Chapter

Three

Syllabification in UHA:

An OT account

3.0. Introduction:

In this chapter, I discuss syllabification in UHA from the perspective of Optimality Theory. The central argument pursued here involves determining the optimal syllable template of the language. The challenge we will encounter, however, is attaining a uniform distribution of this maximum (and minimum) syllable throughout the syllabification domain. Consequently, this leads us to an evaluation of the process of syllabification in Optimality Theory. In particular, I want to determine whether or not OT is capable of accounting for the asymmetric processes of insertion and deletion in UHA. On the other hand, I want to evaluate OT's capacity to explain why UHA resorts to epenthesis or to syncope to overcome a problematic input. In other words, we will see whether or not OT is equipped with the appropriate machinery that demonstrate that both operations are solely motivated by the principle of Prosodic Licensing.

My basic claim is that Optimality Theory is capable of providing a plausible and uniform analysis of syllabification in UHA. I will resolve the issue of the superheavy syllable by proposing the affiliation of its final consonant to the prosodic-word node. Violability, among other OT principles, will facilitate the optimisation of such candidates. Also, I will demonstrate that, for all instances of epenthesis, Optimality Theory attains a selection of the true output utilising a set of universal and independently motivated constraints. The area where Optimality Theory shows some weakness in UHA is syncope, High Vowel Deletion in particular. This process, however, and deletion in general, is very much localised and has no undesirable consequences elsewhere.

The chapter proceeds as follows. Section one, the fundamental contribution, applies Optimality Theory's model of syllabification (summarised in chapter two) to UHA. It is in this section where I isolate CVX (where X = C or V) as the core syllable template in the language. This claim is fundamental to subsequent sections. It will be seen as the major motivation for the different processes and/or arguments presented. Consequently, section two deals with inputs that constitute potential output deviants, i.e. underlying sequences that are not parsable into CVX syllables. I will show how these motivate different instances of epenthesis or syncope attributed to the set of constraints maintaining that syllable template. Section three tackles the same issue from a different angle. There, I deal with true outputs that actually deviate from the norm, i.e. ones that contain non-CVX syllables on the surface. The challenge there is to argue for incorporating those syllables where the CVX syllable template is either under-maximised or over-maximised.

3.1. Optimality Theory and Syllabification in UHA:

There is unanimous agreement amongst researchers who investigated the syllable in Arabic, in general (Brame 1970, Al-Ani 1978, Broselow 1979, McCarthy 1979 *et seq*, Selkirk 1981, among others), that the language's inventory of syllables includes two types (light and heavy) (cf. Al-Ageli 1995 for a slightly different view concerning Tripolitanian Arabic). The light syllable is composed of a simple peak vowel obligatorily preceded by a simple consonant onset. Its heavy counterpart, on the other hand, has a branching rime incorporating an additional consonant serving as a coda or an additional timing slot rendering a long-vowelled nucleus. This internal structure may be represented as follows:

```
(1)          a. Light      σ           b. Heavy i. σ          ii. σ
                           /\                     /\              /\
                          /  \                   /  \            /  \
                         O    R                 O    R          O    R
                         |    |                 |    |          |    |\
                         |    N                 |    N          |    N Cd
                         |    |                 |   /\  |     |  \
                         x    x                 x  x x          x    x    x
                         |    |                 |  \/           |    |    |
                         C    V                 C  V            C    V    C
```

In addition to these distributionally unmarked syllables[1] there are two rather highly marked ones whose distribution is basically confined to the word-final position. These syllables, traditionally termed superheavy, are composed of a heavy syllable plus a consonant: CVVC and CVCC. The following list exemplifies all these syllable types:

(2) Light[2] [CV **ba**.**ga**.rah 'a cow']

Heavy ⎡ CVC **min** 'from' ⎤

[1] The heavy syllable CVV is slightly marked if compared to the other two, especially CV. This syllable tends to appear medially or initially rather than finally (cf. Cairns & Feinstein 1982 for a different view of this syllable's distribution initially).

[2] This syllable type is not exemplified in a word form. This is a consequence of the minimal word restriction. In this language, words are minimally bimoraic.

		mak.tab	'an office'	
	CVV	**kaa**.tib	'a writer'	
Super-heavy	CVCC	**bint**	'a girl'	
		ʔa.**kalt**	'I ate'	
	CVVC	**tiin**	'figs'	
		fa.**nuus**	'a lantern'	

Therefore, we want to find out what exactly is involved in the process of parsing underlying strings into these, and only these, syllable types distributing them as they are attested in the language. In OT terms, we want to determine the set of constraints that conspire to optimise true syllabification outputs, in UHA.

Before going into such matters, we must establish the true existence of the set of Superordinate Constraints on syllable structure, in our hierarchy for UHA. Also, we need to decide on the dominance relations holding between the basic Structural and Faithfulness constraints, viz. ONS, -COD, PARSE, and FILL.

3.1.1. UHA and Superordinate Constraints:

When Prince & Smolensky (1993) provided an OT interpretation of the "basic CV syllable theory", they claimed that the constraints NUC, *COMPLEX, *M/V, and *P/C "are fixed in superordinate position" (Prince and Smolensky 1993: 88). Of course such an assumption reflects the authors' objective of establishing the universality of CV as the cross-linguistically unmarked core syllable. This, however, does not mean that violations of these constraints are not attested in natural languages. Languages like Polish, or even English, for example, manifest violations of

*COMPLEX across the board. In addition, Berber is a textbook example of a language that freely violates *P/C. Also, if we adopt a theory whereby glides are basically treated as vowels (Roca 1997b), we would expect violations of the constraint *M/V in almost every language. Even NUC is susceptible to being violated if we assume the degenerate syllable argument (Aoun (1979), Selkirk (1981), McCarthy & Prince (1990)). Nonetheless, UHA does rank these constraints undominated. Obviously, each syllable must have a nucleus; vowels are not allowed to occupy margins (cf. the so-called "glides"); and no consonants are assigned to syllable nuclei. Even the restriction imposed by *COMPLEX is always adhered to.[3] Therefore, we must focus on the relative ranking holding between the other four syllable constraints: the Structural pair (ONS and -CODA) and the Faithfulness pair (PARSE and FILL). This issue is discussed in the following subsection.

3.1.2. Onsets and Codas in UHA:

As discussed in chapter two, we will need to decide on two points. First, are onsets required and/or codas forbidden, in this language? Secondly, if either are, how is that enforced? The answer to the first question determines the ranking of the structural constraints with respect to their Faithfulness counterparts. The other question, however, investigates the relative ranking holding between the Faithfulness pair.

[3] Long vowels of CVV and CVVC syllables satisfy *COMPLEX as their nuclei are "monosegmental" (Prince & Smolensky 1993: 99). Interestingly however, I will be arguing below that even a final sequence like CVCC satisfies this constraint, as I will demonstrate that the final consonant cluster is not analysed as tautosyllabic.

Let us start by looking at the first question. All syllable types of UHA have onsets, so onsets are required in this dialect of Arabic. This means that ONS must dominate both, or at least one, of the Faithfulness pair. This dominance relation is represented as follows:

(3) ONS >> PARSE, FILL

On the other hand, the existence of the open syllables CV and CVV points at the fact that codas are optional, though not forbidden. In accordance with what has been discussed in chapter two above, this will result in ranking -COD lower than the Faithfulness pair.

(4) PARSE, FILL >> -COD

Therefore, we can say that UHA relatively ranks the Structural constraints, on the one hand, and the Faithfulness ones, on the other, as follows:

(5) ONS >> PARSE, FILL >> -COD

Now, let us examine this partially complete ranking. I will take, as a first example, the input /CVC/ whose three most harmonious candidate analyses are evaluated in the following tableau:

(6)

/CVC/	ONS	PARSE	FILL	-COD
a. ☞ CVC				*

b. CV<C>		*!		
c. CV.C			*!	

Obviously, the postulated ranking of the constraints is sufficient for such inputs. However, the unspecified mutual ranking of PARSE and FILL will have undesirable consequences on the overall evaluation of an input like /V/ Consider the following tableau:

(7)

/V/	ONS	FILL	PARSE	-COD
a. V	*!			
b. V		*		
c. <V>			*	

Apparently, we may not determine an optimal output, as (7b) and (7c) are equally harmonious. We can not choose between epenthesis or deletion as PARSE and FILL, the constraints violated by these processes, are not relatively ranked.

We must determine the way in which the onset requirement is enforced in UHA. In particular, I would like to explain how ONS is satisfied. It can be vacuously satisfied when a candidate fails to incorporate any underlying material into surface structure, and consequently has no structure at all. Alternatively, it is equally satisfied by creating an empty position that can be filled with a potential onset.

There is overwhelming evidence that the onset requirement in Arabic, in general, is enforced by epenthesis. If we go through the cases that call for either epenthesis or syncope to license stray elements, we shall see that epenthesis almost always takes precedence over syncope. This demonstrates the need for ranking FILL, that is violated by insertion, lower than PARSE, which is violated by deletion. Nevertheless, the most robust empirical piece of evidence demonstrating that the onset requirement is enforced by epenthesis is manifested in the group of attested outputs with an initial epenthetic glottal stop. In words like [ʔin.ka.tab] ‘it was written’, a glottal stop is epenthesised to avoid onsetless, vowel-initial, syllables. The seventh binyan (McCarthy 1979a) is an example of an underlying stem with an initial two-consonant cluster, /nkatab/. This consonant clustering is not allowed in the language. As a result, a vowel is usually epenthesised initially. This epenthetic vowel will break up the cluster licensing its initial consonant as a coda and leaving the second consonant to occupy the onset of the following syllable.[4] This process will yield an onsetless initial syllable. This violates the well-established ONS, however. To avoid such a fatal violation, we either delete the initial vowel that we epenthesised and simply go back to square one or epenthesise a consonant that will occupy the onset position of the newly created syllable to satisfy ONS. Obviously, the second choice is better. Consequently, we may say that it is epenthesis that enforces the onset requirement in UHA.

. Therefore, the overall ranking of the basic syllable structure constraints for UHA is as follows:

(8) ONS, PARSE >> FILL >> -COD

[4] One may argue for inserting such a vowel between the two consonants of the initial underlying cluster to serve the same purpose. To ensure that this false output is not optimised, I employ a suitable constraint, discussed in section two below.

Obviously, the relative ranking of ONS and PARSE is not specified. This is attributed to the fact that it is enough for ONS to dominate a Faithfulness constraint, FILL in our case, to establish onset requirement. Assuming this ranking, let us re-evaluate those candidates in (7) above. Consider the following tableau, where the true output is optimised:

(9)

/V/	ONS	PARSE	FILL	-COD
a. V	*!			
b. <V>		*!		
c. ☞ V			*	

However, recognising the major development in OT, i.e. Correspondence Theory (McCarthy and Prince 1995), I will adopt the pair MAX-IO and DEP-IO for PARSE and FILL, respectively. This move is not haphazard or just for the sake of adopting more recent terminology. As we shall see in section three below, it is essentially required to accommodate a fundamental proposal regarding the analysis of final consonants in superheavy syllables.

In conclusion, we say that Optimality Theory shows high potential to serve as an analytical framework after what we have seen with basic syllabification. Below, I will analyse the importance of a restriction imposed on the overall process. In particular, I shall demonstrate that the CVX syllable template is the fundamental factor that regulates syllabification in UHA.

3.1.3. CVX-bound Syllabification:

So far, the issue of syllabic parsing and distribution remains unresolved. How we can parse underlying strings of segments into the syllable types attested in the language, and nothing more, is the central issue in the following discussion. What we ideally want to determine is the syllable template in UHA. Evaluating the syllabic harmony of candidate analyses will then be a matter of comparing them to that template.

The facts in (2) above distinguish the syllable template in UHA. Throughout the forms, the maximal syllable contains two elements in the rime (superheavies will be analysed differently). Such rimes are composed of either a short vowel and a consonant or a long vowel. Also, as mentioned above, the onset position is obligatorily filled by a single consonant. Therefore, the maximal core syllable template, where these two language-specific properties are captured, is given in (10):

(10) Syllable Template in UHA:

CVX
(where X is either a consonant or another timing slot of a long vowel)

This means that this is the maximum syllabic configuration that may be admitted. As a result, syllables in UHA are optimally and maximally bi-moraic. This latter observation will be viewed as an essential factor in what remains of this chapter.

In an attempt to translate this syllable template, which is reminiscent of Itô (1986, 1989) (cf. next chapter), into Optimality Theory terms, I propose incorporating *COMPLEX plus the following pair of constraints:

(11) (I) Syllable Maximality (SYL-MAX):
Syllables are maximally *bi*-moraic.

(II) Syllable Minimality (SYL-MIN):
Syllables are minimally *bi*-moraic.

Together, these two constraints are saying that syllables must be *bi*-moraic.[5] Broselow (1992), in a cross dialectal study of Arabic syllable structure and syllabification, discussed this issue. Precisely, she argued for "the optimality of bimoraic syllables". However, by utilising two of Optimality Theory's principles, viz. Violability and Ranking (Prince & Smolensky 1993, McCarthy & Prince 1993 a-b, etc.), we can achieve a richer array of outputs. For example, by ranking SYL-MAX higher than SYL-MIN, we are saying that syllables are more tolerated if their moraic content falls short of the maximum than if it exceeds it. This is what we need for UHA. We want to maximise whenever we can, but never exceed two moras.[6]

Besides moraic content, the other variable that we must specifically determine for UHA is the overall ranking of these constraints in the language's hierarchy. SYL-MAX should be ranked undominated to establish the fact that syllables in UHA,

[5] A constraint that confines the maximum number of moras per syllable to two is proposed more than once in OT literature. *σμμμ (Sherer 1994 and Walker 1994), *Tri-moraic Syllables: $\sigma \leq 2\mu$ (Hewitt 1994), BIMORA Baković (1996), SYLLBIN Broselow (1997 *et al*), etc. are some of the most common examples. Nevertheless, I think that there is independent motivation for this restriction, especially in languages with moraic trochee footing (cf. chapters 5 & 6 below). The universal constraint FT-BIN (Prince & Smolensky 1993, McCarthy & Prince 1993, and *et seq.*) and the SYLLABLE INTEGRITY condition (Prince 1980, Halle 1990, Halle and Kenstowicz 1991, Idsardi 1992, Kager 1993, Hayes 1995) both say that feet must be binary (syllabically or moraically) and that a syllable must not be divided between two feet. Therefore, unless syllables are maximally bimoraic, a moraic trochee foot parsing will inevitably disturb their integrity. On the other hand, SYL-MIN may be interpreted as an enforcement of the Minimal Word Requirement. Adopting an argument proposed by Hayes (1995) to rule out degenerate feet, I will assume that this constraint indirectly maintains the bimoraicity of the PrWd by imposing a restriction on the minimal syllable that can constitute the minimal foot (cf. FT-BIN) which in turn constitutes the minimal PrWd.

[6] If we are going to allow free ranking of these constraints, which we should do as each conveys a distinct message, we must allow the opposite order, i.e. SYL-MIN >> SYL-MAX. I have not come across any language that would motivate such a ranking by which syllabic over-moraification is better

throughout the word, may not accommodate more than two moras. On the other hand, SYL-MIN must basically be ranked lower than Faithfulness constraints, DEP-IO in particular, to avoid unnecessary overparsing (epenthesis) performed to augment submaximal syllables.

