Phonological Adaptation of English Loanwords in Ammani Arabic

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Dedication

To the memory of my mom,

To my dad,

To my wife and children,

To my brothers and sisters

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List of symbols and abbreviations

AA	Ammani Arabic[1]
C	Consonant
CA	Classical Arabic
dB	Decibel
ERR	End Rule Right
f.	Feminine
F0	Fundamental Frequency
H	Heavy syllable
Hz	Hertz
JA	Jordanian Arabic
L	Light syllable
L1	Recipient/borrowing language
L2	Source language
m.	Masculine
ms	Millisecond
obs	Obstruent
OCP	Obligatory Contour Principle
OT	Optimality Theory
PA	Palestinian Arabic
pl.	Plural
s.	Singular
SA	Standard Arabic
SL	Source language
son	Sonorant
SSP	Sonority Sequencing Principle
TETU	The Emergence of the Unmarked
V	Vowel
Prwd	prosodic/phonological word

[1] I use AA to refer to the subdialect of Ammani Arabic I am addressing in this thesis (see §1.2).

☞	Optimal candidate
μ	Mora
σ	Syllable node
⟨a⟩	Extrametrical element
>	Becomes, is mapped/realised as
.	Syllable boundary
*	Ungrammatical form; reconstructed form
'	Preceding a stressed syllable
a ~ b	a alternates with b

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Abstract

This thesis investigates the phonological adaptation of English loanwords in Ammani Arabic (AA) in order to enhance our understanding of phonological theory and of AA phonology. The thesis also serves as documentation of the dialect in a state of flux. In contrast to previous studies, this study accounts for the phonological adaptation of loanwords not only at the segmental level, but also at the suprasegmental/prosodic level, adopting moraic theory within an OT framework. To achieve this, a corpus of 407 established English loanwords are analysed as they are pronounced by 12 AA monolingual native speakers.

The study reveals that the adaptation process is mainly phonological, albeit informed by phonetics and other linguistic factors. AA native phonology accounts for the numerous modifications that English loanwords undergo. It is shown that the adaptation process is geared towards unmarkedness in that faithfulness to the source input is violated in order to render the output unmarked. Unmarked structures in the adaptation process may arise even though their marked counterparts are equally attested in AA native phonology, giving rise to the Emergence of the Unmarked.

With respect to segmental adaptation, results show that AA maps source segments onto their phonologically closest AA phonemes. However, source allophonic features that are contrastive in AA are faithfully mapped onto their AA phonemic counterparts. For syllabic adaptation, loanwords undergo a number of phonological processes, e.g. epenthesis and gemination, to accommodate ill-formed source syllables into AA phonotactic structure. The study shows that English source stress is mostly neglected in the adaptation process with stress assigned to the adapted phonological string according to AA stress constraints.

The introduction of English loanwords has given rise to new data that invoked hidden phonological constraints that would have remained latent in AA phonology. This study has resulted in a better understanding of AA phonology by shedding light on various AA phonological aspects chief among which are gemination, stress assignment constraints, and syllable structure.

Chapter one

Introduction

The abundance of English loanwords in AA deserves a systematic comprehensive phonological analysis that will enhance our understanding of Arabic phonology in general and the understudied AA phonology in particular. The introduction of loanwords stimulates native phonological constraints that would never have had the chance to surface, thus providing new insights that will ultimately contribute to a better understanding of phonological theory (see §1.1).

Jordanian Arabic (henceforth JA), including AA, has borrowed many words from several languages especially English, with which it has had a long history of contact. These new words pose a challenge to the dialect grammar as borrowers attempt to maintain the source pronunciation and simultaneously satisfy AA phonological constraints. The tug-of-war between these, sometimes conflicting, demands will highlight many phonological aspects of the borrowing language, as will be seen throughout the thesis.

A quick look at the phonological shape of these words calls for a thorough study in an attempt to look for a systematic order in what seems to be a state of chaos. One feels that English loanwords are adapted randomly. Sometimes it seems they are modified only to sound different from their English counterparts. A few examples will clarify this.

The English word ‘bus’ is realised as *baaṣ* in AA with lengthening of the source vowel and mapping the plain alveolar voiceless sibilant onto its emphatic counterpart

/ṣ/. Given that the source does not have emphasis, we need to investigate AA phonology and understand where emphasis comes from. Another example relates to words such as ‘penalty’, which is adapted as *ba'lanti*. This adaptation involves stress shift from the first syllable to the second syllable, a shift in voice from voiceless to voiced, /p/ > [b], and metathesis across syllable boundaries of /l/ and /n/. A final example relates to words such as ‘balloon’, which is realised as *bal'loon*. Of the many modifications that this word undergoes, the most perplexing is the gemination of the lateral. On the face of it, this could be simply attributed to source spelling. However, a quick look at the many geminated cases in the corpus of English loanwords in AA reveals that this contention cannot account for gemination: many loanwords are spelt with double letters in the source but realised with a singleton in AA; and some words, which are spelt with one consonant, are nevertheless realised with a geminate.

Such modifications, which abound in the corpus of loanwords in AA, some of which appear to be unnecessary, constitute an invaluable tool to examine the phonological system of AA. This is because they provide external evidence for many L1 phonological aspects that could enhance our understanding of L1 phonology and uncover its hidden constraints.

The originality of this study lies in the fact that it is a phonological analysis not only at a segmental level, like previous studies, but also at a suprasegmental level of English loanwords in a subdialect of Ammani Arabic that has not been studied before, as far as I am aware of.[1] Moreover, this study will also document the dialect, which is in a state of on-going change due to many linguistic, political and sociolinguistic factors. Amman has been witnessing new influxes of refugees from Iraq and Syria. According to the Jordanian government, the number of Syrian refugees reached 1.4 million of whom 791,000 reside in Amman. This number constitutes about 20% of Amman’s overall population (“Number of Registered Syrian Refugees”, 2015). Moreover, following the escalation of the Syrian crisis afterwards, the number must have increased dramatically. Undoubtedly, the huge number of refugees will have its toll on AA dialects. Moreover, the diffusion of Syrian, especially Damascene, linguistic features into JA dialects through Syrian drama, which has swept all Arabic

[1] This subdialect of Ammani Arabic has not been studied before. All previous research on Ammani Arabic deals with Ammani Arabic as one homogenous dialect, which is not the case, as will be explained in §1.2.

channels, is very noticeable (for the impact of TV on language change, see Stuart-Smith, Pryce, Timmins, & Gunter 2013). It is not unusual to hear Syrian linguistic features, e.g. the realisation of emphasis, adopted by young Jordanian women.[2] For example, the low long vowel /aa/ is velarised in words such as *dʒaamʔa* 'university' by many AA young females.

The remainder of this introductory chapter is organized as follows: §1.1 explores the importance of studying loanwords; §1.2 specifies the dialect under study and justifies its selection; §1.3 provides an overview of the linguistic contact between AA and English that has resulted in the introduction of a large number of English loanwords into AA; §1.4 presents the research questions and objectives; §1.5 concludes with a synopsis of the thesis.

1.1 Significance of the phonological study of loanwords

A phonological analysis of the integration of loanwords into a recipient language (L1) is invaluable for two main reasons: it contributes to a better understanding of L1 phonology and may shed light on phonological theory in general.

First, investigating loanwords sheds more light on L1 phonology and unveils its hidden rules/constraints that would remain latent due to lack of input that would stimulate such rules/constraints (Crawford 2009; Paradis & LaCharite 2011; among others). Loan phonology is a window on native phonology that provides phonologists with new insights into the borrowing language (Davis 1994; LaCharite & Paradis 2005; Calabrese & Wetzels 2009: 8). In the following paragraphs, I give some examples that show how loanword adaptation may highlight aspects of AA phonology.

Loanwords would shed light on the underlying form of the feminine suffix in AA. The Arabic feminine suffix *-a(t)* is realised in AA as [e] except after gutturals (cf. Al-Wer 2007). Here, it is not clear whether the underlying form of this suffix is /a(t)/, as in Standard Arabic (henceforth SA), or /e/ that is lowered before gutturals, which is phonetically motivated. Loanwords would provide us with external evidence supporting one analysis or the other. The fact that English /e/ is almost always adapted as [i] in AA lends support to positing [a] as the underlying vowel of the

[2] This is a very recent trend in JA and calls for a thorough investigation.

feminine suffix. If /e/ was an underlying phoneme in AA, its English counterpart would be mapped faithfully in AA like other English phonemes, as will be discussed in Chapter three.

Likewise, loanwords will shed light on the status of dark /l/ in AA phonology. Many phonologists claim that Arabic dialects have two lateral phonemes: dark /l/ and clear /l/ (Butros 1963; Abu-Salim 1982; Abu-Abbas 2003; among others).[3] However, the phonemic status of dark /l/ is questionable as it is based on a few problematic words. The introduction of English loanwords, which have both allophones, would clarify the status of these two sounds. It will be argued in Chapter three that if AA had a phonemic dark /l/, it would manifest itself in the adaptation process as is the case for AA emphatic consonants, which are established phonemes in AA and all Arabic dialects.

Loanwords will also shed light on AA suprasegmental aspects such as syllable structure, stress assignment and gemination. Results will cast light on the status of complex margins and superheavy syllables in AA, as will be explained in Chapter four. It will be argued that complex margins in AA are not basic, while superheavy CVVC syllables seem to be basic AA syllables. The adaptation process will also enhance our understanding of stress assignment constraints, the thorny issue of final syllables in stress assignment, and the understudied phonological phenomenon of gemination. These aspects will be discussed in Chapter five.

Other aspects that the introduction of loanwords will highlight include the unmarked status of certain features where a choice of a certain feature or phoneme over another licit one highlights the status of the feature in question in terms of markedness, which will be demonstrated in Chapter three. Also the adaptation process will cast more light on the nature of vowel harmony in AA and it will be shown in Chapter three that AA has guttural vowel harmony in addition to round vowel harmony. Undoubtedly, loanword integration constitutes a sort of on-going wug-test that provides external evidence for many phonological aspects (Kang 2011: 2258), where less speculation on underlying representations is assumed (Paradis & LaCharite 2011).

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[3] Abu-Abbas (2003) deals with Ajluni Jordanian Arabic while Butros (1963) and Abu-Salim (1982) deal with PA. These two dialects are very similar to AA and reference will be made to these researchers when they deal with phonological aspects that also apply to AA.

On the other hand, the adaptation of loanwords will shed more light on phonological theory as a whole and in particular its interaction with phonetics and the relationship between perception and production. It will be argued in Chapters three and five that perception is guided by the phonological status of the feature in L1. Moreover, it will be shown in the adaptation of consonants (Chapter three) and in the assignment of syllable structure (Chapter four) that perceptually salient features can justify unusual behaviours of certain features or processes.

Loanwords help us understand the phonological organisation of the mental lexicon (Crawford 2009: 1). Paradis & LaCharite (1997: 442) argue that loanword analysis enables us to observe how language is processed, which will help understand the organisation of language within the human brain. By the same token, loanword integration will shed light on the role and organization of phonological features in the phonological theory, as will be discussed in Chapter three.

Similarly, loanword processing can help us understand the role of extra-linguistic factors on phonological representations and processing. For example, the effect of frequency on the integration of loanwords would shed light on 'majority criteria' where a default pattern would emerge, as will be demonstrated in Chapter five under the adaptation of stress (cf. Crawford 2009; de Lacy 2014).

Finally, the study of loanwords is essential for foreign language learners as it provides them with new vocabulary that is readily integrated into their interlanguage and, more importantly, from a phonological perspective, with an awareness of the intricate, sometimes invisible, differences between the source language and their native dialect.

1.2 Choice of dialect

JA is a Southern Levantine dialect that is very close to Arabic dialects spoken in Palestine (Butros 1963; Al-Khatib 1988; Al-Wer 2002). In general, researchers divide JA into three main groups based on the different realisations of SA uvular stop *q: urban, rural and Bedouin where the stop is realised as [ʔ], [k] and [g] respectively (Al-Khatib 1988; Al-Sughayer 1990; Al-Saqqa 2001; among others). However, this division is not very accurate. For instance, rural dialects can be divided into Palestinian and Jordanian (cf. Hussein & El-Ali 1989). Rural Palestinian itself can be subdivided into at least two main varieties according to the pronunciation of *q. Some use [k]; others use [g]. The latter realisation of *q is similar to Jordanian rural varieties and to Jordanian and Palestinian Bedouin ones.

The Amman dialect is far from being homogeneous. Rather it is a mixture of many subdialects used by people from different origins–Jordan, Palestine, Caucasia, Armenia, Syria and Lebanon (cf. Butros 1963; Holes 1995: 74; Al-Wer 2007).[4] When the first generations of these people settled in Amman, they retained their ethnic and regional dialect markers; however, over time, younger generations have tended not to keep them; rather there is a sort of levelling across all groups of people toward a new Ammani dialect that is strongly influenced by the subdialects surrounding it (Al-Wer 2002, 2007). The most influential dialects to affect this new dialect are urban Palestinian and Bedouin and rural Jordanian (ibid). Moreover, the spread of education and mass media are playing vital roles in shaping the new dialect (Holes 1995: 82).

The linguistic situation is more complicated than this. Gender has become a key factor in Ammani dialects. Female speakers are leading the change toward the adoption of urban Palestinian features, while most male speakers tend to adopt Bedouin markers (ibid). For example, most young Ammani females use urban markers such as [ʔ] for *q, [ʒ] for *dʒ and [ḍ] for *zˤ, among others, regardless of their original dialects while males use [g], [dʒ] and [zˤ] respectively (see §2.1.1 for a full account of Ammani phonemes). [g] has become a marker of masculinity, [ʔ], of femininity (Salam 1980; Daher 1998, cited in Zawaydeh & de Yong 2011; Abd El-Jawad 1986).[5]

Contrary to what other researchers expected (e.g. Al-Wer 2007), the emergence of one Ammani dialect has not materialised yet. Many young people still retain their ethnic and regional dialectal markers for sociolinguistic and cultural reasons. The above-mentioned complications and the existence of many subdialects in Amman oblige us to choose one variety for the purposes of consistency. The dialect adopted in this study is the one used by rural Palestinians who do not belong to the /k/ varieties.[6] The overwhelming majority of these people come from southern Palestine especially from areas around Hebron and south of Al-Ramla. It is also used by some non-

[4] Palscor (1981: 33 cited in Sawaie 2007: 449) mentions that 10 000 employees from Palestine moved to Amman prior to the influx of Palestinians to Amman after 1948.

[5] Note that free variation attributed to gender is beyond the scope of this study.

[6] This dialect would belong to Cleveland's (1963) group II *beguul* dialects.

