moraic trochee system with feet assigned from left to right. Main stress is located in the rightmost foot and the final mora is extrametrical. Some other examples of onset dialects are Sudanese (Trimingham 1946, Hamid 1984), Saudi (Abu-Mansour 1987).

I will now explain how my account captures the fact that epenthesis is non-contrast-preserving in all onset dialects. When discussing contrast-preserving coda dialects, I have proposed that the coda consonant of the syllable with an epenthetic vowel is non-moraic and therefore it counts as light for purposes of stress placement. But in onset dialects epenthesis creates an open syllable (Selkirk 1981, Broselow 1982), as in /katabt+lu/ → ka-tab-ti-lu ‘I wrote to him’. Since in onset dialects there is no mora

consonant in the syllable with an epenthetic vowel, it is not possible to change the weight of the epenthetic syllable so that foot assignment and thus stress placement in words with epenthesis would be different from that of non-epenthetic words. There is no coda to deprive it of a mora.

However, we could change the weight of an adjacent syllable and thus change stress placement, thereby satisfying PC. Given the Egyptian stress pattern, if the preceding syllable was a closed syllable, we could force its coda consonant to be monomoraic. Stress would then move leftwards onto the antepenult and contrast would be preserved. An example is given below:

(60)	Contrast-preserving scenario			
	Epenthetic	bint-na	→	(binti)na
	Non-epenthetic	bint-i-na	→	(bin _μ)(tina)

So how do we rule it out?

To rule out non-local contrast dislocation, in the previous section I have assumed locality of contrast preservation, by which you prefer to realize the surface contrast property locally rather than non-locally. But LOCALITY of surface contrast expression does not rule out the above scenario, as long as it is dominated by PC. In other words, the above scenario violates LOCALITY of stress placement, but only minimally. Such violation of locality can be explained by a high-ranking PC constraint.

Therefore, to rule out the above scenario, I propose that in addition to a locality constraint on surface contrast expression, we need some other constraint dominating PC that would only allow for cases where it is the coda consonant of the epenthetic syllable that loses a mora.

I propose a constraint on the locality of structural contrast expression. It demands that the structural expression of contrast be represented in the same domain as the original locus of contrast. I call it PC-DOMAIN(P). Its effect is to allow a non-moraic coda only in the same syllable as the epenthetic vowel. This constraint works similarly to the constraint formulated in the previous section (see (49)). The primary difference between the two is that the domain constraint guards locality of the structural expression of contrast, mora-hood, as opposed to the surface contrast expression, stress placement. Thus, the domain constraint is evaluated with respect to a prosodic domain. The domain constraint is defined below (as a first approximation):

(61) PC-DOMAIN(P)

Let there be two inputs, In_1 and In_2 , that are minimally distinct in P. Then $In_1 = /...in-seg_i.../$ ($seg_i \in P$) and $In_2 = /...in-seg_j.../$ ($seg_j \in \neg P$). Let $In_1 \rightarrow Out_1$ and $In_2 \rightarrow Out_2$. If Out_1 and Out_2 are distinct in some property Q (so $Out_1 = /...out-seg_k.../$ ($seg_k \in Q$) and $Out_2 = /...out-seg_z.../$ ($seg_z \in \neg Q$)), and $in-seg_i \Re out-seg_i$, then $out-seg_k$ is contained in the same prosodic domain to which $out-seg_i$ belongs (same for $out-seg_z$).

“Do not move a contrast out of its domain.”

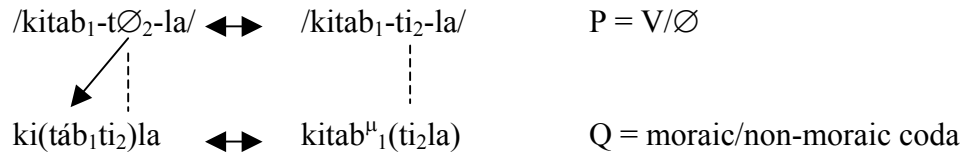
That is, the output segment that bears the Q property and the output correspondent of the input segment that bears the P property are contained in the same domain. The domain is the smallest prosodic domain relevant for a particular contrast expression. As for mora-hood, the smallest relevant domain is the syllable.