Let us test the adequacy of such a proposal starting with a simple input like /katab/ → [ka.tab] 'he wrote'.[7]

(12)

/katab/	ONS	SYL-MAX	MAX-IO	DEP-IO	SYL-MIN	-CODA
a.☞PrWd /\ σ σ /\ /|\ ka tab					*	*
b. PrWd / \ σ σ /|\ /|\ ka***V*** tab				*!		*
c. PrWd /\ σ σ /\ /\ ka t a			*!		**	

than under-moraification. This may hint at a universally set ranking of these two constraints as SYL-MAX >> SYL-MIN amounting to a mere interpretation of Itô's syllabification approach.

[7] In the following section, I will clearly demonstrate how we can determine the moraic content of a syllable through constraint interaction.

d. PrWd /\\ σ σ /\\ /|\\ ka tab***C***		*!		*	*	*

In this tableau, we can feel the effect of SYL-MAX which disfavours candidate analyses like (12 d). Yet, SYL-MIN does not emerge decisive. We will see below that it has an important role to play.

This claim of maximally and optimally confining the moraic content of syllables to two moras will be central to almost all arguments below. In order to maintain this restriction, the language resorts to different processes like vowel epenthesis or deletion (shortening in particular). Besides such problematic inputs, there are some interesting cases of deviant outputs where moraically submaximal and supramaximal syllables are attested. In the remaining two sections of this chapter, I tackle these issues. In particular, I will provide accounts recognising the existence and high ranking of SYL-MAX, and consequently maintaining the restriction it imposes on the syllabification process.

3.2. Problematic Inputs:

We shall now focus our attention on further complications pertaining to syllabification. In this section, I will be discussing input sequences holding potential irregularities of syllabification, that motivate instances of insertion and deletion. In Optimality Theory terms, I will aim at maintaining some highly ranked constraints on syllable structure, namely ONS, *COMPLEX, SYL-MAX, etc., that are potentially violated in some input sequences. Basically, I will be discussing three processes: Initial Vowel and Glottal-stop Epenthesis, Medial Vowel Epenthesis, and Internal Vowel Shortening.

My main claim is that Optimality Theory is superior to any rule-based account of epenthesis in UHA. When we discuss instances of epenthesis, we will see that we do not need to activate any stipulative extrinsically ordered rule application. We merely transfer all the analytical burden to independently motivated universal constraints. These are fully capable of achieving the same degree of descriptive adequacy as will, especially, postlexical epenthesis rules (see chapter 4 below). On the other hand, the syncope operation of Internal Vowel Shortening, analysed in this section, poses a challenge to OT. In particular, the epenthesis vs. syncope paradox constitutes a fundamental difficulty for any OT analysis of processes related to syllabification in UHA (see High Vowel Deletion in section 3).

In what follows, I will divide the discussion into three subsections. The first will present Optimality Theory's account of Initial Vowel and Glottal Epenthesis. Secondly, I will consider Medial Vowel Epenthesis. Finally, I tackle Internal Vowel Shortening that is interestingly attributed to the same constraint enforcing Medial Vowel Epenthesis, as the inputs of both processes have identical canonical forms.

3.2.1. Initial Epenthesis:

This is the first instance of epenthesis I discuss. As we shall see, it is motivated by the process of syllabification. By activating a universal constraint, I will show how OT is capable of accounting for the process of initial vowel and glottal stop epenthesis rather elegantly. However, before going into such matters, it is appropriate to introduce this process first.

This type of epenthesis is prompted by underlying forms with initial sequences of two consonants. These sequences occur in the underlying stems of Forms VII, VIII, X, etc. and their derivatives (McCarthy 1979a, 1981).

(13)	Binyan	Perfective Active			
	a. VII	/nkatab/	→	[ʔin.ka.tab]	'was written'
	b. VIII	/ktatab/	→	[ʔik.ta.tab]	'be registered'
	c. X	/staktab/	→	[ʔis.tak.tab]	'cause to write'

Apparently, the initial consonant may not be parsed in the onset of the left-most syllable. The CVX syllable template can only license simple onsets. Consequently, such forms surface with an epenthetic glottal-stop and a vowel inserted initially. This licenses the initial member of the underlying cluster in the coda position of the first syllable and the other as the onset of the following syllable. Nevertheless, we could achieve an equally sound syllabification by inserting a vowel between the two members of the cluster. The challenge is to rule out this possibility.

A constraint that would ideally maintain the adjacency of the inputs melodic elements was initially hinted at in McCarthy & Prince (1993a), in a footnote. They thought that "if there is a cross-linguistic bias against medial epenthesis, especially in circumstances where there is a choice between medial and peripheral epenthesis, then an appropriate constraint legislating contiguity can be devised." (McCarthy & Prince 1993: 50 (fn. 41)). Kenstowicz (1994b), in an article analysing syllabification in

Chuckchee, made use of such a constraint (also Spencer 1994). Finally, McCarthy & Prince (1995) provided a formalisation of this idea of input melodic contiguity through a pair of correspondence constraints, stated below:

(14) Contiguity:

a. I-CONTIG ("No Skipping")
The portion of S_1 standing in correspondence forms a contiguous string.
Domain (R) is a single contiguous string in S_1.

b. O-CONTIG ("No Insertion")
The portion of S_2 standing in correspondence forms a contiguous string.
Range (R) is a single contiguous string in S_2.

McCarthy & Prince 1995:108

O-CONTIG will be of interest to our present purposes. It disfavours any type of medial insertion, yet it is not violated if epenthesis is peripheral. It must be relatively ranked with respect to the Faithfulness pair. The true output of an input containing an initial bi-consonantal cluster like /staktab/ is [ʔis.tak.tab] which clearly violates DEP-IO twice, but does not violate O-CONTIG. Another possible candidate analysis of such an input as /sɨtaktab/ will only incur a single violation of DEP-IO, but also a violation of O-CONTIG. Therefore, if O-CONTIG is ranked higher than DEP-IO, the language will be shown to tolerate two violations of the latter to fully satisfy the former. With MAX-IO, however, the dominance relation is the other way around. MAX-IO will have to dominate O-CONTIG to maintain the generalisation of epenthesis over deletion. This is because violations of O-CONTIG constitute a subset of DEP-IO's meaning that any relative ranking relation of DEP-IO with respect to other constraints must contain O-CONTIG. The following partial ranking shows the dominance relations holding between these three constraints.

(15) MAX-IO >> O-CONTIG >> DEP-IO

The following tableau shows how the language chooses [ʔis.tak.tab] as the optimal analysis of the input /staktab/:

(16)

/staktab/	NUC, *P/C, *M/V, *COMPLEX, SYL-MAX, ONS	MAX-IO	O-CONTIG	DEP-IO	SYL-MIN	-CODA
a. ☞ ʔis.tak.tab				**		***
b. sv.tak.tab			*!	*	*	**
c. tak.tab		*!				**
d. stak.tab	*!*COMPLEX					**
e. vs.tak.tab	*! ONS			*		***

*COMPLEX disfavours the initial complex onset of the perfectly faithful candidate (16 d). As a result, four candidate analyses are proposed to solve the problem. Internal epenthesis (16 b) is ruled out by O-CONTIG; initial vowel epenthesis (16 e) violates ONS; deleting the first consonant (16 c) violates MAX-IO. Therefore, only one possible remedy is left, i.e. initial vowel and glottal-stop insertion (16 a), which is the true output.

In this subsection, we have seen how the interaction between the various constraints achieved the true output without us having to impose any rules or derivations that are purely extrinsic in nature (as is clarified in chapter four below). Therefore, we can take this as a point for Optimality Theory.[8]

3.2.2. Medial Vowel Epenthesis:

Besides initial glottal-stop and vowel epenthesis, attaining a uniform distribution of the CVX syllable template throughout the syllabification domain motivates other processes of insertion and deletion. Suffixation, in particular, creates some medial configurations that are unparsable by the CVX syllable template. A tri-consonantal medial cluster is just one example of an underlying form that prompts vowel epenthesis.

The OT analysis I propose to account for the instances of vowel epenthesis is reminiscent of Itô's (1986) syllabification principles. Here, I analyse the type of vowel epenthesis that is motivated by suffixation, i.e. the one applying across morpheme boundaries. For this particular process, I am not going to claim any advantages of OT over DT. In other words, the constraints requiring this type of epenthesis and the ones regulating the remedy process are mere translation of Itô's language-particular well-formedness conditions.

Medial vowel epenthesis involves inserting an epenthetic vowel, mainly /a/, to break-up tri-consonantal or quadri-consonantal intervocalic clusters that suffixation may create. Consider the following groups of data:

[8] One may think that OT is equally stipulative as we have to impose a language particular ranking. This is true, but that ranking is supposed to evaluate all other inputs.

I. Tri-consonantal Clusters:

Tri-consonantal clusters emerge under the following circumstances:

(i) When a noun ending in a CVCC sequence is suffixed with a consonant-initial possessive suffix:

(17)	a. /ʔiðn + ha/	→	[ʔið.n**a̲**.ha]	'her ear'
	b. /bint + na/	→	[bin.t**a**.na]	'our daughter'
	c. /ʔuχt + kum/	→	[ʔuχ.t**a̲**.kum]	'your *pl.* sister'
	d. /baħr + hum/	→	[baħ.r**a̲**.hum]	'their sea'
	e. /damm + na/	→	[dam.m**a̲**.na]	'our blood'
	f. /widd + kum/	→	[wid.d**a̲**.kum]	'your *pl.* intimacy'

(ii) When a verb plus a consonant-initial subject suffix[9] is suffixed with a consonant-initial object suffix:

(18)	a. /ʃuft + kum/	→	[ʃuf.t**a̲**.kum]	'I saw you *pl.*'
	b. /gult + ha/	→	[gul.t**a**.ha]	'I/ you *ms. sg.* said it *fm.*'
	c. /katabt + na/	→	[ka.tab.t**a̲**.na]	'you *ms. sg.* wrote our names'
	d. /d͡ʒibt + hum/	→	[d͡ʒib.t**a̲**.hum]	'I/ you *ms. sg.* brought them'

(iii) When a verb plus a consonant-initial subject suffix is suffixed with the dative /l/ or /b/ 'to' and 'with' respectively, which must be followed by an object suffix; here, the object suffix is vowel-initial:

(19)	a. /gult + l + i/	→	[gul.t**a̲**.li]	'you *ms. sg.* told me'
	b. /ʃuft + b + uh/	→	[ʃuf.t**a̲**.buh]	'I saw with it *ms.*'

(iv) When a verb ending in a CVC sequence is suffixed with the dative followed by a consonant-initial object suffix:

(20) a. /katab + l + ha/ → [ka.tab.la̲.ha] 'he wrote to her'
b. /masak + l + hum/ → [ma.sak.la̲.hum] 'he caught for them'
c. /ʃirib + b + ha/ → [ʃi.rib.ba̲.ha] 'he drank with it *fm.*'
d. /fiɾiħ + b + na/ → [fi.riħ.ba̲.na] 'he was happy to see us'

II. Quadri-consonantal Clusters:

These clusters only occur when a verb ending in a CVCC sequence is suffixed with the dative followed by a consonant-initial object suffix:

(21) a. /gult + l + hum/ → [gul.ta̲l.hum] 'I told them'
b. /d͡ʒibt + l + na/ → [d͡ʒib.ta̲l.na] 'you *ms. sg.* brought for us'
c. /firiħt + b + kum/ → [fi.riħ.ta̲b.kum] 'I was happy to see you *pl.*'
d. /ʃuft + b + ha/ → [ʃuf.ta̲b.ha] 'I saw with it *fm.*'

Tri-consonantal and quadri-consonantal clusters are not the only environments where stray consonants may occur. Sometimes, the second member of a medial bi-consonantal cluster cannot be syllabified by the syllable template. The only case where such a segmental configuration may be encountered is when a word terminating in a CVVC sequence is suffixed with a consonant-initial morpheme. Consider the following two groups:

When a noun ending in a CVVC sequence is suffixed with a consonant-initial possessive suffix:

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[9] I will clarify the underlying form of this verb plus the subject suffix when I talk about Internal Vowel Shortening below.

(22) a. /tiin + na/ → [tii.n**a**.na] ‘our figs’
b. /faanuus + hum/ → [faa.nuu.s**a**.hum] ‘their lantern’
c. /χaal + kum/ → [χaa.l**a**.kum] ‘your *pl.* maternal uncle’
d. /raas + ha/ → [raa.s**a**.ha] ‘her head’

When a verb ending in a CVVC sequence is suffixed with a consonant-initial object suffix:[10]

(23) a. /d͡ʒaab + ni/ → [d͡ʒaa.b**a**.ni] ‘he brought me’
b. /ʃaal + ha/ → [ʃaa.l**a**.ha] ‘he carried her’
c. /gaad + hum/ → [gaa.d**a**.hum] ‘he guided them’
d. /faad + kum/ → [faa.d**a**.kum] ‘he benefited you *pl.*’

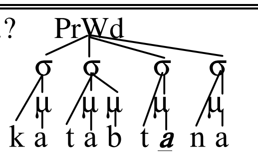
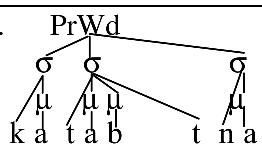
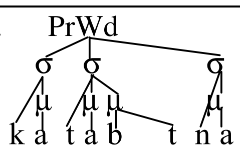
Apparently, all these examples of medial epenthesis are attributed to SYL-MAX, and in some cases to *COMPLEX as well (especially the forms with tri-consonantal and quadri-consonantal clusters). A certain consonant may not be parsed into the coda position of a preceding syllable, nor can it occupy the onset of a following one as both are already maximised, i.e. dominate two moras and a consonantal onset. Therefore, a vowel is epenthesised to license that consonant. However, we can, in principle, link that consonant to the preceding syllable or mora node. This candidate will maintain the maximum number of moras sanctioned per syllable and, at the same time, avoid violating DEP-IO by epenthesis.

For purposes of clarity, I intentionally avoided providing a moraic representation of the internal structure of the syllable. However, unless moras are

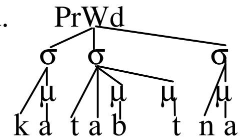
[10] When I talk about Internal Vowel Shortening below, I will tackle a more complex, but rather interesting, phenomenon occurring with CVVC-final verb suffixation.

represented, we may not be able to recognise other equally (if not more) harmonious candidate analyses, that are false outputs.[11] Consider the following tableau where moras are introduced:

(24)

μ μ μ | | | /k a t a b t - n a/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX	MAX-IO	DEP-IO	SYL-MIN	-CODA
a.? 			*!	***	*
b. 				**	*
c. 				**	*

[11] What reason is there to suppose that candidates (24 b, c, and d) are false? Why not analyse UHA with one of them? The answer is footing and NON-FIN, as we shall see in chapter five below. If a final consonant is parsed under the final syllable, that syllable may not be stressed as it will violate the undominated constraint of NON-FIN (Head Syllable). However, final superheavy syllables must always be primarily stressed, which means that unless their rimes are separated from the right periphery by that unsyllabified consonant, they will always violate NON-FIN.

d. 				**	*

Obviously, our already proposed hierarchy of constraints is incapable of discriminating against forms like (24 b, c, or d) which are never to be optimised, if we are to enforce SYL-MAX as an undominated constraint regulating syllabification. These candidate analyses avoid violating SYL-MAX by associating a medial (extrasyllabic) consonant to the preceding syllable node, to the preceding mora, or to a distinct mora (by licensing an unmoraic vowel). This clarifies how central and decisive the issue of syllabic moraification is to my proposed analysis of UHA syllabification. In particular, are we assuming that moras are underlyingly present in the input, or are they supplied by Gen? Our answer depends on the version of mora theory we adopt.[12]

Following Hayes (1989), I shall assume that moras are of two types: underlying and derived. Only vowels and geminate consonants are underlyingly moraic. Precisely, long vowels are bi-moraic and short ones are mono-moraic. Other consonants are assigned moras derivationally through Weight-by-Position. Assuming these concepts within an OT framework, I suggest the set of constraints below:

(25) a. MAX-V-μ
Every vocalic-moraic association of the Input has a correspondent in the Output.

b. Rime Exhaustivity (RIME-EXHAUS)

[12] There have been suggestions in OT literature for incorporating constraints to which one may attribute vocalic moraicity. Rosenthal (1994) introduced V-MORA, and Hewitt (1994) came up with Link VN. Both of these constraints are violated by candidates containing non-moraic vowels.