Palestinians and male Palestinians who belong to the urban vernacular at least when they mix with people from other dialects. Also, it is the dialect that the researcher is most familiar with as it is his native vernacular (see §2.1 for a detailed analysis of this dialect).

1.3 Language contact and loanwords in AA

The first contact between JA and English dates back to the nineteenth century when the British ran a number of academic and religious institutions in Palestine and Jordan (Butros 1963: 25). More influence of English occurred during the British mandate over Jordan between 1917 and 1946. However, the borrowing process did not seem to be widespread at the time as the number of the British personnel was very small and they used to communicate with people through Arabic speaking subordinates (Sawaie 2007: 501) After that, Jordan has kept strong educational, administrative and military relations with Britain and America, which added more loanwords into the dialect (cf. Butros 1963; Al-Khalil 1983; Al-Saqqa 2001). Over the last few decades, English contact with the dialect has gained increasing momentum. English is a compulsory subject in schools and all scientific subjects at universities are taught in English. Also many students pursue their studies in English-speaking countries. In addition, English cinema, especially American, has paved the way for more loanwords to enter the dialect (ibid).[7]

This relatively intensive contact between JA and English has led to the introduction of many loanwords into the dialect. Hence, a systematic analysis of the way these loanwords are adapted into AA is greatly needed.

1.4 Research questions and objectives of the study

So far no study has analysed the phonology of English loanwords in AA (see §2.4 for more details). Therefore, the present study attempts to fill in this gap in the literature by answering the following questions:

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[7] I assume that English loanwords mainly come from British English for consistency of analysis and because Jordan has had longer relations with Britain and the educational curriculum adopted in Jordan in teaching English was mainly a British one.

1. How are English consonants and vowels mapped onto AA and why? What is the role of non-phonological factors such as perceptual/phonetic, morphological, orthographic, frequency and sociolinguistic factors?
2. What is the syllable structure of the loanwords in AA? What phonological processes are used to repair ill-formed source structure?
3. How is stress assigned in loanwords and what is the role of source stress?
4. Why does consonant gemination occur?

In brief, the main objective of the study is to conduct a theoretical comprehensive analysis of the phonological adaptation of English loanwords giving particular attention to the last three questions as they represent understudied areas in JA and also relate to aspects that are usually not imported into borrowing languages (see §2.3). By doing so, we will be in a better position to understand the native phonological system of AA in particular and to contribute to the literature on phonological theory in general.

To achieve this, a corpus of English loanwords in AA has been compiled and analysed phonologically at segmental and prosodic levels within moraic theory under the framework of OT. The motivation for such a study lies in the fact that no previous study on English loanwords in JA has covered the topic in a systematic, comprehensive way. As will be shown in §2.4, all previous studies touch on segmental changes superficially and rarely, if ever, tackle prosodic aspects.

1.5 Organization of the study

This chapter has provided the background to this thesis and stated its significance and objectives. The rest of the study is organized as follows: Chapter two presents background information on AA phonology, reviews related literature and lays out the general methodology employed in this study including data collection, recording of loanwords and information about the participants. It will be shown that the methodology adopted in this study is more reliable than those of previous studies as it avoids common problems encountered by earlier researchers regarding the selection of loanwords and participants

Chapter three reports on the adaptation of English segments into AA and the phonological processes involved. It will be argued that the mapping of English consonants and vowels onto AA is mostly faithful and phonologically based while the unfaithful mapping of some source segments is rooted in markedness whereby a less marked output surfaces. It will also be shown that non-phonological factors such as perception and orthography play a role, albeit small, in the adaptation process. Throughout the chapter, many phonological aspects of AA will be explored such as the status of dark /l/, the specification and underspecification of AA phonemes, and vowel harmony, where a new type of vowel harmony is attested.

Chapters four and five consider the prosodic adaptation of English loanwords into AA within an OT framework. In Chapter four, I account for syllable structure of loanwords and argue that the optimal and maximal syllable in AA is bimoraic and I offer a syllabification algorithm that incorporates semisyllables (Kiparsky 2003) and mora sharing (Watson 2007) to account for complex margins and CVVC syllables respectively. The chapter will also examine the most important phonological processes that AA uses to render the syllable structure less marked. These include deletion, syncope and vowel epenthesis, which is not only invoked to repair complex margins but also to render the output metrically less marked.

In Chapter five, I report on stress assignment and gemination in loanwords. We will see that source stress is ignored and stress is assigned to the adapted phonological string according to AA constraints where syllable weight and position determine stress place. I also provide acoustic evidence for stress position within loanwords and show that AA cues stress by higher F0 and intensity. More importantly, I suggest a new constraint hierarchy couched within OT that accounts for paradoxical cases such as stressing final open syllables ending in long vowels without revoking NONFINALITY. Moreover, the new hierarchy is able to account for the unexpected stress on a light penult, as in *munu'buli* ‘monopoly’.

The second part of Chapter five analyses gemination within loanwords. It will be demonstrated that gemination is an output-oriented process that is rooted in markedness as the source loanwords do not have geminates. Gemination will be divided into two types. The first one results from a minimality constraint in AA that requires prosodic words to be minimally bimoraic. The second type will be further divided into two subtypes. The first is argued to represent a case of the Emergence of the Unmarked and the second is invoked in particular by a hidden AA constraint that requires left-aligning the prosodic word with a foot. The last chapter summarizes the main findings of the study and discusses directions for further studies.

Chapter two

Background and methodology

The purpose of this study is to analyse the phonological adaptation of loanwords in AA to better understand AA phonology in particular. To achieve this goal, this chapter provides the necessary background information on AA phonology and loanword literature. It also describes the methodology used to collect the loanwords, and the theoretical approach adopted to analyse the data. Drawing on insights from previous work, this study aims to avoid the shortcomings of earlier studies, and it will be shown that the methodology used here results in more valid and robust results.

The chapter is organized as follows: §2.1 provides an overview of AA phonology, which is necessary to understand loanword adaptation processes. This will include a description of the phonological features that AA makes use of. The motivation behind a description of AA phonological features is twofold. First, the featural system of AA and many JA dialects has not yet been described in the literature, so this description will fill the gap. Secondly, the description is of importance to understand the phonological behaviour of features in the adaptation process. §2.2 defines the process of lexical borrowing and discusses the factors that affect the integration of loanwords into L1. This is followed in §2.3 by an investigation of the phonological and phonetic adaptation processes of loanwords and the models that are suggested to account for the adaptation process. In §2.4, a review of previous literature on loanword phonology in JA and other Arabic dialects is presented. §2.5 identifies the gap in the literature and establishes the rationale of this study. The methodology and the theoretical model adopted in the study are described in §2.6 and §2.7, respectively. §2.8 concludes the chapter.

2.1 Ammani Arabic phonology

This section aims at providing information about AA phonology that is crucial to understand the adaptation process. It is of paramount importance to be able to differentiate between processes related to the adaptation process and those that refer to native processes (cf. Paradis & LaCharite 2011: 752). First, I describe AA phonemes; then I present an overview of AA morphological aspects that are relevant to the adaptation process. This is followed by an examination of AA distinctive features.

AA shares almost the same phonological inventories and properties with other JA dialects. In the following subsection, I present an overview of the melodic system of AA while phonotactic and prosodic aspects will be dealt with in chapters five and six, respectively.

2.1.1 AA phonemes

A number of studies have described the Jordanian Arabic sound system. However, there is no agreement among researchers on its phonological inventory. Scholars' findings regarding the number of consonants range from 27 to 32. Vowels, including two diphthongs, range from eight to 12 (Al-Khalil 1983; Irshied 1984; Al-Khouli 1990; Al-Saqqa 2001; Abu-Abbas 2003; Abd Al-Jaleel 2010; Amer, Adaileh, & Abu-Rakhieh 2011; Mashaqba 2015). Differences are attributed to counting allophones such as [v] and secondary emphatics as phonemes, an issue that will be tackled later. Table 2.1 and Figure 2.1 below show AA phonemes adopted in this study. Note that within a cell, the phoneme on the left is voiceless; the one on the right is voiced.

Table 2.1 AA consonant phonemes

Place / Manner	Labial	Labio-dental	Inter-dental	Dento- alveolar	Palato-alveolar	Palatal	Velar	Uvular	Pharyngeal	Laryngeal
Stop	b			t d			k g	q		ʔ
Emphatic stop				ṭ ḍ						
Fricative		f	θ ð	s z	ʃ		x ɣ		ħ ʕ	h
Emphatic fricative			zˁ	ṣ						
Affricate					dʒ					
Nasal	m			n						
Lateral				l						
Trill				r						
Glide	(w)					j	w			

i u ii uu

[e] [o] [ee] [oo]

a aa

Figure 2.1 AA vowel phonemes

As Table 2.1 and Figure 2.1 show, AA has 29 consonants and 10 vowels. However, the status of some phonemes is not stable. Below are a few remarks about such phonemes.

Firstly, the two mid long vowels [ee] and [oo] result from a diachronic monophthongisation process that affected SA diphthongs /aj/ and /aw/, respectively (cf. Watson 2002; Youssef 2013). (See §3.2.7.3 on monophthongisation). The examples in (1) show the reflexes of SA /aw/ and /ay/ in AA.

(1) /aw/ > [oo]: /nawm/ > [noom] ‘sleeping’
/aj/ > [ee]: /sajf/ > [seef] ‘sword’

[e] and [o] are positional allophones of the phonemes /a/ and /u/, respectively. These two sounds appear word-finally and in loanwords (Butros 1963; Al-Saqqa 2001). The former results from raising of the feminine suffix /a/, as in *ṭaawl*[*e*] ‘table’, whereas most cases of the latter seem to result from lowering of the short high back vowel /u/ word-finally and following labial and emphatic consonants, as demonstrated in (2) below. This shows that vowels tend to become centralised/deperipheralised in word-final position in AA.

(2) /ʕidduhu/ ‘count it’ > /ʕiddo/
/biddu/ ‘he wants’ > [biddo] cf. [bidduuʃ] ‘he does not want’
/bukra/ > [bokra] ‘tomorrow’
/ṣuff/ > [ṣoff] ‘park m.s.’

In contrast to Butros (1963), I consider these as allophones rather than phonemes. Evidence from the adaptation process suggests that these are allophones. For example, English /e/ is almost always adapted into /i/ in AA, as will be shown in §3.2.1.3. If it were an established AA phoneme, why should it not be mapped onto its counterpart like other phonemes?

Secondly, SA /ḍ/, the emphatic counterpart of /d/ and / zˤ/, the emphatic counterpart of /ð/ have merged in AA as in many Arabic dialects (cf. Sakarna 1999, 2005). The former is used mainly by female speakers, while the latter is retained in male and old generation speech. However, [ẓ], the emphatic counterpart of /z/, appears in a few frozen forms such as *buuẓa* ‘ice cream’ and *maẓbuuṭ* ‘correct’. Such words with [ẓ] may have been borrowed as such from Syrian or Egyptian Arabic where they are realised with [z̧] rather than / zˤ/.

In contrast to other researchers (Butros 1963; Amer et al. 2011; among others), I argue that [ʒ] and [v] are not independent phonemes in the dialect. Rather, they are allophones of /dʒ/ and /f/ respectively. All their realisations are examples of free variation. There are no minimal pairs based on a distinction between /ʒ/ and / dʒ/ or /f/ and /v/. /dʒ/ is realised as such by male speakers and as [ʒ] by the majority of young female speakers. Again, the voiced labio-dental fricative [v] is found in loanwords and as allophone of /f/ in some native words, as in *yivzur* 'he tears'.

Finally, there is a tendency to occlusivise the voiceless interdental plain fricative /θ/ especially by young female speakers, as in *θaman* 'cost' > *taman*, but sometimes it is retained as in proper names such as *layθ*. That is, the phoneme /θ/ appears to be undergoing a change into /t/, as is the case in many other urban dialects of Arabic (Holes 1995: 19; Al-Wer 2007).

Having introduced the melodic system of AA, I present a brief overview of AA morphological aspects that are relevant to the adaptation process in the next subsection.

2.1.2 Relevance of Arabic morphology to loanword adaptation

It is argued here that Arabic morphological aspects, in particular prosodic templates and morphological inflections, have a role in the integration process. For example, many nouns take the feminine suffix *-a(t)*, as in *kreema* 'cream', which affects its phonological form. Moreover, verbs such as *fallal* 'to fill' and some nouns such as *barrakiyye* 'barracks' are readily shaped in compliance with morphological Arabic templates. Furthermore, loanwords that readily take Arabic morphological inflections and/or derivational templates are believed to be more established than those that do not (cf. Butros 1963; Al-Saqqa 2001). That is, morphology could provide us with criteria to distinguish between well integrated and partially integrated loanwords. Below is an overview of Arabic morphological aspects that are deemed essential to understanding the integration process.

As a Semitic language, Arabic is a non-concatenative language that is well-known for its 'root-and-pattern' morphology (McCarthy & Prince 1986; Watson 2002; among others). Nouns and verbs are the main concern of morphological processes with adjectives treated as nouns (Kaye & Rosenhouse 1997, cited in Abu-Abbas 2003: 12; Watson 2002: 3).

Words are composed of consonantal roots that carry an abstract meaning to which vowels are added to give a particular grammatical form (Watson 2002: 3). Roots can be triliteral, quadriliteral or pentaliteral (Khabir 1998: 35), i.e. can be made up of three, four or five consonantal roots, respectively. These roots are put into prosodic templates (Binyanim) to produce content words. For example, there are fifteen derivational templates of triliteral verbs in SA (McCarthy & Prince 1986), of which only the first ten are in common use in most Arabic dialects (Irshied 1984: 13; Sakarna 1999: 30). I assume here that some of these templates are more productive (default patterns) than others. If this assumption turns out to be correct, default patterns would manifest themselves in loan verbs. The same could hold for nouns and adjectives.

AA, like modern Arabic dialects, has simplified the complicated inflectional and derivational patterns of SA (Butros 1963; Al-Saqqa 2001). However, all AA content words follow certain morphological patterns and rules. Nouns in AA inflect for gender, number and definiteness. Definiteness is achieved by using the definite article in Arabic, namely (*ʔi)l-* cf. *ʔil-wald* 'the boy' and *ʔil-banaat* 'the girls'. Case declensions are not used in AA. For gender, a noun must be identified as either masculine or feminine whereas neuter is not attested in Arabic. In terms of number, nouns are used in the singular, dual or plural forms. However, duality is not very common (cf. Watson 2002 for Cairene and San'ani dialects). Very often AA speakers use the word 'two' (*θneen* m. or *θinteen* f.) plus a plural noun to refer to duality (cf. Daana 2009: 27). Plurality is formed in three different ways: sound masculine (-iin suffix), sound feminine (-aat) and broken plurals. Broken plural, a form of an irregular plural, has more than forty templates in SA (Nahr 2010: 222), and many of which are used in AA. The following table shows noun inflections in AA.