I propose that in Arabic, PC-DOMAIN outranks general PC:

(62) PC-DOMAIN(P) >> PC_{IN}(P)

Since domain locality dominates PC, a non-local structural change is not allowed. Any candidate with a non-moraic coda in a non-epenthetic syllable violates the domain constraint.

(63) Violation of PC-DOMAIN



In the example above, the structural locality constraint (called PC-DOMAIN) is violated, as the mora-less coda consonant is in a different syllable than the epenthetic vowel.

(64) The role of PC-DOMAIN

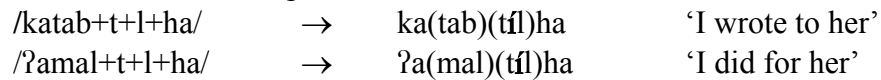
Scenarios		PC-DOMAIN	PC _{IN} (V/∅)
A. Actual بنت	/bint-na/ → (bin _μ)(t̄fna) /bin-t-na/ → (bin _μ)(t̄fna)		*
B. Contrast-preserving (= (63))	/bint-na/ → (binti)na /bin-t-na/ → (bin _μ)(t̄fna)	*!	

Scenario B is ruled out. It preserves contrast but the structural change takes place outside of the epenthetic syllable domain, which is not allowed.

5.6.3 Quadri-consonantal Clusters

As Farwaneh (1995) observed, “epenthetic vowels in medial quadriconsonantal sequences are systematically stressed in all dialects”. That is, in case of epenthesis into a four-consonant cluster, there is no difference in the stress pattern between words with and without epenthetic vowels. Some examples are given below:

(65) Quadri-consonantal epenthesis



This is true of all dialects. In the rest of this section, I will show that my account predicts this result.

Let us consider ways in which we could preserve contrast in quadri-consonantal sequences but which are not allowed, given the high-ranking constraint on domain locality, PC-DOMAIN.

To preserve contrast, we could change the weight of both the epenthetic syllable and the preceding non-epenthetic syllable. This would give us a LLL sequence of syllables, with the epenthetic syllable in bold font. In Egyptian, this would make a difference to stress assignment. Due to this change, stress would be on the antepenult (LL)L, and not on the penultimate syllable, as in identical non-epenthetic words (see section 5.6.2 for Egyptian stress). This scenario is illustrated below:

- (66) Not attested (assume Egyptian stress)
- | | | | |
|----------------|----------------|---|---|
| Epenthetic | /CVCVC+C+C+CV/ | → | cv(c ^ν cc ^ν c)cv |
| Non-epenthetic | /CVCVCCVCCV/ | → | cv(cvc _μ)(c ^ν c _μ)cv |

Even though contrast is preserved, this scenario is ruled out by domain locality. One of the “altered syllables” is not the epenthetic syllable.

To preserve contrast, we could also move stress leftwards, onto the antepenult, without altering the weight of any syllable.

- (67) Not attested
- | | | | |
|----------------|----------------|---|--|
| Epenthetic | /CVCVC+C+C+CV/ | → | cv(c ^ν c _μ)(c ^ν c _μ)cv |
| Non-epenthetic | /CVCVCCVCCV/ | → | cv(cvc _μ)(c ^ν c _μ)cv |

In this scenario, there is no mora-less coda, and so PC-DOMAIN, as formulated in the previous section, is satisfied. But in this scenario, the surface expression of the underlying contrast, main stress, is not contained in the same foot to which the epenthetic vowel belongs. In other words, the main-stressed foot, and the foot with the epenthetic vowel are distinct. If we assume that feet are also in a sense a structural expression of

contrast, then this scenario is ruled out by high-ranking PC-DOMAIN. The epenthetic vowel does not belong to the main-stressed foot.