Within syllable boundaries, post-peak elements are exhaustively parsed into moras.

c. *COMPLEX-μ
A mora may not be associated to more than one segment.

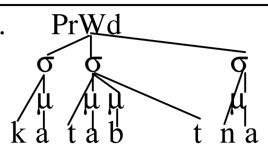
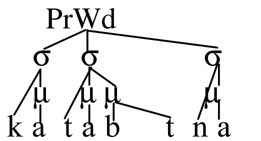
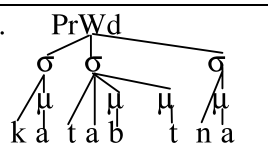
The first constraint maintains input-output moraic correspondence. This means that each vocalic timing slot must be associated to a mora in the output. I want to categorically indicate that I am not assuming constraining the input, restricting "richness of the base". What I want to maintain is underlying weight contrasts, i.e. long vs. short vowels and single vs. geminate consonants (cf. *DELINK Itô, Mester and Padgett (1993) (cited in Spaelti (1994)) for a more general enforcement of maintaining the input's association lines). RIME-EXHAUS carries out the role of Hayes' Weight-by-Position (cf. WxP Zec (1992), WEIGHT-BY-POSITION Kager (1997), and MORAICCODA Broselow *et al* (1997)). Finally, (25 c) discriminates against multiple association linking moras to melodies (cf. *BRANCH-mora Rosenthall (1994) and Walker (1994) and NOSHAREDMORA Broselow *et al* (1997)).[13]

Only by including these constraints in our hierarchy and ranking them undominated, may the desired prosodification be achieved. Consider the following tableau:

(26)

μ μ μ | | | /k a t a b t - n a/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX, MAX-V-μ, RIME-EXHAUS, *COMPLEXμ	MAX-IO	DEP-IO	SYL-MIN	-CODA
a.☞ PrWd σ σ σ σ μ μ μ μ μ k a t a b t *a* n a			*	***	*

13 This constraint will be suppressed by a redefinition of *COMPLEX introduced for a specific purpose analysed below.

b. 	*! RIME-EXHAUS			**	*
c. 	*! *COMPLEXμ			**	*
d. 	*! MAX-V-μ			**	*

Clearly, introducing the moraification constraints suggested above attains a true candidate optimisation. Other candidates are ruled out because they either include a non-moraic element in the rime (26 b), associate more than one melody to the same mora (26 c), or delete an underlying one (26 d).

The question that arises, if we assume the superordinate ranking of these moraic syllable structure constraints, is whether or not the constraint hierarchy introduced so far will help optimise true candidates containing medial epenthetic vowels. Consider the tableau below:

(27)

/bint + kum/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX	MAX-IO	O-CONTIG	DEP-IO	SYL-MIN	-CODA
a.☞ bin.t<u>a</u>.kum			*	*	*	**
b.☞ bi.n**a**t.kum			*	*	*	**
c. bint.kum	*!*COMPLEX * SYL-MAX					**
d. bin.kum		*!				**

What this tableau shows is that we are able to motivate epenthesis, rather than deletion (27 d). However, we could not predict its site. Both (27 a and b) are identical in their violations and consequently equally harmonious. This strongly motivates introducing a constraint that distinguishes between such candidate analyses. It must be capable of optimising (27 a) for languages like UHA and Cairene Arabic, but (27 b) for languages like Iraqi Arabic. This means that we need a constraint that determines the direction of syllabification.

Mester and Padgett (1994) sought an Optimality Theory account that captures the same effects of directional syllabification. They introduced a pair of 'gradiently violable' constraints. Such constraints are expected to be massively violated, but the lower the accumulation of violations a certain candidate obtains, the more optimal that candidate is (all else being equal). They formalised these constraints as follows:

(28) a. Syll-ALIGN (L): Align (Syll, L, PrWd, L)
b. Syll-ALIGN (R): Align (Syll, R, PrWd, R)

(28 a) is saying that every syllable must be left-edge aligned with some prosodic word. (28 b), on the other hand, is requiring such an alignment on the right edge. The former will be violated by every syllable, in a given form, except the initial one, and only a final syllable fully satisfies (28 b). Acknowledging a suggestion of McCarthy's, the authors made it clear that the unit of counting the distance between the designated edge of each syllable and the prosodic word's is the immediately lower prosodic unit, i.e. the mora.

For UHA, we will be utilising Syll-ALIGN (R). This means that the lower the number of moras separating the right edges of all the syllables in any given form from the right edge of some prosodic word, the more optimal such a form will be. However, it will have to be ranked rather low, completely confining its role to epenthesis site prediction. More precisely, it will have to be ranked below SYL-MIN because under maximising the number of moras in a given syllable, when it is possible and optimal to maximise it, means that the distance separating that syllable and all other syllables in that form from the designated edge is one mora less. Such a candidate will falsely be optimised by Syll-ALIGN (R). Therefore, unless we rank it lower than a constraint that enforces syllable maximality (or segment syllabification), a true output like [mak.tab] 'office' will not qualify as the most harmonious candidate analysis of its input. The following tableau shows the necessity of this ranking. For our present purposes, this will rule out degenerate prosodification:[14]

(29)

/maktab/	SYL-MIN	Syll-ALIGN (R)
a.☞ [mak.tab]$_{PrWd}$	√	σi ∅ σii μμ (*)
b. [mak.ta.b]$_{PrWd}$	*!	σi ∅ σii μ (√)

The following three tableaux demonstrate how the so far introduced constraints account for all epenthesis environments created by suffixation, viz. tri-consonantal, bi-consonantal, and quadri-consonantal.

(30) i /bint + kum/ >> [bin.ta̲.kum] 'your *pl.* daughter'

/bint + kum/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX	MAX-IO	O-CONTIG	DEP-IO	SYL-MIN	Syll-ALIGN (R)	-CODA
a.☞ bin.ta̲.kum			*	*	*	5μ	**
b. bi.na̲t.kum			*	*	*	6μ!	**
c. bint.kum	*!*COMPLEX * SYL-MAX					2μ	**
d. bin.kum		*!				2μ	**

[14] This may be achieved by directly associating a segment to the PrWd node (cf. section three below).

ii /d͡ʒaab + ni/ >> [d͡ʒaa.ba.ni] 'he brought me'

/d͡ʒaab + ni/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX	MAX-IO	O-CONTIG	DEP-IO	SYL-MIN	Syll-ALIGN (R)	-CODA
a.☞ d͡ʒaa.ba.ni			*	*	**	3μ	
b. d͡ʒaab.n i	*! SYL-MAX				*	1μ	*
c. d͡ʒab.ni		*!			*	1μ	*
d. d͡ʒaa.ni		*!			*	1μ	

iii /katab+t+l+ha/>> [ka.tab.tal.ha] 'I wrote to her'

/katab+t+l+ha/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX	MAX-IO	O-CONTIG	DEP-IO	SYL-MIN	Syll-ALIGN (R)	-CODA
a.☞ ka.tab.tal.ha			*	*	**	9μ	**
b. ka.ta.bat.la.ha			**!	**	** **	12μ	*
c. ka.tabt.la.ha	*!*COMPLEX * SYL-MAX		*	*	**	8μ	*
d. ka.tab.la.ha		*!			** *	7μ	*

Clearly, the tableaux in (30) demonstrate that medial vowel epenthesis is rather straightforward in UHA. Structural constraints like *COMPLEX and SYL-MAX in (30 i-iii) and SYL-MAX in (30 ii) enforce a remedy process. On the other hand, general constraint rankings like MAX-IO >> DEP-IO determine the type of that process. In particular, these constraints conspire to have a candidate analysis with an epenthetic vowel (rather than one with a syncopated segment) emerge as a victor.

3.2.3. Internal Vowel Shortening:

We now move to the other internal process motivated by the CVX maximal syllable constraint imposed on syllabification. However, this process of Internal Vowel Shortening will constitute a challenge to OT prompting us to adopt a somewhat less plausible analysis. I will have to resort to an analysis that acknowledges the existence of different morphological levels. This may be attained by adopting a multi-strata model of OT or by introducing C(onstraint)-domains. Before going into that, however, I will present the environment of this process.

Internal vowel shortening is a lexical process solely motivated by syllabification. Long vowels of hollow verbs[15] and interrogative pronouns shorten to accommodate a stray consonant resulting from suffixing consonant-initial morphemes. Crucially, however, this shortening only takes effect when the suffix is either nominative or dative. Consider the following groups of examples:

(I) A medial long vowel will shorten when a hollow verb is suffixed with a consonant-initial subject agreement suffix:[16]

(31)	a. /gaal + t/	→	[gult]	'I said'
	b. /d͡ʒaab + na/	→	[d͡ʒib.na]	'we brought'
	c. /ʃaal + ti/	→	[ʃil.ti]	'you *fm. sg.* carried'
	d. /saab + tu/	→	[sib.tu]	'you *pl.* Left'

Shortening will also take effect when hollow verbs are suffixed with prepositional elements, the datives /l/ 'to' or /b/ 'with', that are obligatorily followed by object pronoun suffixes. It is interesting to know that these datives can be prefixed to nouns and interrogative pronouns with no shortening effect. This adds further support to the claim that this type of deletion is completely motivated by syllabification:

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[15] The underlying perfective forms of hollow verbs are of the canonical shape CVVC. As is the case with all verb derivation, verb forms are derived from the underlying perfective form that is, itself an intermediate form derived from the root. Therefore, any tri-consonantal verb whose root's medial element is either /y/ or /w/ surfaces as a hollow verb, with a CaaC underlying perfective form (see Wright (1967) for detailed analysis of hollow verbs).

(32)	a. /daar + l + uh/	→	[dar.luh]	‘he turned to him’
	b. /raaħ + l + ik/	→	[raħ.lik]	‘he went to you *fm. sg.*’
	c. /saab + l + i/	→	[sab.li]	‘he left for me’
	d. /ʃaaf + b + uh/	→	[ʃaf.buh]	‘he saw with it *ms.*’
	e. /ʃaal + b + uh/	→	[ʃal.buh]	‘he raised with it *ms.*’
	f. /saag + b + i/	→	[sag.bi]	‘he drove me’

Finally, that vowel shortens when an interrogative pronoun is suffixed with the prepositional clitic:

(33)	a. /miin + l + i/	→ [min.li]	‘who is for me’
	b. /min feen + l + ak/	→ [min.fin.lak][17]	‘form where did you *ms. sg.* get it’
	c. /ʔeeʃ + b + ik/	→ [ʔiʃ.bik]	‘what is wrong with you *fm. sg.*’

(II) Interestingly, however, no shortening will take place when hollow verbs are suffixed with any other suffixes, viz. object suffixes or vowel-initial subject suffixes. Consider the following examples:

(34)(i)	a. /d͡ʒaab + ni/	→	[d͡ʒaa.b**a**.ni]	‘he brought me’
	b. /ʃaal + na/	→	[ʃaa.l**a**.na]	‘he carried us’
	c. /saab + ha/	→	[saa.b**a**.ha]	‘he left her’
	d. /ʃaaf + hum/	→	[ʃaa.f**a**.hum]	‘he saw them’
(ii)	a. /gaal + at/	→	[gaa.lat]	‘she said’
	b. /d͡ʒaab + u/	→	[d͡ʒaa.bu]	‘they brought’
	c. /ʃaal + ∅/	→	[ʃaal]	‘he carried’
	d. /naam + at/	→	[naa.mat]	‘she slept’

In Optimality Theory terms, the forms in group (I) violate MAX-IO (MAX-μ in particular, as I shall clarify below), and the ones of group (II) violate DEP-IO. Yet

[16] The identity of the root’s medial element, in hallow verbs, may explain vowel change in (31) which is an interesting phenomenon in itself, but one that extends to analytical domains external to the main focus of the current research where vowel length, not identity, is the central issue.

[17] As the long vowels /ee/ and /oo/, that substitute the two diphthongs in MSA /ay/ and /aw/ respectively, do not have shorter counterparts, they are systematically raised to /i/ and /u/ if shortened.

again, these violations are incurred to satisfy SYL-MAX, as a medial consonant is caught in a position where it may neither be parsed into the preceding syllable nor can it belong to the following one. Such an environment is configurationally identical to what we have experienced in the previous subsection, where I argued for an epenthetic vowel to license that stray consonant. Therefore, how can the same set of constraints introduced so far determine, as the optimal candidate analysis, a form with a shortened underlying vowel, rather than the one with an epenthetic vowel? Consider the following tableau:

(35)

/d͡ʒaab+l+i/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX	MAX-IO	O-CONTIG	DEP-IO	SYL-MIN	Syll-ALIGN (R)	-CODA
a.? d͡ʒab.li		*!			*	1μ	*
b. d͡ʒaa.li		*!			*	1μ	
c.☞* d͡ʒaa.b<u>a</u>.li			*	*	**	3μ	
d. d͡ʒaab.li	*! SYL-MAX				*	1μ	*

Obviously, we have a negative result. Firstly, (35 a), the true output, violates MAX-IO. This constraint is higher than DEP-IO (and O-CONTIG), the higher constraint violated by the falsely optimised (35 c). Another problem is the candidate (35 b). There, deleting the consonant /b/, instead of shortening the long vowel, not only satisfies SYL-MAX but also -CODA, which makes that candidate at least more harmonious than (35 a).

To account for the relative harmony of (35 a and b) optimising the former, a decomposed MAX-IO is in order. McCarthy (1995) and McCarthy & Prince (1995) have suggested that languages with attested vowel syncope processes and no consonant deletion like Arabic (or Rotoman) may differentiate between the types of segments evaluated by MAX-IO. Therefore, we can have MAX-C and MAX-V (or more generally MAX-μ to control both vowel shortening and deletion).[18] For the particular case of UHA, I shall rank MAX-C undominated while MAX-μ is the one that will be subject to relative rankings with DEP-IO. Thus, the following tableau is amended accordingly and consequently is expected to demonstrate that (35 a) is more harmonious than (35 b).

(36)

/d͡ʒaab+l+i/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX, MAX-C	MAX-μ	O-CONTIG	DEP-IO	SYL-MIN	Syll-ALIGN (R)	-CODA
a.☞ d͡ʒab.li		*			*	1μ	*
b. d͡ʒaa.li	*! MAX-C				*	1μ	

We now return to (35 c), where an epenthetic vowel is inserted violating DEP-IO rather than MAX-μ. From the beginning of this chapter, I have argued for and successfully employed the ranking MAX >> DEP, or the earlier equivalents PARSE >> FILL. Therefore, the natural thing to do is to keep this ranking that maintains the default statement (see examples in (34) above). To do that, we must provide a constraint that is only violated by the forms in group (II), but not by the ones in group (I). Such a constraint, if it is feasible at all, will have to be ranked higher than the Faithfulness pair to motivate shortening rather than epenthesis in group (II).