Table 2.2 Noun inflections in AA

Example	Singular		Dual		Plural		
	Masculine	Feminine	Masculine	Feminine	Sound m.	Sound f.	Broken
fallaaħ ‘peasant’	fallaaħ	fallaaħa	fallaħiin θneen	fallaħaat θinteen/ fallaħteen	fallaħiin	fallaħaat	NA
ʃaaṭir ‘hard-working person’[1]	ʃaaṭir	ʃaaṭra	(θneen) ʃaaṭriin[2]	(θinteen) ʃaaṭraat	ʃaaṭriin	ʃaaṭraat	ʃuṭṭaar
ʃaħħaad ‘beggar’	ʃaħħaad	ʃaħħaade	ʃaħħadiin θneen	ʃaħħadaat θinteen/ ʃaħħatteen	ʃaħħadiin	ʃaħħadaat	NA
sadʒiin ‘prisoner’	sadʒiin	sadʒiine	masadʒiin θneen	masdʒunaat θinteen	masadʒiin	masdʒunaat	sudʒana

Of interest here is the observation that plural formation of loanwords tends to use the sound feminine template, i.e. adding *-aat* to the singular as in *kumbjuutaraat* ‘computers’ and *baaṣaat* ‘buses’ despite the fact that both nouns are treated as masculine in AA. This observation is consistent with findings in first language acquisition. Children acquiring AA tend to use the sound feminine plural at the first stages of language acquisition (Daana 2009: 146). This suggests that the sound feminine plural is the default plural in AA (ibid: 27).

Verbs in AA inflect for tense (perfect and imperfect), person (first, second and third), gender (feminine and masculine), and number (singular and plural) (cf. Al-Saqqa 2001). The following partial verb paradigm in (3) shows how the verb *katab* ‘to write’ inflects for tense, person, gender and number in AA.

[1] This is an adjective in AA. Recall that adjectives behave like nouns in Arabic.

[2] Note here that the dual forms and the plural forms are identical because AA very often uses the plural to express duality.

(3) Person, gender, number and tense inflections

1s. m./f.	baktib ‘I write’	katabit ‘I wrote’
2 m. s.	btiktib ‘you write’	katabit ‘you wrote’
3 m.s.	biktib[3] ‘he writes’	katab ‘he wrote’
3 f. s.	btiktib ‘she writes’	katbat ‘she wrote’
3 m.pl.	bikitbu ‘they write’	katabu ‘they wrote’

2.1.3 Phonological features in AA

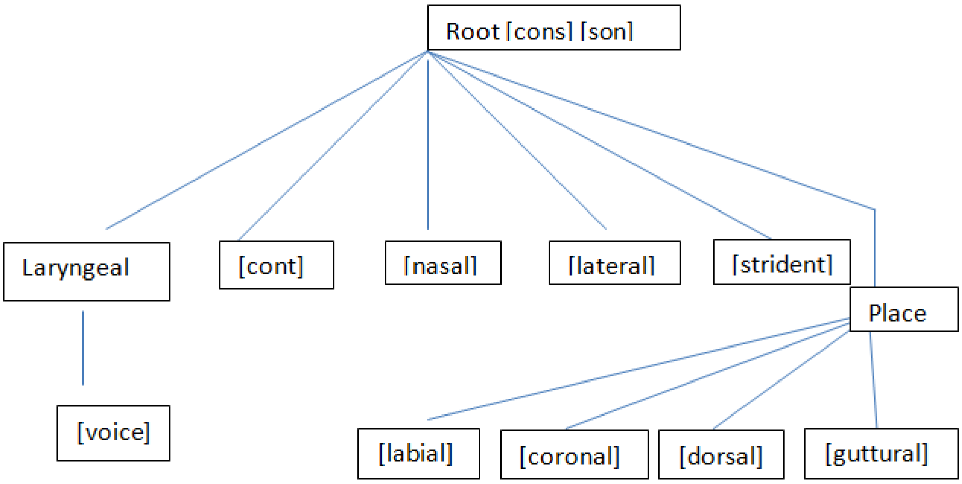
This subsection describes AA phonological features. This description is necessary to account for the behaviour of phonological features in the adaptation process, as will be examined in Chapter three. To account for the phonological features that characterise AA consonants and vowels, I adopt an approach where features are assigned based not only on articulatory phonetic characteristics but also on phonological patterning. Moreover, this approach does not deny the fact that historical factors might affect phonological patterning, where crazy classes, which are not motivated phonologically or phonetically, might arise in the language (cf. Ewen & van der Hulst 2001: 3; Mielke 2008, 2011). This could apply to the velar fricatives in AA, as I will explain below. All in all, the phonological features that I adopt for AA phonemes result from the combinatorial effects of these factors.

The organisation of phonological features has been a debated topic in the literature (Clements 2003; Uffmann 2011). Chomsky & Halle (1968) assume that segments are composed of an unordered bundle of distinctive features. However, this assumption has not been received with great acclaim in later models. It is agreed now that features are organised into a hierarchical order known as *feature geometry* where sets of features are grouped together according to their articulatory characteristics and to their patterning in a number of phonological processes (Uffmann 2011: 643).

Following Watson (2002), I assume the feature geometry in (4) where place features follow Selkirk’s (1993, cited in Watson 2002) model in which privative place features are adopted. Also, the model is minimally specified and all predictable features are assigned either through universal or language redundancy and default rules to yield fully specified surface representations.

[3] All these forms also appear with /u/ due to influence from other dialects.

(4) Feature Geometry[4]



Features are organised into nodes. Mother nodes have dependents lower down the tree known as daughter nodes. For example, the place node above is a mother node with four daughters. A terminal node has no dependents while a non-terminal one has. Nodes which are not placed between square brackets function as structural organisational nodes only, e.g. the place node, and cannot occur terminally as they do not have any phonetic content (cf. Archangeli & Pulleyblank 1994: 21) while the others (in square brackets and boxes only) are terminal features and must have phonetic content, e.g. [labial].

The two features [consonantal] (henceforth [cons]) and [sonorant] (henceforth [son]) form the root node. Their place in the tree is justified on the grounds that they do not spread or delink outside of total assimilation (cf. McCarthy 1988; Kenstowicz 1994; Uffmann 2011). [cons], which describes sounds produced with a constriction in the oral cavity, characterises obstruents, nasals and liquids. However, gutturals, being produced in the laryngeo-pharyngeal zone, glides and vowels are not [cons].

The feature [son], which describes sounds that are produced with a more or less equal air pressure inside and outside the mouth (Chomsky & Halle 1968: 6), denotes nasals, liquids, glides and vowels.[5]

[4] This feature tree is taken from Watson (2002: 25). Text in the tree appears in boxes for formatting reasons. Boxes should be ignored.

[5] Shahin (2011: 619) claims that primary pharyngeals /ħ/ and /ʕ/ in Arabic are sonorants. This claim requires further investigation in AA.

Manner features are attached directly to the root as they are independent of any articulator. [lateral] (henceforth [lat]) relates to sounds that are produced with a lateral release of air and describes one sound in AA, i.e. the alveolar /l/, while [nasal] (henceforth [nas]) denotes a nasal release of air and designates two sounds, i.e. the labial /m/ and the alveolar /n/. [continuant] (henceforth [cont]), where air is not impeded through the oral tract distinguishes fricatives, including sibilants, from stops. The only acoustic feature used here, [strident], which pertains to high pitch intensity, describes sibilants.

Of the laryngeal features, only [voice] is contrastive in AA, which is a voicing language. [voice] refers to vocal folds vibration so a sound specified for [voice] is produced with vocal fold vibration while a sound that lacks this specification is produced without vibration. Aspiration, on the other hand, is attested allophonically, as will be evident in the adaptation of English aspirated voiceless stops in Chapter three.

For place features, following Watson (2002), I adopt Selkirk's (1993, cited in Watson 2002) [Labial]-only Theory to describe the place specifications of AA phonemes. The four place features [lab(ial)], [cor(onal)], [dor(sal)], [gut(tural)] are used as primary and non-primary features to designate all AA sounds.

Based on pharyngealisation facts in AA, I argue that a sound that induces vowel backing and lowering is specified as non-primary [guttural], while a sound that induces vowel lowering only is characterised as tertiary [guttural]. A sound that blocks emphasis is assumed to be characterised with a feature that is antagonistic to pharyngealisation. Here, I adopt the non-primary [dor] feature, which also accounts for palatalization. Being located on the same tier, its blocking effect is justified, as will be shown in §3.1.2.1.

In the subsections to follow, I account for the representation of AA sounds according to their phonological classes.

2.1.3.1 Representation of labials

[Labial] denotes sounds produced by the lips as a primary articulation and as a non-primary articulation expansion of the vocal tract at the lips. AA has three labial consonants, i.e. /b, m, f/. Labials are further distinguished by [cont] and [nas] as the table below shows. The table depicts the minimal feature specification in AA. Predictable features are supposed to be provided by default and redundancy rules. /m/ is the only labial nasal in AA. Nasals are universally sonorant and sonorants are universally voiced. Also, AA does not have nasal vowels; hence /m/ is sufficiently specified as a nasal labial.

Although /b/ is traditionally specified as voiced, I argue that it is underlyingly not specified for voice as Arabic does not have a voiceless labial stop. This is corroborated by facts from voice assimilation in both native words and loanwords (see §3.1.2.2.1).

(5) Representation of labials

	b	m	f
cont			+
nasal		+	

2.1.3.2 Representation of coronals

Coronals are produced by the tongue tip or blade. While it is not relevant for AA vowels, as will be pointed out in §2.1.3.6, it specifies more than half the consonants in AA. Following Watson (2002), I dispense with the daughter features of [coronal], i.e. [anterior] and [distributed], and adopt non-primary [dor] to represent the marked palatoalveolar coronals, which involve pharyngeal expansion and dorsum raising. This specification is partly justified on the grounds that these sounds block emphasis spread in AA. For interdentals, which are produced further front in the mouth than the dental-alveolars (Smith 1988: 214, cited in Watson 2002), they share pharyngeal expansion and distributed constriction with palatoalveolars but differ from them in that they do not involve tongue raising (cf. Watson 2002: 40). Therefore, interdentals are represented as primary [cor] and tertiary non-primary [dor].

Coronals are further distinguished by [son], [voice], [cont], [lat], [nas] and [strident]. Features in parentheses are redundant and are given only for a complete description.

(6) Representation of coronals

	θ	ð	t	d	s	z	ʃ	dʒ	n	l	r
son									(+)	(+)[6]	(+)
voice		+		+		+		+	(+)	(+)	(+)
cont	+	+			+	+	+				+
nas									+		
lat										+	
strident					+	+	+	+			
n-p dorsal							+	+			
Tertiary n-p dorsal	+	+									

Here, unlike the mainstream phonological literature (Ewen & van der Hulst 2001; Levi 2011), I assume that the palatal glide is [dor]. Evidence for this assumption comes primarily from the definite article coronal place assimilation in AA. /l/ totally assimilates to a following coronal in AA, but it fails to assimilate to the glide /j/. If /j/ were coronal, it would induce /l/ assimilation. By the same token, I agree with Watson (2002) that the high front vowel is dorsal rather than coronal in what is known as the [coronal]-front-vowel debate.[7] Given that glides and high vowels are featurally identical and the difference lies in their syllabic position (Pulleyblank 2011: 205; among others), then the front vowel /i/ and the glide /j/ are identical and since /j/ does not induce coronal place assimilation then it cannot be coronal. Consequently, the high front vowel cannot be coronal. Similarly, anatomical evidence shows that front vowels are produced by an external muscle connecting the body of the tongue with the jaw but coronals are produced by other muscles (Kenstowicz 1994: 465).

The least marked coronal in AA is /t/. This is in line with the fact that the lexical default consonant in Arabic is /t/ (Watson 1989). Moreover, coronals are underlyingly specified as such in AA, unlike the cross-linguistic underspecified nature of these segments (cf. Paradis & Prunet 1991). Evidence for this comes from definite article total assimilation in AA, which is presumably attributed to an OCP-Place on the

[6] /l/ is the only lateral sound in AA, so its [son] and [voice] features are redundant.

[7] Watson (2002: 32) gives two more reasons to argue against specifying palatal vocoids as [coronal]. First, palatal consonants are rare cross-linguistically in contrast to coronal ones, which are universally unmarked. Second, a coronal representation does not account for palatalization processes as it fails to show the relationship between triggers and targets. (For details, see Watson 2002: 34).

coronal tier. Also co-occurrence restrictions apply to coronals of the same manner although of lesser strength (cf. Frisch, Pierrehumbert & Broe 2004).

2.1.3.3 Representation of dorsals

[dor] denotes sounds produced by the body of the tongue and non-primary [dor] refers to expansion of the pharyngeal zone. These include the velars /k, g, x, ɣ/, the dorsal vocoids /j, w/ and the uvular /q/ as a primary articulator, and the alveopalatals /ʃ/ and /dʒ/ and the palatal glide and the high front vowel /i/ as a non-primary articulation. Evidence for non-primary [dor] for these sounds comes from the fact that these sounds block emphasis spread in AA, as will be explained in §3.1.2.1. Given that non-primary [dor] involves pharyngeal expansion, which is antagonistic to non-primary [guttural] that characterises emphatic sounds and involves pharyngeal contraction (cf. Davis 1995; Watson 2002), this non-primary [dor] seems well justified.

The only uvular sound in AA is the stop /q/, which has a very restricted distribution. It is specified as primary [dor] and non-primary [guttural], as it causes vowel lowering and backing like the pharyngealised coronals. The common reflex of Classical Arabic *q in AA, the voiced velar /g/, is specified as primary [dor] and tertiary non-primary [guttural] as it induces vowel lowering in the feminine suffix but it does not cause vowel backing or lowering in other contexts. The velar fricatives /x/ and /ɣ/ have the same specification for the same reasons, but are distinguished from /q/ by being [cont]. Voice distinguishes /x/ from /ɣ/. In contrast to Watson (2002), the feature [cont] for /ɣ/ cannot be left unspecified as it is needed to distinguish it from the dorsal /g/, which is also specified as tertiary [guttural].[8] The table below contrasts the dorsal consonants in AA.

(7) Representation of dorsals

	k	g	x	ɣ	q
voice		+		+	
cont			+	+	
n-p guttural					+
3 n-p guttural		+	+	+	

[8] This behaviour of /g/ could be a historical factor, which again shows how diachronic changes might affect feature groupings. That is, /g/ is expected to behave like /k/; however, I think that /g/ developed from SA *q and that is why it induces lowering while /k/ does not.