This scenario could be also ruled out in some languages by adequate ranking of prosodic well-formedness constraints. For example, if HD-FT-R dominated PC, this scenario would be non-optimal, as stress is not located in the rightmost foot. But assuming that in contrast-preserving dialects, PC dominates *FINALFOOT, by transitivity it also dominates HD-FT-R (see (6)), and so prosodic well-formedness alone cannot explain why the above scenario is not attested in Arabic.

Summarizing, in this section we have seen that my proposal of altering the weight of the epenthetic syllables, together with high-ranked PC-DOMAIN, explains why epenthesis in quadri-consonantal sequences is never contrast-preserving. I have also entertained the possibility that PC-DOMAIN may have to be extended to the foot domain.

5.7 Symmetric Violation of PC: The Role of the Learner or OO-Correspondence

In all contrast-preserving dialects it is the mapping with an epenthetic vowel that behaves irregularly to stress assignment. The mapping with an underlying vowel acts regularly. But given the formulation of PC, there is nothing that ensures this result. PC only requires that contrast be preserved in a system and does not determine which mapping should violate markedness to preserve contrast. So why is it the word with an epenthetic vowel that is exceptional to stress assignment? How do we make sure that the other situation does not occur?

One possibility is to say that the child first learns stress assignment of non-epenthetic forms and only then the epenthetic ones. Therefore, from the two, only the

epenthetic forms can be exceptional. This would allow the child to figure out the constraint ranking for a system of mappings, but it may run into problems when we want the constraint ranking itself to be able to generate the optimal scenario. A permuted scenario may be generated.

Another possibility is to assume OO-faithfulness to moraic affiliation of segments, OO-Ident-Mora. This proposal stems from the observation that the coda consonant of the syllable with an epenthetic vowel is never in a coda position outside of the epenthetic environment. But the coda consonant of the syllable with a non-epenthetic vowel is a coda in a variety of morphological forms and thus as a coda bears a mora in those forms. The OO-Ident-Mora constraint would prohibit coda consonants in words with non-epenthetic vowels from losing a mora but would not be violated if coda consonants of syllables with epenthetic vowels lack a mora. Informally, this constraint encodes the “coda” status of a consonant in a paradigm.

5.8 Comparison with Previous Approaches

In this section I compare my account to other approaches to stress-epenthesis interaction proposed in the literature. Rule-based accounts are discussed in (5.8.1), and other OT proposals in (5.8.2).

5.8.1 Rule-based Approaches

In contrast-preserving dialects (Syrian, Levantine, Libyan, Iraqi), the interaction of stress and epenthesis is opaque. That is, the way stress is assigned is inconsistent with the normal pattern. To recall, in word-medial epenthesis into the penult, in epenthetic forms stress is antepenultimate (*ki.tá.bít.la*) and not penultimate (**ki.ta.bít.la*), as

expected. Similar, in word-final epenthesis, stress is penultimate (*ki.tá.bit*) and not antepenultimate (**kí.ta.bit*), as expected.

A standard approach to opaque processes in rule-based theory is rule ordering (Kiparsky 1973, Kenstowicz and Kisseberth 1979, Rubach 1984). By rule ordering, in contrast-neutralizing dialects, epenthesis precedes stress assignment, and thus words with and without epenthesis have the same stress pattern. In contrast-preserving dialects, on the other hand, stress precedes epenthesis, and thus words with and without epenthesis have different stress.

The rule-ordering approach is problematic for several reasons. To begin with, in this approach, it is difficult to explain cases like Iraqi Arabic, where epenthesis is contrast-preserving but only word-finally. Word-medially contrast is merged. In the rule-ordering approach, we either preserve or neutralize contrast depending on the ranking of epenthesis with respect to stress.