I very much doubt the existence of such a constraint unless in the form of a ‘repair strategy’. The underlying forms of both groups of examples above are identical, as far as the cv-tier is concerned. This makes it natural for any set of language-specifically ranked syllable structure constraints to evaluate them equally.

[18] We could in principle activate the constraint WT-IDENT (McCarthy 1995) that maintains input-output weight identity. However, it is more plausible to use MAX-μ that will also be violated by vowel deletion, High Vowel Deletion in particular, as we shall see in section three below.

So, we will need a constraint that specifically motivates shortening only when the nominative and dative suffixes are involved. This constraint may be one of alignment, as Align ({Nominative/Dative}, L, Stem, R), which is obviously satisfied in (35 a) but violated in (35 c). However, I can think of at least one other true output that violates this constraint. An input like /katab-t-l-ha/ will surface with an epenthetic vowel inserted to the left of the dative suffix: [ka.tab.t**a̲**l.ha] (cf. (30) above to see how both SYL-MAX and MAX-IO conspire to enforce epenthesis in similar inputs). This is just to show that whatever ordinary constraint we introduce, i.e. one that evaluates candidates on basis of preserving configurational correctness, epenthesis is optimised across the board. In other words, we will always find a candidate that satisfies this constraint in a manner maintaining MAX-μ but violating DEP-IO. As I said above, only a constraint in a form of a repair strategy can achieve the desired effect. Such a constraint may be stated to require internal vowel shortening, to satisfy SYL-MAX, only whenever the suffix is either a subject pronoun or a prepositional dative.[19]

Another angle from which we can view this issue is Ranking Reversal. Such an account is simply based on the possibility of having more than one ranking, usually between two constraints. It was originally introduced by McCarthy & Prince (1993a-b) to account for reduplication in Axininca Campa and for an exceptional case of possessive suffixation in Ulwa, respectively. Obviously, such a proposal questions one of Optimality Theory's basic claims regarding strictness of language-particular ranking. Allowing for two rankings is basically allowing for two grammars to capture level derivation of some sort. Nevertheless, adopting ranking reversal as a potential

[19] Below, I will be adopting a similar formalism proposed by Buckley (1995 a, b). Only then, will I be

account for the asymmetric processes of epenthesis and shortening means that it will only affect the relative ranking of MAX-μ and DEP-IO when a nominative or a dative suffix is being attached.[20] The following two rankings formalise the idea:

(37) a. DEP-IO >> MAX-μ (for nominative and dative suffixation)
b. MAX-μ >> DEP-IO (elsewhere)

Consider the following tableau where ranking (37 a) is activated because the suffix involved is the dative /l/.

(38)

/d͡ʒaab+l+i/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX, MAX-C	DEP-IO	O-CONTIG	MAX-μ	SYL-MIN	Syll-ALIGN (R)	-CODA
a.☞ d͡ʒab.li				*	*	1μ	*
b. d͡ʒaa.ba̠.li		*!	*		**	3μ	
c. d͡ʒaab.li	*! SYL-MAX				*	1μ	*

Clearly, the true output is optimised. However, there are attested outputs manifesting both processes of epenthesis and shortening. These occur when hollow verbs or interrogative pronouns are suffixed with a prepositional dative followed by a constraint-initial object suffix. The following group of forms represents the environment:

(39) a. /d͡ʒaab+l+ha/ → [d͡ʒab.la̠.ha] 'he brought for her'
b. /min feen+l+kum/ → [min.fin.la̠.kum] 'form where did you *pl.* get it'

able to activate such a constraint.

[20] A different account for this type of asymmetry may be achieved by recognising distinct constraint domains. Buckley (1995a, b) claims that it is possible to have different domains where different constraints or rankings take effect. Identifying a relation between some levels and constraints may explain the motivation behind having different outputs for similar inputs in Optimality Theory. Although attractive, this proposal is again trying to introduce level derivation to Optimality Theory, a thing this theory claims to be unnecessary.

For these forms, we ought to use ranking (37 a) as a dative is being suffixed. Nevertheless, neither of the rankings in (37) will optimise the true output in such environments. The two tableaux below show both rankings evaluating some candidate analyses of (39 a):

(40)i DEP-IO >> MAX-μ

/d͡ʒaab+l+ha/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX, MAX-C	DEP-IO	O-CONTIG	MAX-μ	SYL-MIN	Syll-ALIGN (R)	-CODA
a.? d͡ʒab.la̲.ha		*	*	*!	**	3μ	*
b.☞* d͡ʒaa.ba̲l.ha		*	*		*	4μ	*
c. d͡ʒaab.lha	*!*COMPLEX * SYL-MAX				*	1μ	*

ii MAX-μ >> DEP-IO

/d͡ʒaab+l+ha/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX, MAX-C	MAX-μ	O-CONTIG	DEP-IO	SYL-MIN	Syll-ALIGN (R)	-CODA
a.? d͡ʒab.la̲.ha		*!	*	*	**	3μ	*
b.☞* d͡ʒaa.ba̲l.ha			*	*	*	4μ	*
c. d͡ʒaab.lha	*!*COMPLEX * SYL-MAX				*	1μ	*

These two tableaux demonstrate that ranking reversal is not fully capable of accounting for all the environments of epenthesis and syncope in UHA. A more powerful tool of analysis, that is not at standard Optimality Theory's disposal, is required. Whatever it may be, this tool will have to override some principle(S) to which Optimality Theory has committed itself. However, cross-linguistic reality strongly demands that the theory should somehow attain the same effects of rule-based level derivation. There have been some suggestions towards achieving this in the form of multi-level Optimality Theory, (McCarthy & Prince 1993), or in the form of constraint domains, (Buckley 1995).

As early as McCarthy & Prince (1993), advocates of OT have recognised the need for derivations, in the sense of lexical phonology organisation. In their analysis of Axininca Campa's affixation, McCarthy & Prince (1993a) resorted to a multistratal version of OT. In particular, they wanted to account for the asymmetries in phonological properties of prefixes and suffixes in that language. They proposed evaluating candidates on different levels. Each level has its own constraints and/or constraint ranking. Their actual wording of this proposal is as follows:

> Each level constitutes a separate mini-phonology, just as in ordinary rule-based Lexical Phonology ... or in the level-based rule + constraint system of Goldsmith (1990, 1991). The constraint hierarchies at each level will overlap only in part, and will in fact specify somewhat different constraint rankings. Each level selects the candidate form that best satisfies its parochial constraint hierarchy; the winning candidate is fully interpreted by filling in empty moras or incomplete root-nodes and by erasing unparsed material. This interpreted representation then becomes the input, the underlying representation, for the next level in the derivation.
>
> (McCarthy & Prince 1993a: 24-5)

The same idea is pursued in Rubach (1997) where he attempts to analyse internal extrasyllabic consonants in Polish. He terms the model “Derivational OT” whereby optimised forms of level *n* are taken as inputs to level *n+1*. Different levels may (and ought to) have different constraints and/or rankings. What differentiates his model from that of McCarthy & Prince’s is the scale of application. Rubach aims at a more general, and hence rather powerful, derivationalised OT while McCarthy & Prince are restricting it to affixation on different levels of morphology.

Extending this idea of levels evaluation to the phenomenon of internal vowel shortening in UHA will account for the shortening vs. epenthesis paradox. In particular, I will maintain the two rankings of MAX-μ and DEP-IO, suggested in (37) above, applying them in their respective levels, i.e. DEP-IO >> MAX-μ for nominative and dative suffixation and *vice versa* elsewhere. Consider the following tableaux:

(41)(i) Level One DEP-IO >> MAX-μ (Nominative and Dative Suffixation):

/d͡ʒaab+l/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX, MAX-C	DEP-IO	O-CONTIG	MAX-μ	SYL-MIN	Syll-ALIGN (R)	-CODA
a.☞ d͡ʒabl				*			*
b. d͡ʒaa.b**a̲**l		*!	*			2μ	*
c. d͡ʒaab l	*!*COMPLEX * SYL-MAX						*

(ii) Level Two MAX-μ >> DEP-IO (Elsewhere):

/d͡ʒabl+ha/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX, MAX-C	MAX-μ	O-CONTIG	DEP-IO	SYL-MIN	Syll-ALIGN (R)	-CODA
a.☞ d͡ʒab.l**a̲**.ha			*	*	**	3μ	*
b. d͡ʒa.b**a̲**l.ha			*	*	**	4μ!	
c. d͡ʒa**a̲**.b**a̲**l.ha			**!	**	*	4μ	*
d. d͡ʒabl.ha	*!*COMPLEX * SYL-MAX				*	1μ	*

The ranking DEP >> MAX-μ optimises vowel shortening on level one. Consequently, candidate (41i a) qualifies as the input to level two. There, the relative ranking of MAX-μ and DEP is reversed because the suffix involved is neither a nominative nor a dative morpheme. Therefore, an epenthetic vowel is inserted to break up the medial consonant cluster, and consequently the true output [d͡ʒab.l**a̲**.ha] is optimised.

However, in an attempt to maintain OT's principle of Parallelism, preserving its commitment of being a non-derivational framework, Buckley (1995a, b) argues for a domain-based formalisation of morphological levels. He introduces a set of constraints that will only apply in certain "C[onstraint]-domains" which themselves correspond to "M[orphological]-constituents".

> Other constraints can be specified as holding sway, or having a certain rank, only within specified C-domains. This duplicates to a large extent the function of lexical levels, but a very important difference is that the

word is evaluated once as a whole, and no input-output relationship is possible among the various domains.

(Buckley 1995b: 5)

This entails that the scale of correspondence between C-domains and M-constituents is set language-specifically. Thus, certain constraints can only evaluate certain morphological constituents depending on the language-specific mapping of C-domains to M-constituents. For UHA, I propose the following mapping:

(42) C-domains in UHA:

[[[	[*pref.*	[*root*]$_{ROOT}$	]$_{STEM}$	*suff.*	]$_{M1}$	*suff.*	]$_{M2}$	*suff.*	]$_{M3}$
	{	stem	}$_{C0}$	{ nom.	}$_{C1}$	{ dat.	}$_{C2}$	{ acc.	}$_{C3}$

Therefore, for our particular case of UHA, I shall introduce a special version of the constraint DEP-IO that is only activated in C-domains C1 and C2. It will be ranked higher than MAX-μ. This ranking renders epenthesis more fatal than vowel shortening in the domains of nominative and dative suffixation, but *vice versa* elsewhere. Consequently, this will predict that only hollow verbs and interrogative pronouns undergo vowel shortening, as they are the only forms to which C1 and C2 suffixes can attach.[21]

(43) DEP-IO$^{\{C1, C2\}}$ >> MAX-μ >> DEP-IO

The tableau below demonstrates the positive effects of adopting C-domains. I think it is more plausible to have a one step evaluation of inputs whose true outputs manifest the occurrence of both processes of epenthesis and syncope.

---

[21] This must not be confused with forms like /tiin-na/ → [tii.na̲.na] 'our figs' where the suffix /na/ here is a possessive pronoun rather than a subject pronoun.

(44)

/d͡ʒaab+l+ha/	NUC, *P/C, *M/V, *COMPLEX, ONS, SYL-MAX, MAX-C	DEP-IO {C1, C2}	MAX-μ	O-CONTIG	DEP-IO	SYL-MIN	Syll-ALIGN (R)	-CODA
a.☞ d͡ʒab.l<u>a</u>.ha			*	*	*	**	3μ	*
b. d͡ʒaa.b<u>a</u>l.ha		*!		*	*	*	4μ	*
c. d͡ʒaab.lha	*!*COMPLEX *SYL-MAX					*	1μ	*

Candidate (44 b) epenthesises a vowel in the C-domain C2 (dative suffixation). Obviously, this violates DEP$^{\{C1, C2\}}$. On the other hand, vowel shortening and epenthesis in (44 a) violate the lower constraints MAX-μ and DEP-IO, as the epenthetic vowel appears in the C-domain C3 (accusative suffixation).[22]

In conclusion, I think that neither OT analyses proposed for this process of internal vowel shortening in UHA is as adequate as those presented to account for epenthesis. There, we saw how employing a set of independently motivated constraints serves the desired purposes. Here, however, Optimality Theory is struggling to maintain its principles. Strictness of language-particular ranking is shown to be questionable. Also, Parallelism in input-output candidate evaluation is incapacitated by proposing multiple-levels or domain specific constraints. Conversely, we will see in the following chapter how recognising different levels of morphology can simply, stipulatively, account for the attested facts.[23]

With this, I conclude talking about problematic inputs. In this section I have demonstrated the importance of the CVX syllable template. In particular, I have

[22] Retaining underlying vowel length before object suffixes may tempt one to assume some form of O/O correspondence. This will falsely imply that vowel shortening is the default that is overridden to maintain O/O identity.

argued for a set of constraints, like *COMPLEX, SYL-MAX (and SYL-MIN). I clarified how UHA resorts to some processes of epenthesis and syncope to avoid violating these constraints and consequently achieve some sort of uniform CVX-bound syllabification. In what remains of this chapter, I will discuss some true outputs that deviate from this norm. I shall demonstrate how we may argue for optimising outputs where our syllable template is either over-maximised or under-maximised.

3.3. Deviant Outputs:

The maximum limit of two moras per syllable is obviously the central issue in the discussion so far. Nevertheless, there are some attested outputs that seem to override this restriction. These may include syllables which either have lower moraic content or are potentially capable of parsing more than two moras. In this section, I will be mainly talking about output deviations of this sort. In particular, I will be discussing light syllables and final superheavies. Also, I will analyse the process of High Vowel Deletion, focusing on the exceptional case of non-final CVVC syllables.

3.3.1. Light CV Syllables:

[23] Kager (p.c.) thinks that alternations of length and vowel quality suggest 'stem allomorphy' CvC ~ CvvC, in hollow verbs and interrogative pronouns, prosodically motivated to maintain something like the CVX syllable template.

An obvious output deviation from the CVX syllable template is the CV light syllable. Only parsing a single mora, such a syllable will at least incur a violation of SYL-MIN. On the other hand, augmenting the light syllable by epenthesis or (in some cases) deleting its vowel would satisfy both SYL-MAX and SYL-MIN. The following tableau demonstrates this by evaluating some candidate analyses of the input /bagarah/ 'a cow':

(45)

/bagarah/	SYL-MAX	SYL-MIN
a. ? ba.ga.rah	√	*!*
b. ☞ *ba .ga .rah	√	√
c. ☞ *bag<a>.rah	√	√

Both (45 b and c) are false outputs, but they are more harmonious than the true output (45 a) which violates SYL-MIN.

When SYL-MIN was introduced above, I indicated the need for ranking it lower than the faithfulness pair, to avoid such false optimisation. This ranking will optimise a more faithful candidate, even if it violates SYL-MIN. Consider the following tableau:

(46)

/bagarah/	SYL-MAX	MAX-IO	DEP-IO	SYL-MIN
a.☞ ba.ga.rah				**
b. bav.gav.rah			*!*	
c. bag.rah		*!		

Therefore, this simple ranking accounts for the case of CV light syllables as being outputs that fall short of the ideal moraic content of the CVX syllable template. In the following subsection, I will analyse a more interesting deviant output, namely the superheavy syllable.