The feature [son] sets the vocoids /j/ and /w/ aside from the other dorsals and non-primary [dor] further distinguishes between /j/ and /w/. /w/ has equal labial and dorsal constrictions in AA. However, as Articulator-Only Theory rules out consonants with dual primary place so /w/ is described as primary [dor]. Non-primary [lab] is redundant as it does not contrast with any other segment in AA. /j/ is already specified as non-primary [dor]. Note here that the glides have the same representation as the short high vowels /i/ and /u/ except for the underspecified nature of /i/. They differ in their distribution only. More evidence for this representation comes from the adaptation process, as will be seen in §3.2.3.

A comment on /x/ and /ɣ/ is in order. These two sounds are velar in AA rather than uvular as in SA and many other Arabic dialects. This can be due to a historical factor. It seems probable that these two sounds were uvular at some time in the history of the dialect and underwent phonological change. However, I assign them tertiary [guttural] as they pattern with other gutturals in inducing lowering of the feminine suffix in AA. Unlike other gutturals, however, these sounds do not cause vowel backing. Consider the examples in (8) that show that vowel backing does not occur following velars.

(8) a. Vowel lowering
xooxa ‘peach’
damɣa ‘seal’

b. No vowel backing
xaal ‘uncle’ vs. ṭɑɑl ‘got long’
ɣaali ‘expensive’

2.1.3.4 Representation of gutturals

Unlike the other place features which refer to the articulators, the feature [guttural] denotes an articulatory zone between the uvular and the glottis (McCarthy 1994; Watson 2002). Primary [guttural] describes the laryngeals /ʔ, h/, the pharyngeals /ħ, ʕ/ and the vowel /a/,[9] while non-primary [guttural] denotes the uvular stop and the pharyngealised coronal consonants and tertiary non-primary [guttural] describes the velar fricatives /x/ and /ɣ/ and the voiced velar stop /g/.

[9] For the representation of vowels, see the section below.

Evidence for the guttural class comes from root co-occurrence restrictions that show avoidance of roots composed of more than one guttural besides the fact that gutturals lower adjacent vowels (cf. McCarthy 1994; among others). Also phonetically all gutturals have a high F1 and a constriction in the back of the vocal tract (Watson 2002: 37).

Primary gutturals are further distinguished by [cont], which sets /ʔ/ from the others and [son] which distinguishes /h/ from /a/. /ʔ/ in not specified for any feature, which renders it the default post-lexical consonant in AA (cf. Watson 1989, 2002 for other Arabic dialects).

To distinguish the pharyngeals /ħ/ and /ʕ/ from the laryngeals /h/ and /ʔ/, which both cause vowel lowering,[10] we cannot adopt Watson's (2002) argument for San'ani and Cairene, among others, that the pharyngeals are the emphatic counterparts of the laryngeals, since pharyngeals do not cause vowel backing in AA (cf. Bellem 2007). These sounds share with emphatics a pharyngeal feature. However, this feature denotes a primary articulation for pharyngeals but a secondary one in the case of emphatics. Pharyngeals do affect vowels in that they lower them when they are adjacent to them, as in [bilʕab] 'he is playing' vs. [binzil] 'he is going down'. Nonetheless, the effect from pharyngeals is local and may be attributed to phonetic co-articulation.

Evidence that pharyngeals are not emphatic in AA comes from the fact that these pharyngeals can become emphatic due to emphasis spread form emphatic triggers. Compare, for example, [ħaal] 'condition' and [ṭḫ̱ɑɑḻ] 'spleen'. In the former /ħ/ and the low vowel appear as plain segments whereas in the latter they undergo emphasis. If /ħ/ was emphatic in [ħaal], how would we account for emphasis spread in [ṭ<u>ħɑɑl</u>]? Therefore, I adopt tertiary non-primary [guttural] to denote pharyngeals to differentiate them from laryngeals, which are specified as primary [guttural] only. This is motivated articulatorily on the grounds that pharyngeals but not laryngeals, have aryepiglotic constriction (Shahin 2011: 614). Also, phonologically, pharyngeals cannot co-occur within stems but they co-occur with other laryngeals cf. *ʕahid* 'promise' and *maʕhad* 'college'. Note that laryngeals cannot be placeless in AA due to the existence of pharyngeals (cf. Paradis & LaCharite 2001).

[10] I assume that any [guttural] specification will induce vowel lowering be it primary or non-primary.

The features [cont] and [voice] further distinguish these sounds as depicted in (9) below.

(9) Representation of gutturals

	ħ	ʕ	h	ʔ
voice		+		
cont	+	(+)	+	
3 n-p guttural	+	(+)		

2.1.3.5 Pharyngealised (emphatic) coronals

AA has four emphatic sounds presented in (10) below. They are represented as primary [cor] and non-primary [guttural] to account for the pharyngeal narrowing accompanying these sounds, which sets them off from plain coronals. Strident is called upon to distinguish /ṣ/ from others (cf. Watson 2002: 43).

(10) Representation of emphatics

	ṭ	ḍ	ṣ	zˤ
voice		+		+
cont		(+)	(+)	(+)
strident			+	
3 n-p dorsal				+

In addition, another emphatic is the trill, /r/, presented under ‘coronals’. Its coronal representation above describes the de-emphaticised sound. The coronal specification still holds. However, a non-primary [guttural] is added to account for the emphatic one. It is worth noting that this sonorant approximant has a special status in AA. I argue here that this sound is underlyingly emphatic in AA and it undergoes de-emphasis in the vicinity of high front segments /i, ii, ee, j/, as in other Arabic dialects as shown in (11) below (cf. Herzallah 1990; Watson 2002; Youssef 2013).

(11) Emphatic and de-emphaticised /r/ in AA

a. bɑħɑrɑ ‘lake’
   wizɑɑrɑ ‘ministry’
   rɑbbɑ ‘he brought up’
   rɑiid*e* ‘wise f.’
   duur ‘houses’

door ‘turn’

b. riʔaase ‘presidency’ cf. rɑʔiis ‘president’
xeer ‘bounty’ cf. xeerɑɑt ‘bounties’
ʔidaari ‘administrative’ cf. ʔidɑɑrɑ ‘administration’
naari ‘related to fire’ cf. nɑɑr ‘fire’, nɑɑri ‘my fire’

c. ħɑrb > ħɑ*r*ib ‘war’
dɑrb > dɑ*r*ib ‘hitting’

d. bardaan ‘cold m.s.’
sardʒ ‘saddle’
fariʃ ‘seat cover’

The examples in (11a) show the emphatic allophone of /r/, which is assumed to be the default one, while the examples in (11b) show that /r/ is de-emphaticised if it is tautosyllabic with a high front vocoid. However, if the high front vowel is epenthetic, /r/ retains its emphatic nature and emphasis would spread from it, as in (11c). Moreover, /r/ undergoes de-emphasis when it is immediately preceded by one of the following non-emphatic coronals /θ, ð, t, d, s, z, n, ʃ, dʒ/ as in (11d) (cf. Herzallah 1990; Zawaydeh 1999: 27) or the adjective suffix /i/, as in *naari*.[11] Also note that, unlike the other secondary emphatics in AA, /r/ is not restricted to low vowel environments. It can be found adjacent to all vowels except for the above mentioned [dorsal] vocoids cf. (11a).

2.1.3.6 Representation of vowels

AA has three short vowels and three corresponding long vowels that are qualitatively identical. They differ only in length so a short vowel has one mora while a long one occupies two moras that are linked to one featural set (cf. Odden 2011: 487; on the moraic representation of vowels see §2.7.1 and §4.3). Shortening processes that affect long vowels in AA lend support to such a representation. Moreover, Al-Ani (1970:

[11] Some researchers (Butros 1963; Sakarna 1999) argue that emphatic /r/ and plain /r/ represent two phonemes in Arabic. They cite examples such as /ħaar/ ‘got confused’ vs. /ħɑɑr/ ‘hot’, /barr/ ‘obeyed his parents’ vs. /bɑrr/ ‘over land’, /faar/ ‘boiled’ vs. /fɑɑr/ ‘rat’ /barra/ ‘declared innocent’ vs. /bɑrrɑ/ ‘outside’, /dʒaari/ ‘flowing’ vs. /dʒɑɑri/ ‘my neighbour’, /ʕaari/ ‘naked’ vs. /ʕɑɑri/ ‘my shame’. I argue that this is not the case as only the last two are attested in AA. These result from the different suffixes attached to them. The possessive suffix does not trigger de-emphasis while adjectival –*i* does.

23) maintains that Arabic[12] short and long vowels have almost identical formants except for the long guttural vowel /aa/.

Vowels are distinguished from other sounds by not being [cons]. They differ from glides in their distribution in that they occupy the syllable nucleus. They are redundantly [son], [cont] and [voice]. These last three specifications are predictable from the other specifications.

Place features set them apart from each other. Following Padgett (2011), I assume that all vowels are [dor] as their articulation involves the body tongue. /a/ is also [guttural], /i/ is non-primary [dor] and /u/ is non-primary [labial].

AA also has two diphthongs, /aj/ and /aw/, which undergo monophthongisation in most cases. Adopting a moraic analysis (cf. Hayes 1989), I represent AA diphthongs as a sequence of two melodic units that are linked to two moras. Three facts give support to this analysis. First, the off-glides in AA behave like other consonants. For example, there is no structural difference between the vowel plus consonant sequence in the first syllable in *bayyan* 'he appeared', which is treated as a diphthong and *baṭṭan* 'he covered with a layer', which has a short vowel followed by a consonant. Secondly, vowel epenthesis shows that the off-glide is treated as a consonant where epenthesis applies to break up four consonant clusters and sometimes three consonant clusters. For example, vowel epenthesis applies in loanwords such as 'dry clean' > *drayikliin* and 'night club' > *naytiklabb*, which are treated on a par with forms with four medial consonant clusters, as will be demonstrated in §4.2.4. Thirdly, this representation readily accounts for gemination of the glide. If the diphthong were one structural unit, it would not be easy to account for geminating the second leg of the diphthong.

However, a problem might arise with this representation, namely diphthong shortening (Watson 2002). Diphthongs in AA, like other Arabic dialects shorten before stressed/long syllables, as in *luneen* < /lawn-een/ 'two colours'. I argue here that shortening occurs only after coalescence of the vowel with the glide, i.e. monophthongisation (see §3.2.7.3 for more on this phenomenon). So monophthongisation results in a long vowel that becomes subject to shortening.

[12] His informants are Iraqis and Jordanians.

Evidence comes from the fact that if monophthongisation fails to apply, shortening also fails to apply as in *mayteen* ‘two waters’.

Moreover, the treatment of diphthongs in English loanwords in AA gives support to this analysis (see §3.2.3). It is noticed there that the adaptation process of the English diphthongs/triphthongs sometimes gives rise to glide formation where the glide is realised as an onset of a following vowel, e.g. ‘power’ > *ba.war* and ‘shower’ > *ʃa.war*.

Below is a table that shows the feature specification of all AA phonemes. Redundant features are in brackets.

Table 2.3 AA phonological features[13]

	Root		**Manner**				**Laryngea**	**Place**								
	Con	**Son**	**Cont**	**Nas**	**Lat**	**Strident**	**Voice**	**Lab**	**Cor**	**Dor**	**Gut**	**Non-P Lab**	**Non-P Dor 2**	**Non-P Dor 3**	**Non-P Gut 2**	**Non-P Gut 3**
b	+						(+)	+								
m	(+)	(+)		+			(+)	+								
f	+		+					+								
t	+								+							
d	+						+		+							
θ	+		+						+					+		
ð	+		+				+		+					+		
zˤ	+		+				+		+					+	+	
ṭ	+								+						+	
s	+		+			+			+							
z	+		+			+	+		+							
ṣ	+		+			+			+						+	
ḍ	+						+		+						+	

[13] The format and layout of this table are adopted from Mashaqba (2015).

n	+	(+)		+			(+)	+						
l	+	(+)			+		(+)	+						
r	+	(+)	+				(+)	+						
ʃ	+		+			+		+				+		
dʒ	+					+	+	+				+		
j		+	+				(+)		+			+		
k	+								+					
g	+						+		+					+
q	+								+				+	
w		+	+				(+)		+		(+)			
x	+		+						+					+
ɣ	+		+				+		+					+
ħ			+							+				+
ʕ			(+)				+			+				(+)
h			+							+				
ʔ										+				
a		(+)	(+)				(+)		(+)	+				
i		(+)	(+)				(+)		(+)			+		
u		(+)	(+)				(+)		(+)		+			

To sum up, this section has given an overview of AA phonemic system and the most relevant information about AA morphology. It has also presented, for the first time, a description of AA phonological features. I turn now to the process of lexical borrowing in §2.2.

2.2 Lexical borrowing

This section presents an overview of lexical borrowing and integration of loanwords. This is of crucial importance in order to understand the process of English loanword integration into AA. It will be shown that the process by which a loanword enters a recipient language affects the way it is integrated into the language. The section is divided into two subsections. In the first subsection, I will establish the definition of loanwords and set them apart from other related terms. After that, I will show how loanwords enter recipient languages.

2.2.1 Definition of terms

Lexical borrowing refers to the process whereby words enter a recipient language (L1) from a source language (L2) as a result of contact between them over a period of time (cf. Hoffer 2002: 1; Winford 2010: 173). It is worth mentioning that the two main reasons behind borrowing are need and prestige (Weinreich 1953; Atawneh 2007; among others). Weinreich (1953: 56) notes that the "need to designate new things, persons, places, and concepts" constitutes one of the main reasons to borrow loanwords. This is especially true in the fields of science, technology, media and education. With regard to prestige, it is noted that the direction of borrowing goes form the dominant language to the socially subordinate one (Winford 2010: 177). Another minor reason relates to euphemism (Kaufman & Thomason 1988; Salih 1995). For example, in AA the English word 'cancer' is borrowed as a euphemism for the Arabic word *ṣaraṭaan*.

Unlike code-switches or nonce borrowings, which are loanwords that are used only once by one speaker and might not be used again (cf. Poplack, Sankoff & Miller 1988), a loanword is a foreign word that is used in L1 context by the speech community especially monolinguals and its form usually conforms to L1 rules/constraints, i.e. it is integrated socially and linguistically into L1 (cf. Haugen 1950; Davis 1994; Paradis & LaCharite 1997; among others). Our focus in this study is on loanwords proper, excluding loan blends and loan translations (calque). (See §2.6.2, which describes a pilot study that is used to verify the existence of my list of loanwords among monolinguals).