This problem has been already pointed out by Broselow (1982), who observes that one way to avoid it is to assume distinct epenthesis rules, one for word-final- and the other for word-medial-epenthesis, and to order them differently with respect to stress assignment. Specifically, word-medial epenthesis would precede stress assignment, and thus contrast would be merged word-medially. Word-final epenthesis, on the other hand, would follow stress assignment, and thus contrast would be preserved between epenthetic and non-epenthetic words in case of word-final epenthesis. But, as discussed in Broselow (1982), epenthesis into word-final and word-medial clusters has the same characteristics (Selkirk 1981), and so splitting of the epenthesis rule into two distinct processes is uncalled for. To solve this problem, rule-based accounts usually adopt an additional

assumption of consonant extrametricality. With this assumption, epenthesis in word-final and word-medial positions will be one and the same process, but final consonants will be extrametrical at the point when stress applies. As a result, stress will precede word-final epenthesis. Post-lexically, extrametricality will be revoked and so final epenthesis will apply. But stress will have been assigned by then and thus epenthesis will be contrast-preserving word-finally. However, as shown in Prince and Smolensky (1993), formal extrametricality is problematic and should not be treated as a formal device. P&S argue that properties ascribed to formal extrametricality, such as nonexhaustivity, constituency, peripherality, edge markedness and uniqueness, often encode some more general phonological tendencies and should be recognized as such (see pp. 44-47).

In addition, the rule-ordering approach cannot explain the generalization that quadri-consonantal clusters are always contrast-neutralizing. In this approach, they should be either contrast-preserving or contrast-neutralizing depending on the ranking that holds in a particular dialect.

Another generalization that is missed under the rule-based approach concerns onset dialects. It remains a mystery why all onset dialects are contrast-preserving in Arabic, unlike coda dialects, which are divided into contrast-preserving and contrast-neutralizing types. In rule ordering, this means that only one ordering of rules, epenthesis before stress assignment, is permitted for onset dialects. But why it should be so remains unexplained.

Broselow (1982) takes a different approach to stress-epenthesis interaction. She proposes that the way stress interacts with epenthesis is dependent on the internal organization of the grammar. In Arabic, epenthesis results in a well-formed syllable

structure, that is, by epenthesis, clusters of consonants are avoided. Thus, epenthesis in Arabic refers to the level of syllabic constituents. Since syllables are contained within feet (see Selkirk 1984, 1995), in a serial model, syllables are constructed before feet are built. As argued by Broselow, it follows that most cases of syllable-conditioned epenthesis will be contrast-neutralizing, as epenthesis applies before stress is assigned. In this way, Broselow accounts for dialects where the contrast between epenthetic and non-epenthetic words is neutralized across the board.

To explain hybrid cases like Iraqi Arabic, she proposes that languages choose different orderings between re-syllabification and stress assignment (that is foot building). When re-syllabification follows stress, then stress is contrast-preserving word-finally, as in Iraqi. At the stage when stress applies, in word-final epenthesis, the penult is still heavy despite epenthesis. In effect, stress is penultimate (*ka.tab._t* > by stress *ka.táb._t* > by resyllabification *ka.tá.bit*). Word-medially, regardless of re-syllabification, epenthetic syllables are heavy and so behave with respect to stress like heavy syllables with underlying vowels. Thus, we have a hybrid case. Word-finally epenthetic vowels do not count for stress, but word-medially they do. In contrast-preserving coda dialects, the ordering would be the opposite, that is, resyllabification would precede stress.

But this account does not seem to generalize to those dialects in which contrast is preserved across the board, like Syrian, Levantine and Libyan (see section 5.3.1). If we order stress before re-syllabification, then we get Iraqi (a hybrid case), and with the opposite ranking we arrive at Omani (a contrast-neutralizing case). Syrian (a contrast-preserving dialect) presents a problem.

Broselow (1992) proposes a different account of the same phenomena. She proposes that unsyllabified consonants are assigned the status of a monomoraic syllable in coda dialects (*ki.tab.t_μ.la*) and the status of an onset with an empty mora position in onset dialects (*ki.tab.t_.la*). In onset dialects the empty mora position is then filled with a vowel. This rightly predicts that words with and without epenthesis in onset dialects behave the same. In coda dialects, however, no vowel insertion is required. Therefore, words with and without epenthesis will have different stress. For example, when epenthesis is into the penult, where the antepenultimate syllable is heavy, it is the antepenult that receives stress (*ki.táb.t_μ.la*). Subsequently, epenthesis and resyllabification take place and so stress assignment contradicts surface facts (epenthetic *ki.tá.bi.t_μ.la* versus non-epenthetic *ka.táb.tu*). This explains cases like Syrian, where stress in words with and without epenthesis is distinct.