3.3.2. CVXC Superheavy Syllables:

This section aims to achieve an adequate account of the superheavy syllable in Arabic, in general, and in UHA, in particular. As I have mentioned above, the corner-stone in any analysis of this type of syllables must set out to determine the true affiliation of their final consonants. In particular, we want to determine whether or not such a consonant is licensed in the coda position of a final syllable, exceeding the CVX syllable template. Adopting this approach implies that we are assuming a non-uniform syllable distribution in the language, achieving no analytical competence. On the other hand, if we question that superficial claim, we will have to decide how to prosodify that consonant. The licenser may be a final degenerate syllable, a syllable node, or that of a prosodic word. These are the sort of issues investigated below.

In section one, I clarified why we express reservation about the superheavy syllable. In Optimality Theory terms, I determined the set of constraints that will eventually discriminate against parsing CVVC or CVCC sequences into syllables. In particular, I introduced the pair SYL-MAX and SYL-MIN to control the moraic content of syllables. This may suffice in simple cases like /katab/, in (12) above. However, it will not account for the final consonant in superheavy syllables. SYL-MAX will not sanction incorporating it into the structure of the final syllable. Doing so creates a tri-moraic syllable.[24] Also we may not leave it unassociated to any syllable position, which will inevitably incur a violation of PARSE. Ideally, what we want to achieve is a compromise. A desirable situation could be one where this final consonant is not imposed onto the melodic configuration of the final syllable. Hence, that syllable is not forced to violate SYL-MAX. That consonant may be phonetically realisable by virtue of being prosodified, i.e. associated to a higher prosodic constituent. In this way, input-output faithfulness is maintained. To achieve this, I must assume the correspondence pair MAX-IO and DEP-IO to maintain input-output faithfulness.

The constraint PARSE, as originally introduced by Prince & Smolensky (1993), is violated by both phonological deletion and failure to associate an input segment to a syllable position node. In such cases, it amounts to Stray Erasure, and consequently it leads to lack of phonetic realisation. The correspondence constraint MAX-IO, on the other hand, is only violated by phonological deletion. Assuming this particular characteristic of correspondence constraints, I will aim at optimising the candidate analysis that directly associates the final extrasyllabic consonant to the prosodic word node.

(47)

/katabt/	ONS	SYL-MAX	MAX-IO	DEP-IO	SYL-MIN	-CODA
a. ?PrWd /\ σ σ /\ /|\					*	*

---

[24] Assuming the existence of moras in underlying forms and recognising the language-specific implementation of some rule like Weight by Position (Hayes 1989), I analysed moraification within OT by means of a set of constraints. As we saw above, those constraints disfavour rimes that are not exhaustively parsed into moras. This means that we cannot license a non-moraic element in the coda.

<table>
<tr><td>ka t a b t</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>b. ?PrWd
/\
σ σ
/\ /|\
ka t a b t</td><td></td><td></td><td></td><td></td><td>*</td><td>*</td></tr>
<tr><td>c. PrWd
/|\
σ σ σ
/\ /|\ /\
ka tab tv</td><td></td><td></td><td></td><td>*!</td><td>**</td><td>*</td></tr>
<tr><td>d. PrWd
/\
σ σ
/\ /|\
ka t a b</td><td></td><td></td><td>*!</td><td></td><td>*</td><td>*</td></tr>
<tr><td>e. PrWd
/\
σ σ
/\ /|\
ka t a b t</td><td></td><td>*!</td><td></td><td></td><td>*</td><td>*</td></tr>
</table>

The true output (47 a) is not optimised. A candidate like (47 b), that links the final consonant to no prosodic node, is equally harmonious. Clearly, the key difference between these two candidates is the prosodification status of their final consonant. Ultimately, this will have determinant consequences in the phonetic realisation. Nevertheless, the constraint hierarchy introduced so far is incapable of ruling out candidates with stray segments. Similar candidates in Berber prompted Clements (1997) to propose an appropriate universal constraint that interprets Steriade's (1982) Stray Erasure.

(48) *STRAY: root nodes are linked to prosodic structure.

(Clements, 1997: 42)

Such cross-linguistically undominated constraint will clearly discriminate against analyses like (47 b) where a root node, the final /t/, is not linked to any prosodic structure. The following tableau demonstrates the effects of this constraint.

(49)

/katabt/	NUC, *P/C, *M/V, *COMPLEX, *STRAY, ONS, SYL-MAX	MAX-IO	DEP-IO	SYL-MIN	-CODA
a.☞PrWd /\\ σ σ /\ /|\\ ka t a b t				*	*
b. PrWd /\\ σ σ /\ /|\\ ka t a b t	*! *STRAY			*	*
c. PrWd /|\\ σ σ σ /\ /|\ /\\ ka tab tv̲			*!	**	*
d. PrWd /\\		*!		*	*

σ σ /\ /|\\ ka t a b					
e. PrWd /\\ σ σ /\ /|\\ \\ ka t a b t	*! *COMPLEX * SYL-MAX			*	*

Although tableau (49) demonstrates an evaluation optimising the true output, there remains one important detail. Generally, any candidate containing even one unsyllabified, though prosodified, segment should be inferior to one that is perfectly syllabified. In terms of Optimality Theory constraints, we did not present anything so far that establishes such a principle. In particular, we should determine the constraint that is violated by (49 a) because its final consonant is associated directly to the prosodic word, not to a syllable node.

Phonologists have argued for a Prosodic Hierarchy in which all phonological units belong to higher prosodic structures (Selkirk 1978, 1981, 1984, Nespor and Vogel 1986, Itô 1986, McCarthy and Prince 1986, 1990 a, b). This means that segments belong to syllables, syllables to feet, feet to prosodic words, and so on until we reach the prosodic (or phonological) utterance. The following diagram clarifies this ordering:

(50)

P-Utterance
↓
Intonational phrase
↓
P-Phrase
↓
Clitic Group

↓
P-Word
↓
Foot
↓
Syllable
↓
(Mora)
↓
Segment

The dominance relations holding between the different prosodic domains are regulated by what Selkirk (1981) first introduced and termed the Strict Layer Hypothesis, presented below in a more refined formulation:

(51) Strict Layer Hypothesis:
Pn → Pn-1* (where X* = 'one or more Xs')
(Selkirk 1990: 180)

What motivates such an ordering is not of our interest at the moment. However, we ought to know that its formality comes as a result of one of the basic principles of Prosodic Phonology, namely Prosodic Licensing.

Selkirk (1996) provided an OT revision of this Prosodic Hierarchy. In particular, she introduced a constraint-based formalisation of the various dominance relations imposed on the hierarchy by the Strict Layer Hypothesis *ibid.* These constraints are as follows:

(52) Constraints on Prosodic Domination:

a. Layeredness	No C_i dominates C_j, $j > i$
b. Headedness	Any C_i must dominate a C_{i-1}
c. Exhaustivity	No C_i immediately dominates a constituent C_j, $j < i-1$
d. Nonrecursivity	No C_i dominates C_j, $j = i$

(Selkirk 1996: 443)

Selkirk thinks that Layeredness and Headedness are cross-linguistically undominated and consequently inviolable. The other two, however, are subject to language-particular ranking. What is of interest to us is the constraint Exhaustivity (EXHAUS). This constraint is violated when a prosodic constituent immediately dominates one that is not directly lower than it in the Prosodic Hierarchy. Thus, a prosodic word cannot immediately dominate a terminal segment.[25] This constraint will have to be ranked quite low in our constraint hierarchy as it will always be violated by forms with final superheavy syllables. The following tableau incorporates this constraint.[26]

(53)

/katabt/	NUC, *P/C, *M/V, *COMPLEX, *STRAY, ONS, SYL-MAX	MAX-IO	DEP-IO	SYL-MIN	EXHAUS	-CODA
a.☞PrWd /\ σ σ /\ /|\ ka t a b t				*	*	*
b. PrWd /\ σ σ /\ /|\ ka t a b t	*! *STRAY			*		*
c. PrWd /|\ σ σ σ /\ /|\ /\ ka tab tv̲			*!	**		*
d. PrWd		*!		*		*

[25] Hung (1994) employed the constraint StrictParse to maintain the domination relations imposed by the Strict Layer Hypothesis. To attain the same effect, Spaelti (1994) introduced PARSE (P-CAT1)-IN-(P-CAT2) assuming the SLH. Rubach (1997), on the other hand, simply uses the Strict Layer Hypothesis itself in its mostly broad sense as a constraint to achieve the same result with Polish. Nevertheless, I will demonstrate below that even Selkirk's decomposition of the basic concepts assumed by the general hypothesis does not go to the primitive building blocks of the Prosodic Hierarchy. I will show that, for the case of UHA, we need further decomposition.

[26] Throughout, I am assuming the existence of feet between syllables and prosodic words. In chapter five, we will see why we are suggesting association to the PrWd rather than to the Foot.

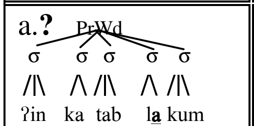
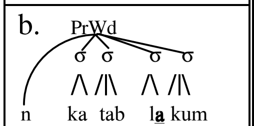
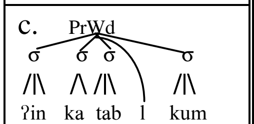
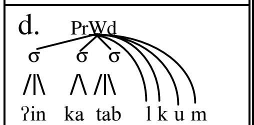
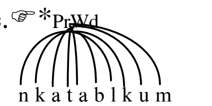
/\\ σ σ /\\ /|\\ ka t a b						
e. PrWd /\\ σ σ /\\ /|\\ \\ ka t a b t	*! *COMPLEX * SYL-MAX					*

So far, I have introduced the basic proposal accounting for the "so called" superheavy syllable. The next important issue involves confining this degenerate association only to the final consonant in superheavy sequences. In other words, I did not present any constraints to disfavour candidate analyses with unsyllabified segments occupying non-final positions in the prosodic word. In the following subsection, this issue is tackled and the necessary constraints are proposed.

3.3.2.1. Restricting Exhaustivity Violations:

We saw above that EXHAUS is introduced as a universal constraint to enforce immediate downward domination between consecutive domains along the Prosodic Hierarchy. Being violable, this constraint is subject to language-particular ranking which, as I argued above, is very low for UHA. This low ranking of the constraint will prompt optimising candidates with initial or medial degenerate association. Also, we will not be able to disfavour analyses with more than one final syllabically unprosodified segment. Also, this list of possible false outputs will accommodate one with a final short unsyllabified vowel. In short, if we are going to allow violation of this constraint by final consonants of superheavies, why not allow it elsewhere? If we take it to the extreme, why syllabify at all if we could in principle associate all underlying segments directly to the prosodic word? The following tableau, evaluates some candidate analyses of the input /nkatab+l+kum/ → [**ʔi**n.ka.tab.l**a**.kum] 'it was written for you'. Utilising the constraints introduced so far, it demonstrates the serious consequences of my proposed account for the superheavy syllable:

(54)

/nkatab+l+kum/	NUC, *P/C, *M/V, *COMPLEX, *STRAY, ONS, SYL-MAX	MAX-IO	DEP-IO	SYL-MIN	EXHAUS	-CODA
a. ? 			*!**	**		***
b. 			*!	**	*	**
c. 			*!*	*	*	***
d. 			*!*	*	****	**
e. ☞* 					***** *****	

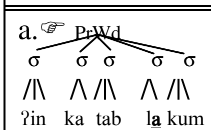
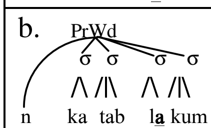
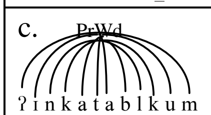
In this tableau, we can clearly see the three major aspects of the problem, viz. initial association to the prosodic word (54 b), medial association to the prosodic word (54 c), and multiple-final association to the prosodic word (54 d-e). Unfortunately, all of these false outputs are more harmonious than the true output (54 a). This means that we must include more constraints in our hierarchy to militate against such unlawful forms. Such constraints, however, should be independently motivated universally to maintain the general principles of syllabification.

I will start with (54 b). How can we discriminate against a form whose initial segment or cluster of segments is immediately dominated by the prosodic word node? We will call on Alignment (McCarthy & Prince 1993b). I will propose a constraint that requires the alignment of the left edge of the prosodic word with the left edge of some syllable. Such a constraint may be formalised as follows:

(55) ALIGN-LEFT:
Align (PrWd, L, Syll, L)
(The left edge of every prosodic word must be aligned with the left edge of some syllable).
(cf. Clements 1997)

For UHA, such a constraint may not, and will not, be violated, and consequently it is ranked undominated. If so, any candidate analysis manifesting left misalignment between these two prosodic domains like (54 b) or lacking syllables like (54 e) can never be optimised. Consider the following tableau:

(56)

/nkatab+l+kum/	NUC, *P/C, *M/V, *COMPLEX, *STRAY, ONS, SYL-MAX, ALIGN-LEFT	MAX-IO	DEP-IO	SYL-MIN	EXHAUS	-CODA
a.☞ 			***	**		***
b. 	*! ALIGN-LEFT		*	**	*	**
c. 	*! ALIGN-LEFT				**********	

Now we move to violations of EXHAUS incurred by having the prosodic word immediately dominating a medial segment. For a similar effect required for Classical Arabic, McCarthy and Prince (1990) proposed a pre-OT constraint whereby the linear contiguity of syllables is maintained. They sensed the need for such a constraint that does not allow interrupting the adjacency of subsyllabic elements. However, it must be made clear that this constraint differs from the more usual Contiguity constraint that favours the input's melodic adjacency (Kenstowicz 1994, Lamontagne 1996, etc.). The focus here is on phonological constituents (syllables in particular). McCarthy and Prince stated this constraint as follows:

(57) Syllabic Contiguity (SYL-CONTIG):[27]
Syllabic well-formedness is enforced over contiguous strings of subsyllabic elements.

(McCarthy & Prince 1990, p. 15)

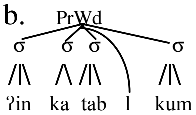
For our present purposes, SYL-CONTIG, that maintains contiguity across syllabic boundaries, is the member to consider. Therefore, if such a constraint is undominated, all non-peripheral segments must be properly syllabified. The following tableau clarifies how (54 c) is cancelled out:

(58)

/nkatab+l+kum/	NUC, *P/C, *M/V, *COMPLEX, *STRAY, ONS, SYL-MAX, ALIGN-LEFT, SYL-CONTIG	MAX-IO	DEP-IO	SYL-MIN	EXHAUS	-CODA
a. ☞ PrWd σ σ σ σ σ /|\ /\ /|\ /\ /|\ ʔin ka tab la kum			***	**		***

---

[27] To attain the same effect for syllabification in Berber, Clements (1997) presents an alignment constraint that requires strict syllabic adjacency: Align (Syll, L, Syll, R). There is one problem with this constraint, however. It will be violated by the left-most syllable in any candidate as that syllable's left edge is not aligned with the right edge of another syllable. This will not affect the overall evaluation, but it will be a unique case of an undominated constraint that is always violated at least once (if we assume the existence of at least one syllable). Nevertheless, both of these constraints can be augmented to cover a larger scale and constitute a family of constraints operative with more phonological constituents, as we shall see in chapter five when we talk about footing.

b. 	*! SYL-CONTIG		**	*	*	***

Finally, we move to the third type of EXHAUS violation, i.e. multiple-final association to the prosodic word. How does the grammar deny optimising candidates that have more than one final segment (consonant) violating the Strict Layer requirement? Having forms like (54 d) or even forms with only one initial syllable, to satisfy ALIGN-LEFT, $(\sigma CVCVCV...)_{PrWd}$ is yet another consequence of my proposal of immediately associating final consonants of superheavy syllables to the prosodic word. The only theoretically and logically feasible account of this undesired overgeneralisation is attained by slightly reformulating the definition of *COMPLEX to accommodate our assumptions. Originally, when this constraint was introduced by Prince & Smolensky (1993), it was intended to be violated by any form that associates more than one C or V to any syllable position node. Nonetheless, since I am adopting a moraic representation of the internal structure of the syllable, I shall redefine *COMPLEX accordingly. This can be stated as follows:

(59) *COMPLEX:
No more than one segment may associate to any prosodic node.