Another important distinction that bears on the study of loanwords is between 'borrowing' and 'imposition'. Coetsem (1988) establishes that borrowing results from the introduction of a foreign word by an L1 speaker (L1 agentitivity) while imposition relates to the introduction of a word by an L2 speaker. For him, borrowing entails that a loanword will undergo adaptation whereas in imposition it usually will not. Although imposition usually applies to second language learning, this does not preclude the possibility that a foreign word might enter L1 as a loanword through imposition. Thus, when a loanword is already established in L1, it is almost impossible to tell whether a word was imposed or borrowed. This adds more complexity to the phonological study of loanwords, as we will see throughout the thesis.

2.2.2 The process of borrowing

The process by which a loanword enters a recipient language is not entirely straightforward. General consensus is that bilinguals introduce loanwords into L1 (Paradis & LaCharite 1997, 2011; among others).[14] At first, a loanword is used as a code switch (Poplack et al. 1988). After that, it is repeated over and over again until it spreads into L1 speech community. This is a gradual process that involves linguistic and social integration of the foreign form to become a 'bona fide' established loanword (Poplack & Dion 2012). Likewise, others argue that loanwords are introduced into the periphery of L1, i.e. they can be marked and not governed by UG. For example, Crawford (2009) and Simonovic (2009) argue that bilinguals first introduce a loanword into the periphery of L1 abiding only by rules/constraints of L1 grammar that belong to the periphery. Crawford refers to this stage as 'adaptation'. Later, over a second stage termed 'transmission', suggests Crawford, the word is spread from one speaker to another, undergoing more modifications to comply with more native rules/constraints. This means that not all loanwords will show the same degree of adaptation, which explains why we see doublets, e.g. 'double' > *dubul* and *dabil* in AA, within the same language (ibid).

On the other hand, loanwords might be introduced by bilinguals or monolinguals who have limited access to L2 (Calabrese & Wetzels 2009). This could happen orally as monolinguals hear words in the media or while travelling (Cohen 2009) or through writing as monolinguals see words written on many products (ibid).

To sum up, loanwords are introduced into L1 in different ways and by different agents. These factors will undoubtedly affect the degree and the way loanwords will be integrated in L1, which is the main concern of the following section.

[14] It should be emphasised here that bilinguals could considerably differ in their L2 abilities, which will eventually affect the adaptation process.

2.3 Integration of loanwords

This section presents an overview of the phonological and phonetic adaptation of loanwords. First, the factors that affect the integration of loanwords are presented in §2.3.1. This is followed by a thorough discussion of phonological and perceptual models of loanword adaptation in §2.3.2. It will be shown that a model that takes in consideration the insights of both models as well as other linguistic factors is better able to account for the adaptation process.

2.3.1 Non-phonological factors

This subsection reviews the non-phonological factors that affect the integration of loanwords. Although this study focuses on the phonological adaptation of loanwords, it is necessary to shed some light on other factors that affect the adaptation process. Such factors would clarify why some loanwords show exceptional behaviour and do not follow the mainstream adaptation processes.

Loanwords are usually required to conform to the phonological, morphological and syntactic rules/constraints of L1 to the extent that they become integrated into native phonology through a gradual and a complicated process. However, there are conflicting demands on borrowers to keep the borrowed form as much similar as possible to the source form but at the same time abide by L1 grammar (Kenstowicz 2007; Paradis & LaCharite 2011). This process involves not only linguistic factors but also extra-linguistic ones (cf. Paradis & LaCharite 1997, 2011; Kertész 2006; Smith 2006; Mwita 2009; Kang 2011).

Below is a list of the most common extra-linguistic factors that affect the adaptation process.

1. Degree of bilingualism
2. Prestige and attitudes
3. Frequency of use
4. Age of borrowing
5. Quantity of loanwords
6. Channel of borrowing

The rate of bilingualism correlates negatively with degree of adaptation. Generally, the more bilingual a community is, the less adapted loanwords are, which results in more direct importations[15] (Paradis & LaCharite 1997, 2011). In this regard, Haugen (1950) identifies three types of bilingual communities that are relevant to the degree of integration of loanwords in L1. In pre-bilingual communities, where a small number of bilinguals are available, borrowers adapt loanwords in an unsystematic way. There are no regular patterns that govern the adaptation process and substitution of foreign elements is considerably high. In adult bilingualism, there is growing knowledge of L2 and adaptations become more regular and systematic and borrowers tend to import more L2 features. Finally, childhood bilingualism witnesses a high level of L2 knowledge and therefore systematic, regular patterns appear where many importations are introduced into L1 (Haugen 1950: 216-217, 1953). For example, Paradis & LaCharite (2011: 763) show that Quebec French has more importations of English loanwords than European French as the rate of bilingualism in Quebec is higher.

The speech community in Amman can be described as pre-bilingual until the 1970s (cf. Butros 1963; Sawaie 2007) that has been turning into adult bilingualism recently due to spread of education, telecommunications, trade, etc. It should be borne in mind that even under adult bilingualism, bilinguals' competence in L2 will vary greatly. Moreover, bilingualism in Jordan is much more restricted to reading and writing (cf. Atawneh 2007). Many people can only read English script as they study English in schools but their other skills are so limited. I believe that this very much affects the adaptation process as many words might be introduced by false bilinguals whose input to L2 is mainly orthographic. In effect, the non-uniformity of bilinguals' proficiency in L2 may lie behind the phonetic and phonological nature of the adaptation process (cf. Chang 2008).[16]

Secondly, prestige of the donor language and recipient language speakers' positive attitudes towards the source language correlate positively with importations (Mwita 2009; Paradis & LaCharite 2011). If L1 speakers hold the source language in high

[15] Importations refer to non-native forms that escape adaptation.

[16] Due to these complications, this dissertation focuses on the adaptation of syllabic and prosodic features as these aspects are not usually imported into L1 under pre-bilingualism and adult bilingualism. In fact, they are imported only under child bilingualism (Haugen1950; Rose 1999).

regard, they tend to retain more elements of its structure. This is also related to loyalty and nationalism. If borrowers feel committed to their L1 and have strong feelings toward their mother tongue, loanwords will undergo more adaptations to sound less foreign (cf. Winford 2010: 178). In Amman, I dare say that English has a prestigious status and social attitudes are rather positive (cf. Atawneh 2007; Bani-Khaled 2014).

Quantity of loans also affects the degree of adaptation. The more loans in the speech community there are, the more likely importations are to appear (cf. Crawford 2009). When more loanwords enter L1, there might appear a set of conventions that regulate the adaptation process as in Japanese (ibid). This could apply to AA due to increasing bilingualism; therefore, the present study will focus on loanwords that are accessible only to monolinguals to control for such distracting factors

Frequency of use of a loanword has a bearing on the adaptation process. The more frequent a word is, the more adapted it will be (Poplack & Sankoff 1984). The frequent use of a loanword in an L1 context turns it into a well-established loanword that fits well into L1 phonological, morphological and syntactic grammar. A related factor is age of attestation of a loanword. The longer a word has been in the language, the more it is fully integrated (Haspelmath & Tadmor 2009). An old loanword might undergo native phonological change and become completely undistinguishable from native ones (Paradis & LaCharite 2011). This explains why established loanwords show different degrees of adaptation: well-integrated and partially-integrated loanwords (Morandini 2007). Note that when words are first introduced they are usually more faithful to the source if they are introduced by bilinguals, who have access to the source. However, when monolinguals start using them they adapt them more to the native phonology.

Finally, the channel of borrowing affects the outcome of the adaptation process. Whether a loanword is introduced into L1 orally or via writing will definitely influence its realisation in L1. Although sociolinguistic studies point out that loanwords are borrowed mainly orally (Paradis & LaCharite 2011: 765), it is still possible that loanwords enter L1 through writing especially when bilingualism is relatively low. In this case, orthography will play a major role in the adaptation process (see §3.3.2 for the role of orthography).

To summarize, the above factors affect the way a loanword is realised in the recipient language. That is, although loanwords are expected to generally conform to L1 phonological constraints, still some words might escape this due to non-phonological factors. Consequently, the present study will deal with loanwords that are accessible to monolinguals only and will focus on patterns of adaptation excluding idiosyncratic cases.

2.3.2 Phonological adaptation of loanwords

When a loanword is introduced into L1, either its form conforms to L1 grammatical rules/constraints or it violates them. If its form conforms to L1, it will usually be used as is. No adaptation is usually required as the form does not violate any markedness rules/constraints. For example, English ‘flash’, ‘shift’ and ‘tank’ are well-formed AA phonological forms so they are incorporated into AA as is (notwithstanding the different phonetic realisations between AA and English). However, if a loanword does not comply with L1 grammatical rules/constraints, it usually needs to undergo certain repairs to become an acceptable word in AA. For example, the loanword ‘extra’ does violate AA grammatical rules/constraints at melodic and phonotactic levels, among other things. At the melodic level, it contains the phoneme /e/, which is not an underlying vowel in AA. Phonotactically, it has an illicit consonant cluster, [kstr] and it begins with an onsetless syllable. AA does not tolerate such a form so it repairs it and maps it onto *ʔikistra*.

The above desirable scenario does not always hold. Sometimes, borrowers retain some foreign elements into their L1 grammar, which leads to expansion of L1 inventory at various levels (cf. Cohen 2009). For example, a loanword that contains the non-native voiced labiodental fricative /v/ is sometimes realised as such in AA, as in ‘vanilla’ and ‘van’. Other times, unnecessary repairs are attested where a foreign input does not violate L1 constraints; nevertheless, it undergoes adaptation giving rise to the Emergence of the Unmarked (see §2.7.3).

The complicated process of incorporating loanwords into L1 has aroused the interest of many phonologists and phoneticians and led to the appearance of a number of approaches and theories that try to account for this process. In what follows, I review the main approaches that deal with loanword adaptation.

2.3.3 Models of loanword adaptation

The literature on loanwords abounds with studies on different languages, e.g. Silverman (1992), Paradis & LaCharité (1997, 2011), Yip (2002), Walter (2004), Gouskova (2001), Haunz (2004), Davis & Cho (2006) Miao (2006), Kenstowicz (2007), Calabrese & Wetzels (2009), Lee (2009), Kang (2011), Tu (2013), to name but a few. The relevance of earlier studies on loanwords in other languages lies mainly in the approaches they adopt to analyse the adaptation process of loanwords. Phonology-based models assume that loanwords are introduced into the recipient language by competent bilinguals, while phonetics-based models believe that it is speakers who have limited knowledge of the source language as well as competent bilinguals who bring loanwords into L1 (Calabrese & Wetzels 2009: 1-2). These two ways of introducing loanwords into the borrowing language represent the two main models of loanword adaptation: the Phonological Stance Model and the Perceptual Stance Model (ibid: 2). The latter model is further divided into two models: a Perception-only Model and a Phonological Perception Model. For ease of exposition, the most important aspects of these approaches are compared in Table 2.4 below.

Table 2.4 A comparison of loanword adaptation models

Model / Aspect	Phonological Model	Perceptual models	
		Perception-only Model	Phonological Perception Model
Input	L2 UR	Acoustic surface representation	
Borrowers	Balanced bilinguals	Monolinguals or bilinguals	
Processes	L1 production grammar	Perceptual	Perceptual and L1 production grammar

In the following subsections, an overview of these main models is presented.

2.3.3.1 Phonological Stance Model

In this model, a bilingual, who has access to the underlying representation of L2 words,[17] produces the surface form of the loanword using his L1 production grammar (e.g. Ito & Mester 1995; Paradis & LaCharite 1997, 2011; Gussenhoven & Jacobs 2005). That is, it is one grammar that accounts for both native as well as loan words. The adaptation process is phonological so borrowers are assumed not to pay attention to non-distinctive allophonic information of L2 structures (Calabrese & Wetzels 2009).

Gussenhoven & Jacobs (2005: 238) add that speakers of all languages can perceive sounds in any other language but they might think that the different realisations of segments are not crucial according to their L1. This entails that perception does not play a role in the adaptation process. This is hard to believe as non-native speakers do have difficulties perceiving foreign features (Peperkamp & Dupoux 2003; see section below).

To account for loanwords that do not abide by all L1 grammar, this model's proponents, e.g. Ito & Mester 1995 and Paradis & LaCharité 1997, follow Chomsky's distinction between core and periphery and argue that loanwords could belong to the periphery rather than to the core of L1 grammar. Moreover, some constraints which appear to apply to loanwords only are not specific to loanwords. Rather they represent hidden constraints that never have had the chance to appear in native words (Paradis & LaCharité 2011).

Furthermore, LaCharite and Paradis (2005) argue that perceptual models cannot account for all borrowing situations. They maintain that perceptual approaches confuse loanword adaptation with the perceptual deafness of L2 learners. They show that errors found in interlanguage, caused by phonetic approximation, are not attested in loanword adaptation in their project (LaCharite & Paradis 2005: 885).

Proponents of this approach cite numerous examples of loanword adaptations that show that the adaptation process is phonological rather than phonetic. For example,

[17] To support this idea, Paradis & LaCharite (1997) show that importations in their corpus represent 27.8% of cases. These importations would not have happened if borrowers had not had an access to L2 UR.

LaCharite & Paradis (2005) argue that phonetic approximation resulting in 'phoneme mismatching or non-perception' represents a very low percentage in loanword adaptation. Only 0.4 % of adaptation is attributed to phonetic approximation in their twelve corpora of English and French loanwords (ibid).

The phonological model assumes that when an L2 phoneme is present in L1, borrowers will opt for the same phoneme even where another L1 phoneme that is phonetically more similar to the L2 phoneme is available in the language. For instance, they report that English /b/ is consistently adapted as French /b/, although the English stop is phonetically closer to the French voiceless stop /p/. However, if the phoneme is not available, borrowers will look for the closest L1 phoneme from a phonological perspective (features and structure)[18] —a principle they call 'category proximity principle'. For example, they show that English /ɪ/ and /ʊ/ are acoustically closer to Mexican Spanish /e/ and /o/ than to /i/ and /u/. Nevertheless, they are adapted as /i/ and /u/ respectively almost in all cases of English loanwords in Mexican Spanish (for more details see LaCharite & Paradis 2005: 233-7).

Moreover, English reduced vowels are correctly interpreted in Quebec French loans (Paradis & LaCharite 1997). Some might attribute such adaptations to orthography but Paradis & LaCharite argue that this cannot be the case as spelling influence cannot be used inconsistently (see §3.2). They show that silent letters are ignored and two-letter vowels such as 'ea' and 'ou' are mapped faithfully most of the time. They argue that if orthography was behind the phonological adaptation of reduced vowels and the voiceless stops above, it would not be able to account for silent letters and two-letter vowels. However, it could be the case that these represent obvious cases of English orthography and bilinguals are aware of them.