Under this approach, contrast-neutralizing dialects like Omani seem problematic. That is, we need to explain why in some coda dialects epenthetic vowels count for stress.

Another problem is to explain what forces epenthesis in this proposal. If the extrasyllabic consonant forms its own syllable, then there is no cluster within a syllable to be broken up by an epenthetic vowel. We need some additional assumptions to force epenthesis. (With regard to the same problem, see the discussion of Piggott (1995) in section 5.2.)

Farwaneh (1995) provides a solution. In her proposal, unlike Broselow (1982), epenthetic syllables count as light in coda dialects until nucleus formation is invoked. Nucleus formation takes place iff the epenthetic syllable has an onset. She furthermore proposes that languages choose an option of either assigning an onset to the epenthetic

syllables (*ka.ta.b_t.la*) or keeping the potential onset consonant in the coda of the preceding syllable (*ka.tab._t.la*). She captures this formally by allowing languages to choose either the so-called onset or weight-by-position parameter. Languages that choose the onset parameter merge the contrast between words with epenthetic and non-epenthetic vowels. Languages that choose the weight-by-position parameter, retain the contrast. This can be seen in relation to resyllabification. That is, the onset parameter means that resyllabification takes place at the point when stress applies, whereas the weight-by-position parameter implies that resyllabification has not yet taken place. Since onsetless syllables do not have a nucleus when stress is assigned, this distinguishes between contrast-preserving and contrast-neutralizing dialects, a problem that Broselow's account faces.

This account does not seem to predict cases like Iraqi Arabic, where contrast is merged word-medially but preserved word-finally. Since contrast is merged for word-medial epenthesis, Iraqi would choose the onset parameter word medially, thus surface *ki.ta.bf.la* would be syllabified *ki.ta.b_t.la* at the stage when stress applies (with the nucleus filled). By choosing the onset parameter, syllabification is the same as on the surface, and stress is assigned in the same way as to underlying vowels in the same position. But in word-final position, the onset parameter wrongly predicts antepenultimate stress, **kí.ta.b_t*, instead of the actual penultimate stress which is consistent with the WBP parameter, *ki.táb._t*. By choosing the WBP parameter, the penultimate syllable is heavy and thus receives stress. To account for cases of this type, we need to assume that a language can choose parameters depending on the site of epenthesis. In case of Iraqi, the onset parameter is chosen word-medially, but the WBP

parameter word-finally. Unless there is some principled way of explaining this difference in the choice of the parameter, it should be avoided. Epenthesis is one process in Iraqi and should be formally captured as such. (But see a discussion of Libyan versus Levantine in Farwaneh 1995:142-151).

A similar problem arises in the approach to epenthesis developed by Michelson (1989), modifying Archangeli (1984). On the example of Mohawk epenthesis, Michelson proposes that in cases when words with epenthesis behave differently with respect to stress assignment than words without epenthesis: epenthetic vowels are invisible to stress. The invisibility is achieved by proposing that in those cases epenthesis inserts segmental features without accompanying V-slots. V-slots give vowels the status of a nucleus. Thus, at the point when stress applies, epenthetic vowels do not have the status of a syllabic nucleus and so do not count for stress. In languages where epenthetic words behave the same as non-epenthetic words with respect to stress, on the other hand, V-slots are supplied before stress assignment takes place.

Just like the proposal in Farwaneh (1995), the invisibility hypothesis does not account for hybrid cases like Iraqi Arabic, unless we allow for separate V-slot rules depending on the environment of the epenthetic segment. This again brings us back to the general problem with the rule-ordering hypothesis described at the beginning of this section, which is that epenthesis in those dialects is one and the same process, and so should be treated as such under any formal account of those facts.