As a result, final associations to the prosodic word are minimised to only one segment.[28] Consider the following tableau:

(60)

[28] Below, we will find that we do not really need such a modification of *COMPLEX definition for the attested cases in UHA. The interaction of other constraints will not allow prosodic words to immediately dominate more than one peripheral consonant.

/nkatab+l+kum/	NUC, *P/C, *M/V, *COMPLEX, *STRAY, ONS, SYL-MAX, ALIGN-LEFT	MAX-IO	DEP-IO	SYL-MIN	EXHAUS	-CODA
a.☞ PrWd σ σ σ σ σ /|\ /\ /|\ /\ /|\ ʔin ka tab la kum			** *	**		***
b. PrWd σ σ σ /|\ /\ /|\ ʔin ka tab l k u m	*! *COMPLEX		**	*	****	**
c. PrWd n k a t a b l k u m	*! *COMPLEX				***** *****	

Clearly, this will restrict extrasyllabicity to a single final consonant of final superheavy syllables.[29] However, this will not account for cases with final consonant geminates. Being monosegmental, associating both members of a final geminate directly to the prosodic word will not violate *COMPLEX. Therefore, we need yet another constraint especially if we also include a related case, where a vowel of a final CV syllable is prosodified to the prosodic word. The factor that relates vowels and geminates is moraicity.

Hayes' (1989) claims regarding moraification induce us to consider enforcing syllabification of underlying moras. I am not going to propose a new constraint. I will demonstrate that decomposing EXHAUS into its very primitive micro constraints reveals more specific domains of Exhaustivity enforcement. This fragmenting is shown in the following table:

[29] Final consonants of final CVC syllables are not allowed to be prosodified to the prosodic word, as doing so would incur a further violation of SYL-MIN. The following mini tableau shows this interaction:

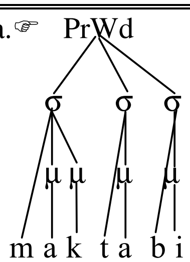
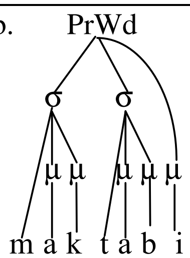
/maktab/	NUC, *P/C, *M/V, *COMPLEX, *STRAY, ONS, SYL-MAX, ALIGN-LEFT	MAX-IO	DEP-IO	SYL-MIN	EXHAUS	-CODA
a.☞[$(mak)_{\sigma}(tab)_{\sigma}]_{PrWd}$						**
b. $[(mak)_{\sigma}(ta)_{\sigma}b]_{PrWd}$				*!	*	*

(61)

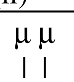
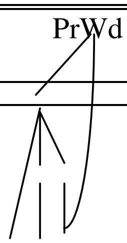
Seg - EXHAUS	μ - EXHAUS	σ - EXHAUS	Ft - EXHAUS	PrWd - EXHAUS	PPh - EXHAUS
*Utt >> seg *IP >> seg *PPh >> seg *PrWd >> seg *Ft >> seg	*Utt >> μ *IP >> μ *PPh >> μ *PrWd >> μ *Ft >> μ	*Utt >> σ *IP >> σ *PPh >> σ *PrWd >> σ -----------------	*Utt >> Ft *IP >> Ft *PPh >> Ft --------------- ---------------	*Utt >> PrWd *IP >> PrWd ------------------ ------------------ ------------------	*Utt >> PPh ---------------- ---------------- ---------------- ----------------

Of these six groups of micro constraint, I will utilise μ-EXHAUS. This group will be treated as a constraint, ranked undominated. Doing so will militate against having any prosodic domain, other than a syllable, immediately dominating a mora. The following tableau evaluates key candidate analyses of two inputs, one with a final short vowel /maktabi/ 'my office' and one with a final consonant geminate /fann/ 'art':

(62)(i)

/maktab/	NUC, *P/C, *M/V, *COMPLEX, *STRAY, ONS, SYL-MAX, ALIGN-LEFT, μ - EXHAUS	MAX-IO	DEP-IO	SYL-MIN	EXHAUS	-CODA
a.☞ 				**		*
b. 	*! μ - EXHAUS				*	**

(ii)

	NUC, *P/C, *M/V, *COMPLEX, *STRAY, ONS, SYL-MAX, ALIGN-LEFT, μ - EXHAUS	MAX-IO	DEP-IO	SYL-MIN	EXHAUS	-CODA
a.☞ 					*	*

σ μ μ f a n						
b. PrWd σ μ μ f a n	*! μ - EXHAUS			*	**	

In conclusion, I can say that the suggested constraints provide a greater degree of control regarding the direct association of segments to the prosodic word. We saw how a constraint like ALIGN-LEFT disfavours initial degenerate association. Also, SYL-CONTIG guarantees adjacency of syllable boundaries. On the other hand, the constraint μ-EXHAUS enforces proper final vowel and geminate syllabification.[30] For UHA, μ-EXHAUS and SYL-MIN can also perform the task for which I had to redefine *COMPLEX. In UHA, the only attested environment of potential final multiple-association to the prosodic word is a final CVCC sequence. Obviously, associating the final non-geminate consonant cluster to the PrWd will not violate μ-EXHAUS. However, this prosodification can easily be ruled out by SYL-MIN, as a mono-moraic syllable is created.[31]

3.3.2.2. A Different Motivation: Sonority and Epenthesis:

[30] However, what motivates the other association line linking the final root node to the PrWd in (62 ii) (cf. ONS and medial geminates)? More generally, can we represent final geminates in mora theory as in (62 ii a)?

[31] However, with some loan words, the restriction *COMPLEX imposes is quite clear. Words like [ka:rd] ‘card’ surface as [kart]. This vowel shortening is performed to accommodate the final two consonants. A long vowel maximises a syllable template. Therefore, unless the underlying vowel shortens, these consonants will have to be linked to the prosodic word violating *COMPLEX.

The above discussion maintains the claim that a final consonant of a final superheavy sequence (syllable) is extrasyllabic. This is because such a sequence may not be fully parsed by UHA's syllable template. Therefore, I had to propose licensing its final consonant by directly associating it to the PrWd. In that case, the sonority profile of the final syllable may not be influenced by the sonority value of that final extrasyllabic consonant, as it is external to that syllable's structure. However, as demonstrated in (63 i), a final consonant cluster with rising sonority values triggers vowel epenthesis.[32]

(63)(i)	a. /d͡ʒism/	→	[d͡ʒi.s**i̲**m]	'body'
	b. /ʔiðn/	→	[ʔi.ð**i̲**n]	'ear'
	c. /ħukm/	→	[ħu.k**u̲**m]	'law sentence or ruling'
	d. /gutˤn/	→	[gu.tˤ**u̲**n]	'cotton'
	e. /faħm/	→	[fa.ħ**a̲**m]	'coal'
	f. /nahr/	→	[na.h**a̲**r]	'river'
	g. /ʔakl/	→	[ʔa.k**i̲**l]	'food'
	h. /ħabl/	→	[ħa.b**i̲**l]	'rope'
	i. /sˤabr/	→	[sˤa.b**u̲**r]	'patience'
	j. /fad͡ʒr/	→	[fa.d͡ʒ**u**r]	'dawn'
(ii)	a. /misk/	→	[misk]	'musk'
	b. /ʔuχt/	→	[ʔuχt]	'sister'
	c. /bint/	→	[bint]	'girl, daughter'
	d. /saħb/	→	[saħb]	'pulling'
	e. /faχχ/	→	[faχχ]	'trap'

One may claim that in the first group of examples the final consonant is not syllabified, as this would create a sonority trough within a syllable. Consequently, and to avoid Stray Erasure, an appropriate vowel is epenthesised. If we accept such a

[32] Apparently, the identity of the epenthetic vowel varies quite considerably if compared to lexical epenthesis where it is always /a/. The stem's vowel has some bearing on determining the inserted vowel.

justification, we are indirectly assuming that the final consonant in such sequences is always syllabified, providing that the SSP is maintained. Obviously, this contradicts our previous assumptions regarding Syllable Maximality. Therefore, if we want to uphold our earlier inclinations, the question that will arise is how we can justify this process of vowel epenthesis.[33]

The angle from which we shall view the relation between sonority and syllabification differs from that of any derivational approach. As we shall see in chapter four below, sonority values of segments block syllabification if it creates syllable-internal sonority troughs. In the OT analysis I am adopting, sonority, especially a sonority peak, i.e. "any local maximum of sonority" (Clements (1997): 303), drives syllabification. In particular, I will propose incorporating a constraint that links sonority peaks to syllable peaks. This can be formalised as follows:

(64) Sonority Peak Principle (SPP):
Within the syllabification domain, sonority peaks contain syllable peaks.
(Clements (1997): 303)

For UHA, SPP is ranked undominated. To avoid incurring a violation, in a form containing a sonority peak that is not a syllable peak, we will have to either syncopate one of the two consonants between which the sonority trough occurs, or epenthesise a vowel between them creating a new vocalic sonority peak. Each of these alternatives

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Nevertheless, the complications of analysing this vowel change, though straightforward in most cases, is beyond the scope of this fundamentally prosodic study.

[33] In the following chapter, a stipulative rule will have to be postulated to insert an epenthetic vowel, and crucially between the two consonants. We will not be able to say why, and why in this position, not finally for example. On the other hand, we will see below how the proposed OT account overcomes such shortcomings of the derivational approach.

violates some constraint(S). The following tableau, where candidate analyses of the input /nahr/ 'river' are evaluated, determines which violation the language tolerates:

(65)

/nahr/	NUC, *P/C, *M/V, *COMPLEX, *STRAY, ONS, SYL-MAX, ALIGN-LEFT, µ - EXHAUS, SPP	MAX-IO	O-CONTIG	DEP-IO	SYL-MIN	EXHAUS	-CODA
a. ? $[(\text{na})_\sigma(\text{h}\underline{\textbf{a}}\text{r})_\sigma]_{PrWd}$			*!	*	*		*
b.☞ *$[(\text{nah})_\sigma(\text{r}\underline{V})_\sigma]_{PrWd}$				*	*		*
c. $[(\text{nahr})_\sigma]_{PrWd}$	*!*COMPLEX * SYL-MAX * SPP						*
d. $[(\text{nah})_\sigma]_{PrWd}$		*!					*
e. $[(\text{nah})_\sigma\text{r}]_{PrWd}$	*! SPP					*	*

Tableau (65) demonstrates that epenthesis is the optimal solution but could not optimise (65 a), the true output. The most harmonious candidate (65 b), where the epenthetic vowel is peripheral, incurs no violation of O-CONTIG. We will call on alignment, yet again, to rule out this undesired outcome. The right edge of our true output summarises the intended constraint. At this particular edge, right edges of both the lexical word and the prosodic word coincide. On the other hand, in (65 b) these edges are misaligned. The epenthetic vowel intervenes between the edges. This constraint may be stated as follows:

(66) ALIGN-RIGHT
Align (LxWd, R, PrWd, R)
(The right edge of every lexical word must be aligned with the right edge of some prosodic word).[34]
(cf. McCarthy & Prince 1993b)

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[34] ALIGN-RIGHT was originally proposed by McCarthy & Prince (1993b) to align the right edges of stems and syllables. This lexical-prosodic alignment on this lower level is the last thing we need in UHA. Clearly, such a constraint will systematically be violated by stems with final superheavy

Obviously, such a constraint will have to be ranked higher than O-CONTIG in UHA. ALIGN-RIGHT imposes coincidence at the right edges of lexical and prosodic words and forces epenthesis, if required by other constraints, to be medial, which would eventually incur a violation of O-CONTIG. It is more fatal in UHA to violate ALIGN-RIGHT than O-CONTIG, hence the dominance of the former. Actually, ALIGN-RIGHT is considered inviolable in UHA, joining the set of undominated constraints. Consider the following tableau:

(67)

/nahr/	NUC, *P/C, *M/V, *COMPLEX, *STRAY, ONS, SYL-MAX, ALIGN-LEFT, μ - EXHAUS, SPP, ALIGN-RIGHT	MAX-IO	O-CONTIG	DEP-IO	SYL-MIN	EXHAUS	-CODA
a. ☞ $[(na)_\sigma(h\underline{a}r)_\sigma]_{PrWd}$			*	*	*		*
b. $[(nah)_\sigma(r\underline{v})_\sigma]_{PrWd}$	*! ALIGN-RIGHT			*	*		*
c. $[(nahr)_\sigma]_{PrWd}$	*!*COMPLEX * SYL-MAX * SPP						*
d. $[(nah)_\sigma]_{PrWd}$	*! ALIGN-RIGHT	*					*
e. $[(nah)_\sigma r]_{PrWd}$	*! SPP					*	*

By this, I conclude discussing superheavy syllables. I will move on to another interesting issue of output deviation, in particular one that is created by the process of High Vowel Deletion.

3.3.3. High Vowel Deletion and Non-final CVVC Syllables:

In the previous two subsections, I analysed two deviant outputs where the CVX syllable template is not maintained in the output. Here, I talk about a more challenging case that involves non-final CVVC superheavy syllables. Interestingly though, instances of this output counterexample are not input irregularities. They are

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syllables, where the right edges of such stems are aligned with some prosodic word's, not with a the product of a completely independent process that involves deleting high medial short vowels. However, this process is blocked if its output would contain a non-final CVCC superheavy syllable. Consider the following examples:

(68)	(i)	High Vowel Deletion:			
	a.	/ʃaaʕir + ak/	→	[ʃaaʕ.rak]	‘your *sg. ms.* male poet’
	b.	/$t^{ʕ}$aalib + een/	→	[$t^{ʕ}$aal.been]	‘two students’
	c.	/ʃaa$t^{ʕ}$ir + ah/	→	[ʃaa$t^{ʕ}$.rah]	‘bright *sg. fm.*’
	d.	/d͡ʒaahil + aat/	→	[d͡ʒaah.laat]	‘ignorant *pl. fm.*’
	(ii)	No High Vowel Deletion:			
	a.	/ti + tard͡ʒim + uh/	→	[ti.tar.d͡ʒi.muh]	‘she translates it *ms.*’
				(cf. *[tita**rd͡ʒm**uh])	
	b.	/ni + kallim + ak/	→	[ni.kal.li.mak]	‘we talk to you’
				(cf. *[nika**llm**ak])	
	c.	/ti + stagbil + ik/	→	[tis.tag.bi.lik]	‘she meets you *sg. fm.*’
				(cf. *[tista**gbl**ik])	
	d.	/mud͡ʒrim + ah/	→	[mud͡ʒ.ri.mah]	‘a criminal *fm.*’
				(cf. *[mud͡ʒr.mah])	

To be able to suggest an account for such an output (only) deviation from the CVX syllable template, I must first of all provide a thorough analysis of the whole process of high vowel deletion. This will reveal its true motivations (formalised as OT constraints).