Paradis & LaCharite (2011) argue that 'stability' as well as 'monotonicity' of adaptation within and across languages lends support to the phonological model of loanword adaptation (pp. 772-3). The former refers to cases where a certain phoneme is mapped faithfully in different contexts. For instance, English /ɪ/ is almost always adapted as /i/ in many languages such as French, Spanish and Japanese despite the phonetic differences in the realisation of the phoneme /i/ in these languages. The latter

[18] For this model, phonological closeness is calculated by the number of steps a phoneme needs to undergo to become a well-formed segment in L1.

refers to cases where one phoneme is almost always mapped onto one and only one correspondent phoneme into L1. They report one-to-one segment correspondence between source and recipient languages as evidence for the phonological adaptation of loanwords in their corpora of loanwords where “a single foreign sound systematically yields a single L1 segment” (ibid: 773).

The most influential theory that adopts this model is the Theory of Constraints and Repair Strategies (TCRS) developed by Paradis & LaCharite (1997). This theory has four principles: the Preservation Principle, which requires segmental information to be maximally preserved; the Threshold Principle, which restricts the amount of repair to two or three steps; the Minimality Principle, which ensures that the fewest possible repairs apply at the lowest phonological level; and finally the Precedence Convention, which gives priority to repairing higher phonological levels. (For details on this theory, see Paradis & LaCharite 1997).

Many adaptation cases in our corpus of loanwords provide counterevidence to the TCRS model. AA has borrowed English words containing the illicit voiced fricative labiodental sound /v/, as in ‘video’, and ‘valve’. According to the TCRS model, this sound would be adapted as /f/, which is the closest phonologically or into /w/ or /b/ as these repairs are in line with the TCRS principles: Delinking the feature [+continuant] yields /b/, delinking [+voice] produces /f/ and inserting [+sonorant] results in /w/. So all these adaptations are minimal and abide by the TCRS principles. However, TCRS cannot account for the fact that /w/ is the least frequent option in AA, unlike in Fula, a West African language, where /w/ is the dominant one. To account for the mapping of /v/ onto /w/ in Fula, Paradis & LaCharite suggest that this is in line with the preservation principle, which favours adding content rather than deleting it (p. 460). This is doubtful as it cannot account for AA and there is no preference for /v/ adaptation to [w] cross-linguistically.

Another problem with this model can be seen in cases of deletion. The model expects deletion only when adaptation would be too costly, i.e. exceeds two/three repairs. However, deletion is common in many languages, especially among East Asian languages (cf. Silverman 1992; Miao 2006; among others). Likewise, data from AA loanwords reveal that this model cannot account for cases of deletion and lack of deletion. It will be shown in Chapter three that deletion is attested even when repair would not exceed two/three steps. For example, a word such as ‘shorts’ is realised as *ʃurt*, with /s/ deletion. Inserting a vowel to repair the cluster would be more economical as this would require two steps only according to the TCRS Model. In contrast, a word such as ‘scrap’ is adapted in AA as *sikraab* with no deletion at all although its adaptation involves at least three repair steps, which contradicts the TCRS model.[19]

Moreover, the preservation principle as worded by Paradis & LaCharite refers only to segmental information. This is paradoxical in that the model assumes that borrowing is accomplished by competent bilinguals so a suprasegmental feature such as stress should be preserved as much as possible, which should have priority according to the precedence convention. Again this is not the case in AA, where stress shift is widespread, as will be demonstrated in Chapter five. Findings from stress adaptation suggest that AA adapters do not give priority to stress. Rather stress is ignored and the adapted form is stressed according to AA native constraints.

Similarly, many researchers find that this model is incompatible with findings in their loanword data. For example, Louriz (n.d.) reports that deletion is more common than preservation in French borrowings in Moroccan Arabic. Likewise, Rose (1999: 50) rejects TCRS on the grounds that the threshold Principle requires counting, which is not accepted in standard phonological theories. Davis & Cho (2006) also criticise this theory on the grounds that it predicts a consistent mapping of English /s/ onto Korean, which is mapped either as a geminate or a singleton depending on context.

Also, TCRS does not take into account saliency factors. For example, all perceptual models argue that salient features are very crucial in the adaptation process (see Perceptual Model). Salient features resist deletion while less salient ones are more vulnerable to deletion. This is also the case for AA. A case in point is the lateral in consonant clusters, as in ‘amplifier’. Here the lateral is deleted as it is not salient enough due to its short duration (see §3.1 on the adaptation of consonants).

To sum up, TCRS can account for many cases of loanword adaptation but still it fails to account for many other cases. Moreover, the TCRS model assumes that constraints are not violable so this, unlike OT constraints, cannot account for the Emergence of

[19] It can be argued that emphasis spread that results from the emphatic rhotic constitutes a fourth step.

the Unmarked, as explained in §2.7.3. TCRS would be better able to account for loanword adaptation if it incorporated salient features into the model and the phonological status of the source input in the borrowing language such as stress in AA.

Having reviewed the Phonological Stance Model, which views the adaptation process as a purely phonological process that abstracts way from perceptual and phonetic processes, I turn to the Perceptual Stance Model, which gives a major role to perceptual factors.

2.3.3.2 Perceptual Stance Model

Proponents of the Perceptual Stance Model (e.g. Silverman 1992; Yip 1993; Peperkamp & Dupoux 2003; Kenstowicz 2007) argue that adapters do not have access to the underlying representation of L2 structures so they draw on the acoustic surface signals of L2 words. This represents 'nativisation through perception' according to Calabrese & Wetzels (2009: 2). Under this model, two main types of processes account for the adaptation of loanwords. The first is phonological and uses the processes of the production grammar while the second is perceptual in nature and depends on 'phonetic similarity/approximation' (ibid: 4).

Borrowers use the acoustic signal of L2 and look for a similar form in their L1. This means that adaptation is based on perceptual/phonetic similarity and salience (cf. Silverman 1992; Peperkamp & Dupoux 2003; Kenstowicz 2007). For example, French [n] is adapted as a geminate followed by an epenthetic vowel in Japanese, while English [n] is realised as a singleton only (Vendelin & Peperkamp 2004). Vendelin & Peperkamp (2004) argue that the subtle phonetic differences between the French and the English nasals account for this discrepancy in that French [n] is longer than the English one and has a shorter release. This difference makes Japanese borrowers perceive it as a geminate followed by a vowel (ibid). Followers of this model argue convincingly that the adaptation of the alveolar nasal above cannot be accounted for adopting a purely phonological model.

More evidence in support of the Perceptual Stance Model comes from many observations in loanword phonology regarding salience and perceptual similarity**.** The majority of researchers adopting the Perceptual Stance Model believe that perceptual salience and similarity are the key factors in loanword adaptation. For example, salient features such as nasality and continuancy tend to be preserved while less salient ones such as voicing are modified or deleted (cf. Broselow 2000 for Selayarese; Adler 2006 for Hawaiian; Kenstowicz 2007 for Fijian). Again, segments in phonologically salient positions tend to be preserved. For example, onset segments do not delete as much as coda ones (cf. Brasington 1997 for Marshallese; Miao 2006 for Mandarin Chinese).

In line with this, Kenstowicz (2007) argues that similarity and auditory salience are the fundamental factors in loanword adaptation processes. A mapping tries to be as similar as possible to the source with salient features preserved. This explains why loanwords avoid assigning prosodic prominence to epenthetic vowels (ibid: 141). Also, this accounts for the overwhelming tendency of epenthesis over deletion in loanwords (ibid). Deletion contradicts similarity to source in that it makes the output less similar to the source. This is consistent with the fact that the more salient a feature is, the less likely it is deleted. Moreover, epenthesis in general is much more common than deletion even in languages that prefer deletion in their native phonology (Smith 2006).

Furthermore, according to this model, source stress tends to be preserved in stress languages and stressed syllables in the source language tend to be lengthened or assigned a high tone in tone languages (cf. Kenstowicz 2007 for Fijian; Broselow 2009 for Huave; Kang 2010).[20] Finally, the nature of epenthetic vowels lends support to this model. These vowels tend to be phonetically the least marked and the least salient in that they are the shortest in the borrowing language (Peperkamp & Dupoux 2003; Kenstowicz 2007).

To summarize, distinctive as well as non-distinctive features in L2 affect adaptation of forms in L1. All these observations lend support to the fact that perceptual effects of the source structure have a crucial role in the adaptation process. This poses a challenge to phonological models, which hold that non-distinctive features are ignored in the adaptation process (cf. Phonological Stance Model above). I will argue in Chapter three that it is non-distinctive features in L2 that are phonologically

[20] Note that stress adaptation in our corpus contradicts this argument.

distinctive in L1 that affect the adaptation process. More details on the Perceptual Stance Model are given below.

2.3.3.2.1 Phonological Perception Model

Under the Phonological Perception Model, the adaptation process is both perceptual and phonological. The process is perceptual as L2 acoustic signal is mapped perceptually and this in turn constitutes an input to the production grammar of L1.

Silverman (1992), the pioneer of this model, proposes a two-level model to account for English loanwords in Cantonese where he assumes that the input is a non-linguistic acoustic signal and its mapping is context-free. According to him, the inventory of native segments and prosodies determine which segments will be perceived and which will not at level one (the Perceptual Level). The perceived structure represents a phonological output that is consistent with native segmental and prosodic rules. This output constitutes the input to level two (the Operative Level) where native phonotactic rules apply. These rules will bring about some phonological processes, most of which are loanword-specific to produce a well-formed word in L1 (ibid). This means that loan phonology processes are separate from those of the native phonology, a claim that Silverman himself abandons later (LaCharite & Paradis 1997: 486).

Furthermore, to account for deletion and preservation of segments, Silverman (1992) proposes that consonant saliency determines whether it will be deleted or retained. Salient segments such as fricatives and affricates, as /s/ in ‘bus’ are more likely to be perceived and consequently retained. However, final stops as /t/ in ‘lift’, which are not salient, undergo deletion at level one as they are not perceived even though the form violates bisyllabicity —a constraint dictated by Cantonese native phonology.

Silverman's model has been criticised by a number of researchers. For example, Kertész (2006) wonders why Cantonese speakers cannot perceive the sequence /ft/ at the Perceptual Level. She argues that if this was a phonotactics constraint, it should apply at the Operative Level according to Silverman’s model. Moreover, she maintains that the position of the phoneme is crucial in Cantonese. The phonemes /s/ and /l/ in codas are not deleted while other sounds are. Silverman attributes this to salience. However, Kertész argues that this cannot account for /l/. Therefore, such a context-free mapping runs into a number of problems, which led other researchers following the perceptual model to posit a context-sensitive analysis where consonants in salient positions are preserved while deleted elsewhere (cf. Kenstowicz 2007: 329).

Paradis & LaCharite (1997) reject Silverman's model for two main reasons. First, they claim that it is redundant in nature as it requires certain processes to apply at both levels. For example, it requires a segment such as /t/ in the coda cluster –nt to be unperceivable at the Perceptual Level while at the Operative Level it stipulates that this cluster is ill-formed. If it was not perceived at level one, it should not be available at level two. It could be the case that a constraint against clusters exists in Cantonese phonology, which could account for both processes (ibid: 474). Redundancy also results from positing two phonologies —native and loan. Many constraints that account for loanwords are also active in native Cantonese phonology, e.g. FOOT BINARITY. This leads to stating the same constraints twice in Silverman's model (ibid: 474). However, Paradis & LaCharite admit that Cantonese might have constraints that seem to apply to loanwords only as Cantonese native words, being morphologically simple, do not trigger such constraints (ibid: 474). That is, such constraints might be inactive in Cantonese native phonology but are activated by loanwords.

The second objection relates to contradictions. Silverman argues that the input to level one is non-linguistic and therefore adapters do not have access to L2 phonology. However, Silverman assumes that borrowers have knowledge of English morphological structure when he deals with prosody (Paradis & LaCharite 1997: 475). Moreover, Paradis & LaCharite (1997) go on to say that the model is incompatible with findings of sociolinguistic and psycholinguistic studies that support the idea that borrowing is achieved by bilinguals, who have access to both L1 and L2 phonologies. Adopting this view, Paradis and LaCharite (1997: 476) argue, would dispense with the Perceptual Level and move its constraints to the Operative Level, which will reduce redundancy in Silverman's model.

Yip (1993), following Silverman (1992), adopts an OT approach that makes use of Silverman's two levels to account for English loanwords in Cantonese. She maintains that an L2 source is perceived by the perceptual module yielding a non-native percept which constitutes the input to L1 grammar that yields the adapted form. However, she argues that one phonology accounts for both native and loan words alike. She further contends that loanword phonology consists of the native phonology as well as a group of faithfulness constraints called MIMIC that require the borrowed form to be faithful to the source form. She argues that if these MIMIC constraints are highly ranked in the borrowing language then the form will not undergo much adaptation (Yip 1993). On the other hand, if they are low ranked, the form will comply with the native constraints and become completely assimilated. However, this constraint seems to be inconsistent in loanword adaptation. Sometimes it needs to be ranked differently in the same language to account for deletion and preservation of the same segment in different contexts.

She also argues that perceptual salience is very crucial in the adaptation process. For example, salient consonants and consonants in salient phonological positions tend to be preserved. She argues that the fact that vowels are never deleted in Cantonese loanwords and that word-final post-consonantal stops are always deleted even if the output violates bisyllabicity supports her view that saliency plays a major role in the adaptation process (ibid).

Another proponent of perceptual models, Kenstowicz (2003: 103), maintains that there are two grammars —perception and production— that account for loanword adaptation. He asserts that these grammars have different constraint rankings. For example, to account for loanwords in Fon, an African language, he suggests that DEP-V, which bans insertion of vowels, is ranked higher than MAX-C, which prohibits deletion of segments, in the perception grammar. This renders consonant deletion more harmonic than vowel epenthesis so an input such as French ‘poste’ [post] will be perceived as [pos]. However, the reverse ranking holds in the production grammar yielding [posu] (ibid). Here, inserting a vowel to repair the ill-formed structure is more harmonic than an illicit coda. This cannot be true for all languages as it would predict all coda clusters to undergo deletion. However, results in AA show that vowel epenthesis is more frequent than consonant deletion even if the consonant in question is not salient enough (see §4.2).

A more convincing approach within this model is put forth by Boersma & Hamann (2009). To account for the adaptation of English loanwords in Korean, they suggest that perception is phonological and both loan and native words are governed by the same phonology. They maintain that adapters interpret the auditory form in terms of their L1 phonology (ibid: 13). In their model, perception is regarded as an active process that maps the auditory input into a surface phonological representation, where structural constraints interact with cue constraints while in production structural constraints interact with faithfulness constraints (ibid: 12). This approach would have been better if it had taken orthographic influences into account as it applies perfectly only when loanwords are introduced orally.