The proposal developed by Michelson (1989), moreover, does not give a principled explanation for why epenthesis into quadri-consonantal sequences is never contrast-preserving. Again, in languages that choose to insert V-slots after stress

assignment, epenthesis in quadri-consonantal sequences should be contrast-neutralizing just like epenthesis into other clusters in the same language.

Furthermore, under the invisibility proposal onset dialects are left unexplained. That is, we expect onset dialects to either preserve or neutralize the underlying contrast on the surface depending on the ordering of V-slots insertion with respect to stress assignment. Yet, they are all contrast-preserving. This would mean that in all onset dialects, V-slots assignment precedes stress. This seems accidental. Onset dialects present a problem for a number of rule-ordering accounts, as has been described in this section.

Finally, in cases where epenthesis improves syllable structure, as in Arabic, if V-slots are not present at the point when epenthesis takes place, then there is no reason for epenthesis. Vowels inserted without V slots do not improve the syllable structure and thus there seem to be no reason for inserting them. Therefore, this account finds it problematic to explain epenthesis in languages where it is syllable-driven.

5.8.2 OT Proposals

To account for stress-epenthesis interaction, Alderete (1995) proposes a constraint HEAD-DEPENDENCE, by which only underlying vowels can receive stress. Like other OT constraints, this is a violable constraint, and therefore epenthetic vowels will receive stress under the compulsion of constraints ranked higher than HEAD-DEP. Thus, this account predicts both contrast-preserving and contrast-neutralizing dialects depending on the ranking of the constraint HEAD-DEP. To illustrate this proposal, assume that the epenthetic syllable is non-moraic, as proposed in this chapter - epenthetic *kitabitla* is footed as *ki(tābit)la*. In comparison, an identical non epenthetic form is footed as *(kita)(bft_μ)la*. Those two forms differ on WBP (Weight-By-Position), and also on PARSE-

SYLLABLE. Therefore, for the contrast-preserving mapping to be optimal, HEAD-DEP must outrank the two conflicting constraints, thereby forcing a violation of them.

(68) The role of HEAD-DEP

	/kitab-t-la/ 'I wrote to him'	HEAD-DEP	PARSE-SYLL	WBP
a. Contrast-preserving ^{كُتِبَ}	ki(tábit)la		**	*
b. Contrast-neutralizing	(kita)(bft _μ)la	*!	*	

With the opposite ranking, WBP >> HEAD-DEP, or PARSE-SYLL >> HEAD-DEP, epenthesis would be contrast-neutralizing (provided that no other higher-ranked constraint forces a violation of WBP or PARSE-SYLL).

This account finds it problematic to explain cases where epenthesis is contrast-preserving but for reasons other than avoiding the HEAD-DEP violation. These are cases where stress in words with and without epenthesis is distinct, but the epenthetic vowel would not be stressed anyway, even if epenthetic words received regular stress. Since the epenthetic vowel would not be stressed anyway, there is no violation of HEAD-DEP, and thus something else must be forcing the irregular stress of epenthetic words. Word-final epenthesis in Iraqi Arabic provides an example. Neither the contrast-preserving form *ki(tábit)* nor the contrast-neutralizing form *(káta)bit* violate HEAD-DEP. Thus, something else must decide in favor of the contrast-preserving form in this dialect.

Kiparsky (2000ab) develops a different proposal for stress-epenthesis interaction based on the Lexical Phonology Model of OT (LPM-OT). Like Broselow (1992), Kiparsky posits a special structure for epenthetic syllables at the lexical (word) level in contrast-preserving dialects. It is proposed that in those dialects stray consonants are licensed as semi-syllables at the word level, directly adjoined to a PrWd node rather than