The process of High Vowel Deletion attracted some discussion in OT literature, Abu-Mansour (1996), Kager (1995 b), and Davis (1997). However, I think that all these accounts have got some defects. I will be pointing them out suggesting

syllable’s (cf. above).

alternatives, when appropriate. For convenience, I will start by presenting some examples from UHA to demonstrate the basic process of High Vowel Deletion:[35]

(69) i. Vowel Deletion:

a.	/kibir + u/	→	[kib.ru]	'they got older/ grew up'
b.	/nidim + at/	→	[nid.mat]	'she felt remorse'
c.	/simiʕ + ak/	→	[sim.ʕak]	'he heard you *sg. ms.*'
d.	/ʕirif + uh/	→	[ʕir.fuh]	'he recognised him'
e.	/ti + ħtarim + ik/	→	[tiħ.tar.mik]	'she respects you *sg. fm.*'
f.	/bi + ni + darris/	→	[bin.dar.ris]	'we are teaching'

ii. NO Vowel Deletion:

a.	/ʔakal + u/	→	[ʔa.ka.lu]	'they ate'
b.	/saħab + at/	→	[sa.ħa.bat]	'she pulled'
c.	/madaħ + ak/	→	[ma.da.ħak]	'he praised you *sg. ms.*'
d.	/$d^{ʕ}$arab + uh/	→	[$d^{ʕ}$a.ra.buh]	'he hit him'
e.	/ʔamar + at + ni/	→	[ʔa.ma.rat.ni]	'she ordered me'
f.	/sarag + uu + ki/	→	[sa.ra.guu.ki]	'they robbed you *sg. fm.*'

To account for this behaviour that involves deleting medial high short vowels, Davis suggested the following set of constraints:[36]

(70) a. Max-Low V:
A low vowel in the input must have a correspondent in the output.
b. *LightLight:
A sequence of light syllables is not permitted.
c. Max-Hi V:
A high vowel in the input must have a correspondent in the output.
(Davis 1997: 5)

These constraints, in this particular ranking (a >> b >> c), collectively say that deleting a high vowel to avoid a sequence of two light syllables is less costly than

[35] There are some attested exceptions. The forms [ma.li.ki] 'my king' and [ma.li.kah] 'a queen', obviously contain medial short high vowels.
[36] To achieve the same objective, Kager and Abu-Mansour suggested No [i] and *C[$\check{v}_{[+high]}$]$, respectively.

deleting a low one, to avoid a sequence of two light syllables.[37] Obviously, this will achieve the surface alternation. However, the motivation is not well founded. The vowel does not delete to avoid a sequence of two light syllables. Consider the group of examples in (68 i) above. There, the high vowel deletes although the input does not contain a sequence of two light syllables.[38] Consequently, the deletion must be enforced by a more plausible OT constraint that militates against monomoraic syllables all together.

The idea of disfavouring a medial light monomoraic syllable, in Arabic, was introduced, in the form of a rule, in McCarthy (1981: 287) and more generally, i.e. not only medially, in Broselow (1992: 32). The latter influenced Kager (1995 b) to suggest, though not adopt, a general constraint that discriminates against monomoraic syllables. For the sake of plausibility, I will pursue this line of argument ranking such a constraint between Max-Low V and Max-Hi V to maintain the alternation in (69). This constraint is already at our disposal. SYL-MIN provides the desired restriction. However, we cannot rank it higher than Max-Hi V and consequently higher than DEP-IO.

In section one above, I argued for ranking SYL-MIN lower than the faithfulness pair. That was to rule out unattested instances of insertion or deletion

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[37] In a footnote, Kager (1995 b) hints at a very similar account. He mentions the possibility of ranking a constraint, to whom we may attribute high vowel deletion, between IDENT-[a] and IDENT-[i].

[38] In Cairene, such forms surface with shortened internal vowels. The shortening is performed to satisfy something like SYL-MAX which is subject to being violated if the high vowel deletes, not *vice versa*. In other words, in an underlying form like /ʃaaʕir + ah/, there is no need for shortening the internal long vowel, in principle. However, as a result of the high vowel being deleted, its former onset /ʕ/ will become stray. It can neither be syllabified with the previous syllable nor can it join in the onset of the following one. The remedy adopted by the language is shortening the preceding long vowel to

performed to attain the maximum syllable. However, a more robust argument favouring this ranking can be drawn from the interaction between footing and syllabification. As we shall see in chapter five below, constraints on footing, WSP in particular, will be seen to motivate a process of Final Vowel Shortening. Obviously, the output of this process violates SYL-MIN, as a final CVV sequence surfaces as a monomoraic CV syllable. This means that WSP must dominate SYL-MIN. On the other hand, we will see that WSP must be dominated by both I-CONTIG, that is against skipping, and DEP-IO. This is to rule out medial deletion or epenthesis to satisfy WSP, restricting this footing-related process of vowel shortening to the final position (see 5.2.2. for details). Therefore, I-CONTIG and DEP-IO must dominate SYL-MIN. This interaction is clarified in the following constraint dominance relations:

(71)	*if*	WSP >> SYL-MIN
	if	I-CONTIG >> DEP-IO >> WSP
	then	I-CONTIG >> DEP-IO >> SYL-MIN

To overcome this ranking paradox, i.e. to accommodate for both the restriction on final long vowels and the restriction on medial short vowels, I suggest including a special version of SYL-MIN that maintains syllable optimality only word medially.[39] A constraint like SYL-MIN (Wd. Int.) will be violated by word internal light syllables (cf. McCarthy 1981).[40] Ranking it between Max-Low V and Max-Hi V will motivate medial short high vowel deletion (all else being equal). However, to limit the

accommodate that consonant as a coda. Therefore, one may not claim that the input contains a sequence of two potential light syllables: */ʃaʕirah/.

[39] Calling on multi-level evaluation, as we shall see below, renders such decomposition of SYL-MIN redundant.

[40] As mentioned above, McCarthy (1981) proposes a rule that excludes sequences of light syllables, in an attempt to regulate the canonical distribution of consonants and vowels. However, the cross-linguistic motivation of the proposed constraint is yet to be verified.

application of this constraint to medial light syllables, we could force an appropriate condition on its formalisation. More plausibly however, as the tableaux below demonstrate, we can attain that through interaction with independently motivated constraints. In particular, acknowledging the undominated ranking of *COMPLEX will guarantee that the high vowel of an initial light syllable is not deleted. Deleting it will create a complex onset. Similarly, final light syllables retain their high vowels to satisfy another undominated constraint, namely ALIGN-RIGHT. As we saw above, this constraint is independently motivated to maintain the alignment of the right edges of Lexical and Prosodic words.[41] Therefore, the overall constraint ranking pertaining to High Vowel Deletion is given below:

(72) ALIGN-RIGHT, *COMPLEX >>
MAX-Low V >> SYL-MIN (Wd. Int.) >> MAX-Hi V >>
DEP-IO >> SYL-MIN

The two tableaux below show how the interaction between these constraints, in this particular ranking, achieves the desired alternation:

(73) High Vowel Deletion:

/kibir + u/	*COMPLEX	ALIGN-RIGHT	Max-Low V	SYL-MIN (Wd. Int.)	Max-Hi V	DEP-IO	SYL-MIN
a.☞ kib.ru					*		*
b. ki.bi.ru				*!			***
c. ki.bir		*!			*		*
d. kbi.ru	*!				*		**

Candidate (73 b) is completely faithful to its input violating SYL-MIN (Wd. Int.), so it is ruled out. The other candidates incur no violations of this constraint. However,

[41] Nonetheless, this will not account for the interaction with DEP-IO and WSP unless they dominate SYL-MIN.

candidates (73 c and d) violate even higher constraints, *COMPLEX and ALIGN-RIGHT respectively. Therefore, we are left with (37 a). SYL-MIN (Wd. Int.) is satisfied, without creating a complex onset nor disturbing the right edge alignment.

(74) No Low Vowel Deletion:

/ʔakal + u/	*COMPLEX	ALIGN-RIGHT	Max-Low V	SYL-MIN (Wd. Int.)	Max-Hi V	DEP-IO	SYL-MIN
a. ʔak.lu			*!				*
c.☞ ʔa.ka.lu				*			***
d. ʔa.kal		*!					*
b. ʔka.lu	*!		*				**

The input in (74) contains no legitimate target for deletion. This is manifested in the tableau above by optimising the candidate that is most faithful to the input. Any attempt to delete a short vowel to satisfy SYL-MIN (Wd. Int.) will violate a higher ranked constraint, (74 a, c, or d).

So far, I have argued for a constraint that is satisfied by not parsing medial light syllables. This may be achieved by deletion, as we have been claiming so far. It may also be attained by insertion. Inserting a glottal stop (or in principle any other consonant) in the coda position of a potentially medial light syllable or lengthening its vowel will render it heavy, hence satisfying SYL-MIN (Wd. Int.). This is an example of the insertion vs. deletion paradox that was shown to have similar consequences with other processes like Internal Vowel Shortening. We can satisfy a certain constraint by either of the two operations. Nonetheless, the hierarchy introduced so far will optimise insertion, as MAX dominates DEP. This issue has been systematically ignored in the above mentioned analyses though it is of extreme importance. The following tableau demonstrates this point.

(75)

/kibiru/	*COMPLEX	ALIGN-RIGHT	Max-Low V	SYL-MIN (Wd. Int.)	Max-Hi V	DEP -IO	SYL-MIN
a. ? kib.ru					*!		*
b. kib.ruʔ		*!			*		
c. kiʔ.biʔ.ru						*!*	*
d. ☞ *kii.bii.ru							*

The false outputs (75 c, d) are more harmonious than the true output (75 a). The highest constraint either of them violates is ranked lower than Max-Hi V. Candidate (75 c) violates DEP-IO twice, but these violations are obviously insignificant. Moreover, the two instances of vowel lengthening in (75 d) appear to incur no violations of any constraint. They do not violate DEP-IO as the correspondence between input and output segments is maintained. The only difference is length (or weight), which is purely phonological.

To solve this problem, I will introduce two constraints. One will discriminate against consonant medial insertion, and the other against input-output weight alternation. Firstly, I will assume the possibility of splitting O-CONTIG, that is violated by medial insertion (epenthesis or lengthening), into the two freely rankable constraints O-CONTIG (C) and O-CONTIG (V). The former is violated by consonant epenthesis and the latter by vowel epenthesis. Such a move is justified on empirical grounds. In UHA, there are no attested instances of internal consonant insertion.[42] Therefore, if O-CONTIG (C) is ranked undominated, candidates like (75 c) will be ruled out. Secondly, and to account for a candidate like (75 d), I will present WT-IDENT, a constraint proposed in McCarthy (1995). This constraint enforces input-output quantity faithfulness:

(76) WT-IDENT:
If $\alpha \in$ Domain (*f*),
if α is monomoraic, then $f(\alpha)$ is monomoraic. (No lengthening.)
if α is bimoraic, then $f(\alpha)$ is bimoraic. (No shortening.)
(McCarthy 1995: 43)

Categorically, McCarthy mentioned the possibility of treating the two provisions as separate constraints. This means that this constraint may be split into a pair of constraints; one disfavours shortening, WT-IDENT(μμ), and the other rules out a candidate with a lengthened underlying vowel, WT-IDENT(μ). Therefore, I will rank the latter undominated. The following tableau demonstrates how including these two constraints in our hierarchy achieves the desired optimisation:

(77)

/kibiru/	*COMPLEX	ALIGN-RIGHT	WT-IDENT (μ)	O-CONTIG (C)	Max-Low V	SYL-MIN (Wd. Int.)	Max-Hi V	DEP-IO	SYL-MIN
a. ☞ kib.ru							*		*
b. kib.ruʔ		*!					*	*	
c. kiʔ.biʔ.ru				*!*				**	*
d. kii.bii.ru			*!*						*

[42] Dividing DEP I-O into DEP (C) and DEP (V), ranking the former higher, will have undesired consequences with other outputs. Underlying forms with initial bi-consonantal clusters require optimising a candidate with initial epenthetic vowel and glottal-stop (cf. 3..2.1 above) violating DEP (V) DEP (C). However, a false output epenthesising a vowel between the two consonants of the cluster will only violate the lower DEP (V), making that false candidate more harmonious.

I now move to the central complication of the process of High Vowel Deletion. Outputs of forms like the ones in (68 i) above seemingly contain non-final CVVC superheavy syllables. On the other hand, the forms in group (68 ii) show that the process of deletion is blocked if the output contains a CVCCC sequence. To account for this alternation, we will need to investigate the whole process more thoroughly. In particular, we will need to determine what constraint(s) we should allow forms with non-final CVVC superheavies to violate. Also, we will need to determine the level where these constraints are violated, i.e. the level where High Vowel Deletion applies.

High Vowel Deletion is a syncope operation that occurs across word/phrase boundaries. Consider the following examples:

(78) a. /||#huda# #**t**i**g**aatil#||/ → [||hu.dat.gaa.til||] 'Huda is fighting'
b. /||#ʔiħna# #n**i**saafir#||/ → [||ʔiħ.nan.saa.fir||] 'we travel'
c. /||#ʃufna# #ʕ**u**maarah#||/ → [||ʃuf.naʕ.maa.rah||] 'we saw a building'
d. /||#ʔiʃtara# #ħ**u**maar#||/ → [||ʔiʃ.ta.raħ.maar||] 'he bought a donkey'
(gloss: || = PPh boundary, # = PrWd boundary)

These forms demonstrate that the phonological phrase (PPh) is the domain where this operation applies. This means that a special version of the constraint that would otherwise be violated by non-final CVVC superheavies must be specified to only apply in the PPh. Then, this domain specific constraint is ranked lower than SYL-MIN.

However, we must first of all determine this constraint. It will have to be SYL-MAX, SYL-CONTIG, or RIME-EXHAUS. As we shall see in chapter five, the first two options are ruled out because allowing these constraints to be violated will have fatal consequences on the process of metrification. In particular, we must not allow for tri-moraic syllables to be created. Otherwise, we will inevitably violate the undominated FT-BIN or σ-INTEGRITY, when we perform moraic footing. Also, allowing medial degenerate prosodification, by associating the stray consonant to a constituent higher than the syllable, will incur a violation of FOOT-CONTIG. This undominated constraint, as we shall see in chapter five, will be violated if we allow anything but a foot to intervene between two feet. Therefore, we are left only with one option. Allowing RIME-EXHAUS to be violated on the domain of the PPh may have less fatal consequences elsewhere.