To account for the fact that repair strategies that apply to native or loanwords may differ, they suggest that the input is different although it looks identical on the surface. For example, forms such as English 'tag' and 'deck' that end with an illicit stop are repaired via vowel insertion while the same illicit forms in native Korean words are repaired differently (ibid: 13). They attribute this to perception and argue that these forms are perceived with a final vowel as they are released in English, which lead them to postulate that they are in onset position. That is, the underlying form of the loanword is not faithfully stored in Korean.

2.3.3.2.2 Perception-only Model

Proponents of this model argue that the process of loanword adaptation lies in perception (Peperkamp & Dupoux 2003; Peperkamp 2005; Peperkamp, Vendelin & Nakamura 2008). They claim that psychological experiments show that whether borrowers would perceive the loanword acoustic signal accurately is determined by their L1 phonology. If it is consistent with their L1 phonology, it would be correctly identified; otherwise it would be misperceived and consequently distorted. So they claim that all adaptation takes place during perception without access to underlying representations.

Peperkamp & Dupoux (2003) cite examples form English loanwords in Cantonese to support their contention that acoustic information is the crucial element in the adaptation process. For example, in English loanwords in Cantonese, /v/ is realised as /w/ most of the time because /w/ is acoustically closer to /v/ than to either /f/ or /b/. Moreover, Peperkamp & Dupoux (2003) show that Cantonese inserts a vowel in clusters ending in a fricative/affricate while it deletes stops in the same environment. Phonetic similarity is also a key issue in the mapping. Borrowers try to map the incoming input into the closest phonetic counterpart in L1, which is determined acoustically and articulatorily (ibid).

Peperkamp & Dupoux (2003) suggest a model in which borrowers possess two modules. The first is the Phonetic Decoding Module. It transforms the L2 acoustic signal into a surface phonetic representation while the Phonological Decoding Module of the borrowing language transforms the signal into a corresponding underlying representation that is in conformity with native language phonology (ibid: 368).

Phonological deafness results from the Phonetic Decoding Module, which is unable to perceive foreign sounds and structures (ibid). Therefore, Peperkamp & Dupoux (2003) claim that adaptation is carried out in the Phonetic Decoding Module during perception. Accordingly, borrowers, being unable to perceive a foreign phoneme, opt for deletion of phonemes or a mismatch occurs. However, proponents of the phonological Stance Model argue that deletion and phonemic mismatching are rare in loanwords (e.g., LaCharite & Paradis 2005) and borrowers can perceive non-native sounds accurately (cf. Jacobs & Gussenhoven 2000; Gussenhoven & Jacobs 2005).

To conclude, Peperkamp & Dupoux assert that the process of assimilating loanwords is phonetic rather than phonological and occurs when the Phonetic Decoding Module perceives or fails to perceive the incoming foreign acoustic signals.

For loanwords in AA, it seems that perception could account for the adaptation of the voiceless stop /p/ and stress as these two cases cause great perceptual difficulties to AA native speakers (cf. Al-Jarrah 2002; Zuraiq 2005). However, contrary to Peperkamp & Dupoux’s claims, the results of our corpus show that phonemes are mapped onto their closest phonological counterparts rather than phonetic ones, as will be explained in §3.1. and §3.2.

2.3.4 Section summary

As has been shown in this review of loanword adaptation models, every model has its merits and shortcomings. No model is able to account for the whole adaptation process in a unified, comprehensive manner on its own. Perceptual models can explain the behaviour of salient features and positions as well as the role of non-distinctive features while they fail to account for importations, as attested in AA. Phonological approaches can highlight the influence of phonological features in the adaptation process but they fail to account for the behaviour of allophonic features of source language that are retained in the adaptation process such as emphasis in AA, as will be shown in §3.1.2.1.

It seems that the controversy between these models could stem from the data they deal with. If loanwords were introduced by competent bilinguals where bilingualism is high, a phonological model would be better to account for the adaptation process. In contrast, if loanwords enter L1 via monolinguals or limited bilinguals, a perceptual model would be better. A model that takes both cases in addition to orthography would provide a better picture about loanword adaptation. To illustrate, the input could be the L2 written form as pronounced by L1 speakers, who have different L2 abilities. For example, a second language learner could encounter an English form and pronounce it according to his interlanguage abilities, which could be deviant from the original (cf. Crawford 2009). This is manifested in spelling pronunciations that abound in the corpus (see §3.3.2).

In this work, an eclectic approach to loanword phonology will be adopted, making use of these complementary theories and hypotheses. The following assumptions hold for my approach:

- Loanwords can be introduced by many agents: competent bilinguals, low-level bilinguals, monolinguals and even by L2 native speakers.
- The input to L1 could be the surface phonetic form or the written form but it cannot be an intact L2 representation. This is corroborated by the fact that stress and syllable structure are distorted in L1, which is in line with the literature on bilingualism where access to syllabic levels relates to stage three (child bilingualism) (cf. Haugen1950; Rose 1999).
- The adaptation processes can be both phonological and/or phonetic. The process is governed primarily by L1 grammar where L1 contrastive features play a major role in the adaptation process, e.g. emphasis. Nonetheless, the adaptation process can be affected by other non-phonological factors.
- Both natural and structural markedness play a major role in the adaptation process. Covert L1 markedness constraints besides universal markedness constraints will show up in the adaptation process in the form of the Emergence of the Unmarked (see §2.7.3).

- AA borrowers do their best to retain as much L2 input as possible and faithfulness to L2 input is violated chiefly to satisfy markedness.
- In view of bilingualism levels in AA society, adaptation at the segmental level will be inconsistent and its role in illuminating AA phonology will be limited. However, adaptation at higher phonological levels will be more systematic and expectedly will provide more insightful information about AA phonology.

2.4 Previous studies of loanwords in Arabic

The aim of this section is to review earlier studies on loanwords in Arabic. The focus will be on studies on JA and a comprehensive treatment will be presented. However, it does not attempt to review earlier studies on specific world languages as the importance and relevance of these studies to this study lie mainly in the models that they adopt to account for the phonological and phonetic adaptation of loanwords, as pointed out in the previous section. It will be shown that none of the studies on JA has succeeded in accounting for the phonological adaptation of English loanwords. Almost all of them focus on segmental adaptation and rarely do they tackle adaptation at the suprasegmental level, hence the motivation behind the present study. First, I review earlier studies on JA.

A number of studies have investigated lexical borrowing in JA. The first study is Butros' (1963) PhD dissertation. He collected 1230 technical, and common English loanwords besides a large number of proper names that were in use in Palestine and Jordan from 1917 to 1962. Butros attempted a linguistic analysis, although superficial, to explore the impact of those loanwords on colloquial Arabic from phonological, morphological and semantic perspectives. Phonologically, he found that new sounds, e.g., /v/ and /e/ as well as some consonant clusters found their way into the dialect.

However, although this study has the largest corpus of loanwords among all previous studies on loanwords in JA, it does not give a clear and a comprehensive picture about the phonology of loanwords in JA. First, it was not devoted to phonological aspects only; rather it tried to offer a linguistic analysis in general. It focused only on the segmental changes from the source language, English, to the target language, Arabic, ignoring adaptation of prosodic features. Second, the study was conducted more than half a century ago, which means that quite a few words have come in and out of the dialect, and many phonological theories have appeared since then, which could add more insight into the analysis of the data. Furthermore, the author (Butros) was the main informant of his study. This casts doubts on the validity of at least the pronunciation of the words as he had been exposed to English for a long time before he conducted his research. Consequently, his pronunciation might not be an ideal representative of the speech community in Amman at the time. By contrast, the present study focuses on the way monolinguals pronounce these words believing that their speech would give a better and a more reliable understanding of the phonology of the dialect.

Two MA theses were conducted by Al-Khalil (1983) and Al-Saqqa (2001) to investigate the adaptation of loanwords in JA. The first studied loans in written journalistic Arabic as read by educated native speakers. Data was collected from 60 issues of the most widespread two daily newspapers in Jordan. The study identified 528 loanwords that were in use in written Arabic. The second studied loanwords in the language of advertising in written JA between 1998 and 2000. Al-Saqqa compiled 421 proper names and 271 common nouns.

Both Al-Khalil and Al-Saqqa conducted a phonological, morphological and semantic analysis. Phonologically, they listed the consonantal and vocalic substitutions the words underwent in JA. They paid more attention to processes such as voicing and velarisation with a hint at the phonological contexts that trigger these changes. For example, they mentioned that /s/ is velarised when adjacent to back or central vowels, as in ‘bus’ and ‘ounce’. Moreover, Al-Khalil tried to account for phoneme substitutions such as the realisation of English /z/ as Arabic /s/ in ‘physiology’ by attributing this change to ‘phonetic reasons’ without explaining what these reasons were. Again, the same thing applies to vowels. They listed the realisations of English vowels in JA with very little phonological or phonetic explanation to account for their adaptations. For example, they mentioned that the vowel in ‘bus’ was realised as /ɑɑ/ in JA as it was followed by the velarised /ṣ/. This explanation looks circular as they tried to account for velarizing /s/ by assuming that it resulted from its adjacency to a back/central vowel. So which is which?

Al-Khalil also mentioned that the English diphthong /aɪ/ was realised as /ii/, /i/ or /ei/ and the diphthong /eɪ/ was adapted as /i/, /u/ or /a/ attributing these adaptations to the fact that the vowels are represented by the grapheme **jāʔ* in Arabic orthography (ibid:

40). This analysis is not adequate to explain the phenomenon phonologically. Moreover, Al-Khalil's study failed to account for both consonantal and vocalic adaptations as it attributed changes to 'pure linguistic reasons' without providing an adequate explanation of these reasons. Likewise, Al-Saqqa attributed the adaptations to the different 'rules and principles' of both languages, but failed to mention what these rules were (ibid: 105). Both studies had very rich data, but inadequate phonological analysis.

In order to investigate the impact of English loanwords on JA, Suleiman (1985) investigated the speech of Yarmouk University bilingual students whose medium of instruction was English, and compared it with the speech of students who were taught in Arabic. This study was completely different from the present study in two ways. First, the list of loanwords it compiled was not restricted to common words in JA; rather it included many technical, and uncommon words such as 'dimple', 'left-wing', 'mess', to name but a few, besides words that were not used in JA at all, such as 'November'. His list of words was almost completely based on Butros' (1963), as he mentioned in his study (ibid: 101). Second, Suleiman analysed the data phonologically as they were produced by his Yarmouk University bilingual informants. Consequently, it is more likely that the results would apply to interlanguage studies rather than loanword phonology—the focus of the present study.

Like the other studies on JA, his phonological analysis was rather limited. For example, he attempted to account for gemination in some words such as 'connect' and 'collect' (although they do not belong to JA monolinguals' lexicon) by attributing it to the source word spelling. Although it might be partially responsible for such a phenomenon, this assumption is by no means satisfactory for a number of reasons. First, it fails to account for gemination in loans that are spelt with simplex consonants such as 'ok' and 'Toyota'. Second, not all double consonants in the source language are realised with a geminate in the recipient language, e.g., 'commission', 'commando' and 'dettol'. Double consonants almost always only represent gemination in English across a morpheme boundary, as in: u[nn]ecessary, i[ll]ogical. By contrast, gemination occurs in dozens of loanwords in the corpus of the present study, a phenomenon that deserves a thorough phonological investigation. (See §5.2.2).

Suleiman touched on an interesting issue in Arabic loanword phonology when he mentioned vowel lengthening to account for lengthening the final vowels in words such as 'vitamin', 'carton', 'aspirin' and 'album'. He argued convincingly that lengthening in these examples resulted from a tendency in Arabic to stress long vowels word-finally in multisyllabic words (ibid: 850). Further analysis of vowel lengthening is required: since it does not apply across the board, other phonological factors that could relate to this tendency need to be thoroughly considered. On the whole, Suleiman's analysis was neither comprehensive nor representative. He did not try to account for all the data, and the data did not represent JA monolingual speech.

The study of loanwords in JA was also the focus of five more papers. Kilani (1994) compiled a corpus of 500 loanwords that were used in colloquial JA. Al-Omoush & Al-Faqara (2010) used a corpus of 334 words, most of which were trademarks and technical words. Again, like the other studies, these studies attempted a superficial phonological, morphological and semantic analysis. Bader (1990) conducted another study that was entirely dedicated to semantic changes in loanwords. Hussein & Zughoul (1993) examined loanwords in journalistic JA focusing on semantic change and morphological inflections. Finally, Abu-Mathkour (n.d.) conducted a study that was completely devoted to a descriptive morphological analysis.

Loanwords attracted studies in other Arabic dialects as well, e.g. Heath (1989) on Moroccan Arabic, Araj (1993) on MSA, Hafez (1996) on Egyptian Arabic and Abdallah & Daffar (2006) on Iraqi Arabic. Heath's study dealt with the adaptation of the abundant number of French loanwords in Moroccan Arabic focussing on the transfer of French words from being used in code switching to loanwords in a bilingual community. Araj's (1993) PhD thesis studied European loanwords, loan translations, and blends especially English and French ones in MSA in an Egyptian newspaper with a focus on the sociolinguistic and pedagogical aspects. Phonologically, this study is of little relevance as it bases the pronunciation of a word on its spelling as it is written in the newspaper. Like other studies it presents a surface phonological analysis that is mainly devoted to segmental changes without indicating why such changes occur. For example, for the adaptation of English 'bus' it only mentions that it is realised as *baaṣ* where /ʌ/ is pronounced /ɑɑ/ as it is the closest sound, and /s/ is velarised. Her analysis is restricted to a list of the segmental substitutions without explaining why such changes occur.

Hafez (1996) studied loanwords from European languages in Egyptian Arabic. Although she mentioned some factors that might affect the adaptation process such as sociolinguistic factors, her analysis was almost restricted to segmental changes without an in-depth comprehensive phonological analysis. Moreover, she did not tackle stress assignment; she only mentioned that stress assignment follows native rules. The last study was restricted to variation in use of loanwords that is attributed to sociolinguistic factors such as age, gender, etc. in Iraqi Arabic.

To conclude, earlier studies on JA provide the current study with accessible lists of loanwords. Many of these words have been checked and sifted and only common words that are believed to be accessible to AA monolinguals nowadays have been included in the corpus of the current study. Moreover, they provide the current study with valuable information with respect to the pronunciation of loanwords. Tracking how the words have been pronounced over the decades might throw more light on the status of JA phonology. For example, a word such as ‘vitamin’ used to be pronounced with an initial ‘f’ (Al-Saqqa 2001), but now this way of pronunciation is stigmatised due to increasing levels of bilingualism. The voiced sound is now the norm in such words.