a syllable node. Consequently, there is no need for epenthesis at that level since there are no consonant clusters. This structure is then readjusted postlexically by epenthesis. But stress has already applied at the word level. As a result, epenthetic vowels are opaque to stress. To take an example, underlying /*fihm-na*/ ‘our understanding’ maps onto word-level (*fih*)*m-na* with no epenthesis. Stress applies at this level but does not see epenthetic syllables since they are not there. Subsequently, the same structure maps onto post-lexical *fihim-na* with epenthetic *i* and stress carried over from the word stratum. Thus, in those dialects epenthetic vowels are opaque to stress. This is achieved by positing distinct constraint rankings for word and post-lexical levels of representation by which in contrast-preserving dialects semi-syllables exist at the lexical level, as *m* in (*fih*)*m-na*, and are repaired at the post-lexical level by epenthesis, as in *fihim-na*. In contrast-neutralizing dialects, on the other hand, semi-syllables are not allowed and so epenthetic vowels count for stress. Thus, in this account of Arabic opacity follows from the ordering of levels and special assumptions about epenthetic syllables. In this chapter, I develop a very different approach from Kiparsky’s to stress-epenthesis interaction, based on a parallel model of OT, and see where it leads.

5.9 Conclusions and Extensions

In this chapter I have provided an analysis of stress-epenthesis interaction in dialects of Arabic. In some dialects words with epenthetic vowels behave differently with respect to stress assignment from words with non-epenthetic vowels. I have explained this difference in terms of contrast preservation, by observing that the underlying V/∅ contrast is transformed into surface stress contrast.

To capture this observation formally, I have proposed that a PC constraint militating against the loss of the V/\emptyset contrast, $PC_{IN}(V/\emptyset)$, can force violation of WBP so that the coda consonant in the syllable with an epenthetic vowel lacks a mora. The non-moraic status of the coda consonant leads to a different foot structure of a word and consequently different stress placement. Arabic dialects differ in the ranking of the PC constraint with respect to WBP and thus either preserve or neutralize contrasts (see section 5.3).

To explain cases where contrast is preserved only finally but not medially (see section 5.4), I have proposed a high-ranking constraint against discontinuity at the level of moras. This constraint, when ranked higher than PC, does not allow for a mora-less coda medially in the string of segments.

In section 5.6 I have discussed locality of contrast preservation. I have formulated locality constraints on structural and surface contrast expression. Constraints on locality can be seen as aiding recoverability of the underlying form (for a discussion of recoverability see Kaye 1974, 1975, Kisseberth 1976). Locality explains why contrast is only dislocated minimally in the string of segments. It also provides a principled explanation for why epenthesis in onset dialects and into quadri-consonantal sequences in all dialects is never contrast-preserving.

In Arabic the underlying V/\emptyset contrast is transformed into surface stress contrast. Whenever an underlying contrast is transformed into a different surface contrast, some instances of the original surface contrast are lost. So, in this particular case, some instances of the original stress contrast are lost, because it now represents another contrast. Stress is a good choice to represent other contrasts, as it is itself non-contrastive

on the surface, that is various input stress patterns neutralize onto the actual stress pattern anyway, with or without compulsion from the high-ranked $PC_{IN}(V/\emptyset)$ constraint. In PC theory, this means that $PC_{IN}(\text{stress})$ is low-ranked.

PC theory makes a prediction with respect to epenthesis that is confirmed by the facts. Epenthetic segments are often not found outside of the epenthetic environment in the same language. In the rule-based theory, this is known as non-structure preserving epenthesis (Steriade 1995). In OT, this means that markedness constraints against such segments are high-ranked, but $PC_{IN}(V/\emptyset)$ forces a violation of them. Marked segments are then utilized to preserve contrasts between words with and without epenthesis. Under the contrast preservation approach, this fact is explained because such segments do not neutralize meaningful underlying distinctions on the surface. They never surface outside of the epenthetic environment, and thus by epenthesizing them no contrasts between words with and without epenthesis are merged. On the other hand, if an epenthetic segment is the one that surfaces in some other environments in the language, epenthesis has the potential to merge underlying distinctions on the surface, and languages need to resort to some other means to preserve such distinctions. Arabic dialects provide an example.