The assumptions provided in the discussion above facilitate the possibility of parsing a non-moraic element in a given syllable's rime. Nonetheless, to explain the alternation between non-final CVVC and CVCC superheavies, we must acknowledge the restriction imposed by *COMPLEX. Therefore, on the level of the PPh, we will tolerate medial CVVC syllables as RIME-EXHAUS{PPh} is ranked lower than SYL-MIN (Wd. Int.). On the other hand, a non-final CVCC syllable is ruled out by the undominated *COMPLEX. Consider the tableaux below:

(79)(i) High Vowel Deletion and Non-final CVVC:

/ʃaatˤir + ah/	*COMPLEX, SYL-MAX, RIME-EXHAUS{PrWd}	Max-Low V	SYL-MIN (Wd. Int.)	Max-Hi V	RIME-EXHAUS{PPh}
a. ☞ ‖ʃaatˤ.rah‖				*	*
b. ‖ʃaa.tˤi.rah‖			*!		
c. #ʃaa.tˤi.rah#			*!		
d. #ʃaatˤ.rah#	*! RIME-EXHAUS{PrWd}			*	

(ii) No High Vowel Deletion and No Non-final CVCC:

/mud͡ʒrim + ah/	*COMPLEX, SYL-MAX, RIME-EXHAUS{PrWd}	Max-Low V	SYL-MIN (Wd. Int.)	Max-Hi V	RIME-EXHAUS{PPh}
a. ‖mud͡ʒr.mah‖	*! COMPLEX			*	*

b.☞ ‖mud͡ʒ.ri.mah‖			*		
c.☞#mud͡ʒ.ri.mah#			*		
d. #mud͡ʒr.mah#	*! RIME-EXHAUS{PrWd}				

Having two equally harmonious candidates in (79 ii) is not the real problem of the proposed account. We could always suggest an appropriate constraint to discriminate against (79 ii c). Alternatively, we may argue for accepting both candidates as optimal outputs, since both portray the surface realisation equally well. What I want to question, however, is the plausibility of the suggested ranking in different environments. Take, for example, the input /tiin + na/. As we saw above, similar forms will surface with an epenthetic vowel inserted to license the medial stray consonant, [tii.n<u>a</u>.na]. Such an optimal candidate does that to avoid violating SYL-MAX, SYL-CONTIG, or RIME-EXHAUS. Nonetheless, if we are allowing violations of RIME-EXHAUS in the PPh domain, we will not be able to optimise any candidate that creates an extra monomoraic syllable. This is because SYL-MIN (Wd. Int.) is higher than RIME-EXHAUS{PPh}. The following tableau clarifies this counterexample to the proposed hierarchy:

(80)

/tiin + na/	*COMPLEX, SYL-MAX, RIME-EXHAUS{PrWd}	Max-Low V	SYL-MIN (Wd. Int.)	Max-Hi V	RIME-EXHAUS{PPh}	DEP-IO
a. ☞ *‖tiin.na‖					*	
b. ? ‖tii.n<u>a</u>.na‖			*!			*
c. ? #tii.n<u>a</u>.na#			*!			*
d. #tiin.na#	*! RIME-EXHAUS					

In the present study, this is the strongest evidence for the need of some sort of level derivation, in any phonological theory we may adopt. Unless we exclude SYL-

MIN form our consideration, we will not only motivate High Vowel Deletion but also falsely prevent medial light syllable creation. Otherwise, maintaining the transparent interaction of Max-Low V >> SYL-MIN (Wd. Int.) >> Max-Hi V means that we have to assume the existence of two distinct levels with distinct constraint hierarchies. Level one, the level of the PrWd, comprises the same set of constraints argued for in previous sections. On the other hand, level two is the level of the PPh, in which the following constraint hierarchy applies:

(81) *COMPLEX, ALIGN-RIGHT, WT-IDNET(μ), DEP-IO >>
Max-Low V >> SYL-MIN >>Max-Hi V >> RIME-EXHAUS

The input to level two is level one's most harmonious PrWd candidate, and input-output faithfulness on level two is evaluated accordingly. This means that any instances of insertion or deletion done on level one should be maintained on level two, if we are to satisfy constraints on faithfulness. As we saw above, this analysis of level evaluation is reminiscent of McCarthy and Prince (1993a), Rubach (1997), among others. The following tableaux demonstrate the process of evaluation on Level Two.

(82)(i) Level Two: $[ti.gaa.ti.lu]_{PrWd}$ → $[ti.gaat.lu]_{PPh}$ 'you *pl.* fight'

$[ti.gaa.ti.lu]_{PrWd}$	*COMPLEX, ALIGN-RIGHT, WT-IDNET(μ), DEP-IO	Max-Low V	SYL-MIN	Max-Hi V	RIME-EXHAUS
a. ☞ ‖ti.gaat.lu‖			**	*	*
b. ‖ti.gaa.ti.lu‖			***!		
c. ‖tgaat.lu‖	*! COMPLEX		*	**	*
d. ‖ti.gaa.til‖	*! ALIGN-RIGHT		*	*	
e.‖tii.gaa.tii.luu‖	*!** WT-IDNET(μ)				
f. ‖tiʔ.gaa.tiʔ.lu‖	*!* DEP-IO		*		

(ii) Level Two: $[mud͡ʒ.ri.mah]_{PrWd}$ → $[mud͡ʒ.ri.mah]_{PPh}$

$[mud͡ʒ.ri.mah]_{PrWd}$	*COMPLEX, ALIGN-RIGHT, WT-IDNET(μ), DEP-IO	Max-Low V	SYL-MIN	Max-Hi V	RIME-EXHAUS
a. ‖mud͡ʒr.mah‖	*! COMPLEX			*	*

b.☞ ǁmud͡ʒ.ri.mahǁ			*		

(iii) Level Two: $[\text{tii.n\underline{a}.na}]_{PrWd}$ → $[\text{tii.n\underline{a}.na}]_{PPh}$

$[\text{tii.n\underline{a}.na}]_{PrWd}$	*COMPLEX, ALIGN-RIGHT, WT-IDNET(μ), DEP-IO	Max-Low V	SYL-MIN	Max-Hi V	RIME-EXHAUS
a. ǁtiin.naǁ		*!	*		*
b. ☞ ǁtii.n<u>a</u>.naǁ			**		

3.3.3.1. Output/Output Correspondence and Sympathy:

McCarthy (1998) argues that such an analysis which assumes multiple constraint hierarchies is inferior to rule-based derivation. He thinks that DT is capable of accounting for similar cases of phonological opacity by only employing simple rule ordering. On the other hand, multi-strata OT "OT+serialism" calls on both "constraint domination" and "stratal ordering". Therefore, in an attempt to provide a more plausible account and at the same time try to maintain OT's principle of Parallelism, I will explore two other proposals discussed in OT literature. In particular, I will consider Output/Output (O/O) correspondence, Burzio (1994), McCarthy (1995), Kenstowicz (1995), Kager (1995b), Benua (1997), etc. Also, I will provide an account assuming the more recent proposal of candidate-to-candidate faithfulness (Sympathy), McCarthy (1998).

The argument of O/O correspondence is built on the assumption that the faithfulness relations can actually be extended to evaluate Output-Output correspondence. Belonging to the same paradigm, two actual outputs, one of which is usually called the Base, maintain certain faithfulness relations, hence the more transparent term Base/Output-Correspondence. To account for i-syncope in

Palestinian, a process similar to High Vowel Deletion in UHA, Kager (1995b) utilised B/O correspondence. In what follows, I will adopt the gist of his argument.

For our own purposes, I will assume that /ʃaatˤir/ → [ʃaa.tˤir] 'bright *sg. ms.*' is the Base form used to evaluate /ʃaatˤir + ah/ → [ʃaatˤ.rah] 'bright *sg. fm.*', as both belong to the same paradigm, i.e. both are "morphologically related".[43] However, we need to introduce two more constraints. First, we need a constraint that maintains some sort of B/O correspondence. Secondly, we need a constraint to substitute SYL-MIN (Wd. Int.). This constraint will only motivate High Vowel Deletion; it will not rule out medial light syllable creation (cf. (80) above). These two constraints are already provided in Kager (1995b):

(83) a. MAX-μ(B/O):
Every mora in the base has a correspondent in the output.
(cf. Kager 1995b: 11)

b. No [i]:
/i/ is not allowed in light syllables.[44]
(Kager 1995b: 8)

No [i] must dominate MAX-μ(B/O) and be dominated by *COMPLEX to force High Vowel Deletion, unless it creates a non-final CVCC syllable. On the other hand, MAX-μ(B/O) should dominate RIME-EXHAUS, so the output of High Vowel Deletion can accommodate a non-final CVVC syllable, which is assumed to contain a

[43] For purposes of metrification, Kager assumes that the Base should not only be a free form but also "compositionally related to the affixed word in a morphological and semantic sense" (Kager 1995b: 7). As we shall see below, this particular limitation imposed on the base form will prompt us to introduce a different proposal to account for this case of phonological opacity.

[44] I will assume that this constraint evaluates both high vowels (see 78 c, d). Also, I will assume that it only evaluates medial syllables (see final vowel shortening in chapter five and above).

non-moraic rime consonant. The following tableaux demonstrate how these constraints in this particular ranking achieve the desired alternation:[45]

(84) (i) High Vowel Deletion and Non-final CVVC:

I: /ʃaatˤir + ah/ B: [ʃaa.tˤir]	*COMPLEX	MAX-C	No[i]	MAX-μ(B/O)	RIME-EXHAUS	MAX-μ
a. ☞ ʃaatˤ.rah				*	*	*
b. ʃaa.tˤi.rah			*!			
c. ʃatˤ.rah				**!		**

(ii) No High Vowel Deletion and No Non-final CVCC:

I: /mud͡ʒrim + ah/ B: [mud͡ʒ.rim]	*COMPLEX	MAX-C	No[i]	MAX-μ(B/O)	RIME-EXHAUS	MAX-μ
a. mud͡ʒr.mah	*!			*	*	*
b.☞ mud͡ʒ.ri.mah			*			
c. mud͡ʒ.mah		*!		*		*

To restrict the notion of the Base, Kager (1995 b) proposes the principle of compositional relation, whereby an affixed form must contain all the grammatical features of the base (see footnote 43 above). In our particular case, unless we ease this constraint, the claimed O/O correspondence relations in tableaux (84) are not very well defined. Therefore, in an attempt to maintain a more principled analysis, I will investigate a different proposal to account for this case of phonological opacity.

A recent development, suggested as a more general OT account for phonological opacity, is the proposal of C/C correspondence. McCarthy (1998) cited some examples in OT literature where O/O correspondence is incapable of explaining

[45] The tableaux in (84) do not include the important candidates *[ʃaa.tˤ**a**.rah] and *[mud͡ʒ.r**a̲**.mah], with deletion of /i/ as well as epenthesis of [a], which will obviously violate the relatively low ranked MAX-μ and DEP-IO. The tableaux in (79) did not include these candidates as they were assumed to be easily ruled out by SYL-MIN Wd. Int. (or SYL-MIN in (82)). However, as we are now attributing high vowel deletion to No[i], something else must be done about similar candidates that satisfy this constraint. In particular, I

surface opacity. This is most obvious in cases where underlying contrasts are eliminated on the surface. In these cases the situation of "transparency nowhere in the paradigm" is usually created. This means that there is no form, in a given paradigm, "where the otherwise opaque process applies transparently" (McCarthy 1998: 7).

To solve similar problems, McCarthy introduced the notion of Sympathy. In particular, he argues for maintaining the correspondence between two otherwise failed candidates, one of which is the opaque actual output and the other represents the intermediate transparent stage, in a derivational account. McCarthy calls the latter "the object of sympathy" or "the ❀-candidate". This ❀-candidate is the most harmonious candidate that satisfies an I/O faithfulness constraint, that is determined language-particularly, and is called the Selector.[46] Finally, McCarthy indicates the need for a candidate-to-candidate sympathetic faithfulness constraint to enforce some sort of C/C correspondence. Assuming the expected similarities between the actual output and the ❀-candidate, the interaction of this sympathetic faithfulness constraint, that is also marked with the symbol ❀, with other constraints in a given hierarchy will render the actual output most harmonious. When applied to UHA, all these concepts will become clear. Consider the following tableaux:

(85) (i) High Vowel Deletion and Non-final CVVC:

/ʃaatˤir + ah/	*COMPLEX	MAX-C	No[i]	❀MAX-μ $_{\text{MAX-μ}}$	RIME-EXHAUS	MAX-μ
a. ☞ ʃaatˤ.rah				*	*	*
b. ☜ ʃatˤ.ra h				**!		**

will assume ranking the O/O correspondence constraint DEP-IO (B/O) higher than No[i]. This will enforce high vowel deletion in (84 i) and maintains the high vowel in (84 ii).

[46] I find it more attractive to say, for example, that this constraint is the one whose violation does harm I/O faithfulness the most. But, will this generalisation be cross-linguistically apt?

c. ❀$_{\text{MAX-}\mu}$ ʃaa.tˤi.rah			*!			√

(ii) No High Vowel Deletion and No Non-final CVCC:

/mud͡ʒrim + ah/	*COMPLEX	MAX-C	No[i]	❀MAX-$\mu_{\text{MAX-}\mu}$	RIME-EXHAUS	MAX-μ
a. mud͡ʒr.mah	*!			*	*	*
b. ❀$_{\text{MAX-}\mu}$, ☞ mud͡ʒ.ri.mah			*			√
c. mud͡ʒ.mah		*!		*		*

As demonstrated in (85 i), in particular, the ❀-candidate that represents the intermediate stage in a derivational account, in this case a syllabified input, is selected by the constraint MAX-μ. Obviously, it is the most harmonious candidate that satisfies this I/O faithfulness constraint. After that, the overall harmony of the true output is computed by actually evaluating its correspondence to that ❀-candidate. This renders the otherwise transparent, but false, candidate (85 i b) less harmonious as the candidate-to-candidate sympathetic faithfulness constraint ❀MAX-$\mu_{\text{MAX-}\mu}$ is ranked higher than RIME-EXHAUS. On the other hand, tableau (85 ii) shows that this sympathy analysis is also consistent with unproblematic cases. Here, the ❀-candidate is chosen as the most harmonious, as the process of High Vowel Deletion is blocked by the constraint *COMPLEX.

In conclusion, the analyses presented for the process of High Vowel Deletion are far from being simple and straightforward. In addition, the arguments were in some areas rather *ad hoc*. Partially, this has resulted from acknowledging the epenthesis syncope paradox. More fundamentally, however, the exceptional case of non-final CVVC syllables negatively affected the plausibility of the argument. This is because all other processes, and consequently constraints, analysed in this study presuppose the unique final distribution of superheavy syllables. Nonetheless, as we shall see in the next chapter, this will not have similar undesired consequences on the overall analysis of the process of syllabification in UHA. There we will see how a single and very simple rule is utilised to derive the true output of High Vowel Deletion.

In this section, I have demonstrated, to a large extent, that it is possible to control some of the undesired consequences of the analysed counterexamples of the CVX syllable template. Most importantly, I denied the true existence of superheavies as a distinct type of syllables in UHA. I did that by assuming the association of their final consonant to the PrWd node. Before that however, I explained the constraint ranking to which we can attribute the surface realisation of CV light syllables. In particular, I ranked the faithfulness pair higher than SYL-MIN, on the level of the PrWd. Yet, most radically, I argued for confining parsing non-final CVVC syllables to the level of the PPh. To do that, however, I presupposed three different analyses, viz. multi-level evaluation, O/O correspondence, and C/C correspondence.

3.4. Conclusion:

The issue of CVX-bound syllabification is central to the discussion in this chapter. In particular, the idea is to achieve a uniform distribution of this syllable type throughout the syllabification domain. In OT terms, that syllable template is fundamentally interpreted as a set of constraints, namely, *COMPLEX, SYL-MAX, and SYL-MIN. However, satisfying these constraints may not always be straightforward. Some inputs are potentially parsable into different syllable types. On the other hand, some attested outputs seemingly hold some violations of these constraints. Nonetheless, the proposed OT analysis is, on the whole, capable of providing a plausible account of these irregularities. The only exception is the process of High Vowel Deletion. I think the fact that a non-final CVVC syllable is attested in certain true outputs poses a challenge to any OT account of syllabification in UHA. Therefore, the purpose of the next chapter is to investigate the derivational alternative in an attempt of achieve both descriptive simplicity and plausibility.