To sum up, unlike the present study, all the previous studies on JA attempted only limited phonological analysis that was restricted to segmental changes and rarely tackled syllable structure, stress or gemination. The most important results in this regard can be represented by the following phonological processes that were used to assimilate loans: (examples are taken from previous studies)

1. Substitution (/tʃ/ > /ʃ/): inch > inʃ
2. Voicing (/p/ > /b/) : plastic > blaastiik
3. Devoicing (/v /> /f/): volt > foolt
4. Velarisation (s > ṣ): bus > bɑɑṣ
5. Omission: circus > sirk
6. Lengthening (/i/ > /ii/): plastic > blaastiik
7. Shortening (/ii > /i/): meter > mitir
8. Gemination:[21] connect > kunnikt

[21]Gemination was rarely mentioned in previous studies. Only Suleiman (1985) hinted at it and attributed it to source spelling.

9. Cluster simplification: background > baakigraawnd
10. ʔ prothesis: album > ʔalbuum

2.5 Significance and rationale of the study

The integration of the large number of loanwords into AA calls for a systematic comprehensive phonological analysis that will contribute to a better understanding of AA phonology in particular and phonological theory in general (see §1.1).

Unfortunately, as has been shown in the previous section, previous studies on JA did not provide us with a full explanation of the phonological adaptation of loanwords. Almost all of them hardly ever investigated factors like the role of perception, perceptual similarity, markedness, L1 phonotactics and prosodic structure. They mostly restricted themselves to listing the ten phonological processes above with some representative examples. It would be much better to examine all the words that contained a certain process and then try to explain the phonological or phonetic reasons behind that.

Until now there is still a gap in the literature on the phonology of loanwords in JA. A study that conducts a comprehensive and systematic analysis of the phonological adaptation is very crucial, as pointed out in §1.1. The present study is an attempt to bridge this gap in the literature. Informed by earlier studies, the present study will be different from all previous studies in its scope and approach in many ways. Most importantly, it is completely devoted to phonological analysis of the loanwords covering aspects that have never been studied in loanwords in JA such as prosodic structure. Its main focus will be on syllable structure and stress assignment and the phonological processes involved therein. It deals with morphological and sociolinguistic factors only if they pertain to the phonological adaptation. Furthermore, it includes only common words that are accessible to JA monolinguals. Only monolinguals will be selected as participants to elicit the pronunciation of these words, as shown in §2.6.3. I argue that the way monolinguals pronounce these words would give better information about the L1 phonology and the processes of integrating loanwords.

To conclude, the rationale of the present study stems from the fact that the previous studies fail to provide a complete and a comprehensive picture of loanword phonology in JA. Unlike previous studies this thesis will conduct an in-depth phonological analysis to account for the intriguing nativisation processes of the many loanwords that have entered JA adopting a methodology that avoids the shortcomings of earlier studies.

2.6 Methodology

This section lays out the methodology used in this study. It describes the process of data collection and the selection of the corpus for this study. It provides information on participants and the tools used to analyse the data. It will explain how the methodology followed in this study gives more valid and reliable results than previous studies.

2.6.1 Data collection

Data collection started in 2005 and the list of loanwords was repeatedly updated and sifted until July 2014. The data were collected from different sources. First, loanwords already compiled in previous studies were checked and sifted and all words that were believed to exist in AA were used (cf. Butros 1963; Al-Khalil 1983; Al-Saqqa 2001). Second, a systematic search for loanwords in *Merriam-Webster's Collegiate Dictionary: Eleventh Edition* (2004) was carried out. The researcher went over all the entries in the dictionary and spotted any English lexeme used in AA. This dictionary was chosen as it includes etymology, which enables us to avoid Arabic loanwords in English. Moreover, the researcher checked the *Dictionary of Everyday Language in Jordan*, published by the Jordan Academy of Arabic in 2006. This is the largest dictionary of JA so far. Many loanwords were retrieved and added to the corpus of this study. Finally, the researcher, as a native speaker of AA, drew on self-observation technique to collect more loanwords.

A preliminary list of more than 6000 words was compiled. The list included proper names, common words and technical words. As this study is concerned with how loanwords are realised in AA by monolinguals, all technical words that are restricted to jargons and proper names were excluded.[22] Proper names were excluded for two reasons. The first relates to the difficulty of determining their provenance. The second

[22] This means that a few technical words, e.g. *ʔaks* ‘axle’, that are so common among monolinguals are included.

is related to the fact that they are often not nativised for other linguistic and non-linguistic factors (Al-Saqqa 2001). The total number of the remaining common words was about 1500. The list was given to three Jordanian Arab linguists to verify their existence and use in AA. Afterwards, some words were deleted as there was no unanimous agreement on their common use in JA.

It is well known in the field of loanword phonology that time is the most distorting non-phonological source that might affect the phonological shape of loanwords due to language change (cf. Paradis & LaCharite 1997, 2011). A word might enter the dialect and then undergo phonological natural change which would obscure the adaptation process altogether as it will not be possible to know whether the actual output results from adaptation or language change. For example, many words which used to be pronounced with a short high front vowel, e.g. *midrase* ‘school’ are now pronounced with a short low vowel, i.e. *madras*[*e*], due to influences from SA and other surrounding dialects. To avoid such an undesirable effect, the researcher excluded all loanwords that have existed in the language for more than fifty years. To this end, the researcher scanned *Hava’s Arabic-English Dictionary,* published in 1915, and excluded more than 100 loanwords that appeared therein, e.g. ‘bale’, ‘battery’, ‘buckle’, ‘carton’, ‘consul’, ‘gas’, and ‘sandal’. This dictionary includes colloquial words that were used in both Syria and Egypt at the time. These words were excluded on the grounds that by 1899 the words had already been established in Arabic and there is no way to guarantee their origin in AA. Also, Wehr’s *Dictionary of Modern Written Arabic*, published in 1961, was checked and all loanwords that appeared there were excluded. More than 400 words were found and excluded, e.g. ‘academy’, ‘anaemia’, ‘bus’, ‘canteen’, ‘capsule’, ‘casino’, ‘cement’, and ‘cholera’.

Although these two dictionaries do not deal with AA directly and there is no way to guarantee that a word that existed in Egypt or in Syria was also used in AA at that time, it can be argued that if such words were not used in AA at that time, they could have been borrowed indirectly into AA later. That is, there is no way to make sure that these words were borrowed from English directly or were borrowed via Egyptian or Syrian Arabic.

Also excluded were all other problematic words. These included words that could not be traced back to English with great certainty, e.g. ‘can’ and ‘dim’. Words restricted to certain genre or words mainly used in the written language, e.g. ‘cellulose’, and ‘commonwealth’, which tend to belong to formal language more than to spoken one, were excluded. For example, the word ‘commonwealth’ can be used in AA but it is used mainly in formal situations, which implies that these words do not belong to the dialect in as much as they belong to SA. It could be that these cases represent cases of code mixing. Also words that are used mostly by bilinguals such as ‘autograph’, ‘basketball’ and ‘bowling’, which might represent cases of ‘code switching’ were excluded.

Words originating from languages other than English fall into two types. The first type consists of words that exist in English and in another language. Very often the word is originally not English. In this case there is no way to make sure which language was the donor language so it will be assumed that these words have come via English as JA did not have enough contact with those dialects. Such words were kept in the database. Examples are ‘spaghetti’ from Italian, ‘kata’ from Japanese, ‘ketchup’ from Chinese and many words from French such as ‘boutique’ and ‘routine’.

Upon excluding all these problematic words, the remaining list of loanwords comprised 420 words.[23] The bulk of loans belongs to the grammatical category of nouns, followed by adjectives while verbs are the least common with five verbs only, namely *batwan, fabrak, fallal, ʃayyat* and *nootar*. (See appendix for the complete list of loanwords). The fact that the overwhelming majority of words are nouns is widely attested in the literature (Weinreich 1953; Haugen 1950; Kaufman & Thomason 1988). Unlike nouns, verbs tend to resist borrowing as they require a great deal of adaptation to fit into the grammatical system of L1 and because they represent core actions that are heavily tied to culture (Haspelmath & Tadmor 2009: 35).

It should be mentioned that Richness of the Base in OT does not restrict the input to the phonological component. It follows that provenance of a loanword would not be crucial as the output would abide by L1 phonological constraints regardless of the source input. However, I argue that the origin of the loanword is still important as it is assumed that L1 borrowers would try to maintain the source pronunciation as long as

[23] When more than one morphologically derived form of a loanword exists, only one form is listed unless the derived word has a specialized meaning.

it does not contradict L1 phonological constraints (cf. Kenstowicz 2007; Paradis & LaCharite 2011).

2.6.2 Pilot study

In search of more objectivity, the researcher conducted a pilot study to further verify the existence of the list of 420 loanwords in AA. Four male and four female AA informants whose ages range from 30 to 70 were asked to verify the loanwords. All of them live in Amman and their knowledge of English ranges from nil to intermediate. As expected, not all words were recognised by all informants. This is natural given that some words are used mainly by female speakers, others by male speakers. Also some words are common among young people, others among old people. Taking all this into consideration, a word that was not verified by at least four informants was deleted, e.g. 'drop', 'synthetic', and ‘telethon’. The final list of loanwords used in this study has 407 words (see appendix). On the whole, the list was restricted to common words that were accessible to AA monolinguals only.

2.6.3 Participants

As explained above, the way monolinguals pronounce loanwords will give a better picture about the phonology of AA. Therefore, twelve monolingual native AA speakers were asked to pronounce the words three times using two frame sentences, namely *ʔiʃtara* ______ *mbaariħ* ‘He bought _____ yesterday’ and *baguul* ____ *marra θ̠aanye* ‘I say ____ again’.[24] The researcher took certain measures to make sure that the participants were monolinguals. First, all the participants live in the neighbourhood where the researcher lives and the researcher knows a lot of information about their linguistic and educational background. Furthermore, the researcher asked them about their linguistic background and ensured that none of them was a bilingual.

Following convenience sampling, the researcher approached the participants and called them to participate in the study. To control for variables such as gender and age, male and female participants whose ages range from 30 to 60 were chosen. Each category was represented by two participants. This number helps to avoid undesirable effects that are attributed to individual differences, in case they come up. All the

[24] This was not the case for all participants. Three speakers pronounced the words only once.

subjects live in Amman and represent the dialect under investigation. None of them is known for any speech defects, which gives reason to believe that the results are natural and accurate. Also, all the subjects had received their school education in Amman public schools. Three female participants did a two-year diploma at a college in Arabic.

Participants were given verbal and written information about the study and procedures and they were provided with full information about the use and storage of the data. After that they signed an information sheet and a consent form to show their consent. For more privacy, recordings were coded as M1 (to stand for the oldest male participant), M2 … F6 (to stand for the youngest female participant). The researcher explained the task to the participants without bringing their attention to the fact that the researcher was concerned with how they pronounced the words to limit researcher and subject expectancy.

The researcher presented the majority of words using pictures where appropriate. First, a picture was shown on a computer screen and the subjects were asked to identify it. If they could not identify the target word, they were given clues to help them name the target word. To avoid the possible effect of spelling, no word was presented in its written form.

Under no circumstances did the researcher pronounce the word to the subjects. When pictures were not available, the researcher gave a definition of the target word to help participants recognise the word. Once they identified the word, they said it three times using one of the frame sentences above, whichever is a better natural context. It is felt that the first sentence 'He bought _____ yesterday' provides a more natural context than the second one. Therefore, the majority of words were read in that sentence. Only when the context sounds odd, the second frame sentence was used. For example, the word 'computer' fits well in the first sentence while words such as 'gentle' and 'goal' do not; hence, the second sentence was used.

All the recordings were digitally recorded in a quiet room using an LG Professional recorder and saved in WAV format, labelled and stored in the researcher's laptop. The recording took place either at the researcher's home or at the participant's home over two sessions. Each session took approximately two hours.

Upon completing all the recordings, the researcher transcribed the words using IPA symbols. To verify the accuracy of transcription, an American native speaker and trained phonetician checked the transcription and reported that there was an inter-transcriber reliability at 98%.[25] After that, Filemaker software was used to organise the database. Words were entered into the file along with all relevant information that is necessary to analyse the data.

Not all words were recognized by the participants. Participants recognized from 391 to 406 forms. The total number of recorded tokens is 4810. A token here denotes a form (a loanword) pronounced by a participant. That is, a loanword that is recognized by 10 participants represents 10 tokens.

To control for intensity of the uttered sound, a fixed distance between the speaker's mouth and the microphone was kept, which will be crucial to intensity analysis, as will be shown in §5.1.3. Using the target words in frame sentences rather than in isolation is necessary to avoid confounding word stress with phrasal pitch accent as a word in isolation would make a whole phrase on its own (Gordon 2011a: 827).

To counteract undesirable impacts on the naturalness of the elicited data such as the Hawthorne effect, where participants might change their behaviour as they are being part of an experiment, the researcher did not interfere in the recording except for instructions and informants were asked individually.

2.6.4 PRAAT analysis

The correlates of stress in Arabic are not well-defined and agreed upon. In fact, some Arab phonologists, e.g. Al-Absi (2011), deny the fact that stressed syllables have any specific phonetic correlates. Moreover, word-final gemination in native and loan words alike is not easy to perceive. Often researchers depend on their impressionistic abilities to judge the place of stress and the presence of geminates word-finally. Thus, in search of objectivity and solid evidence for these two phenomena, PRAAT software version 1.4.9 (Boersma & Weenink 2015) will be used.

[25] This was done by my co-supervisor, Gary Linebaugh, to whom I am very grateful.

2.7 Theoretical model

This section lays out the theoretical model that will be used to analyse the phonological adaptation of loanwords. It is not intended to present a thorough review of the literature on the theoretical model; rather relevant literature will be reviewed throughout the thesis under relevant sections. First, I present an overview of moraic theory, then I introduce Stratal OT and finally I conclude with a note on the Emergence of the Unmarked.

2.7.1 Moraic Theory

Moraic theory (Hyman 1985; McCarthy & Prince 1986; Hayes 1989) adopts only the mora as a prosodic unit that is represented on the prosodic template. It serves two functions: it is a weight unit and an organizational unit where melodic elements are associated with to indicate their skeletal position. Therefore, syllable weight is identified by the number of moras it contains. Following Hayes (1995), short vowels contribute one mora, while long vowels and diphthongs contribute two. Geminates contribute one mora, and non-final coda consonants are assigned a mora through the parametric constraint WEIGHT-BY-POSITION (WBP) (Hayes 1989). So a CV syllable is monomoraic while CVV and CVC syllables are bimoraic. It will be shown in §4.3 that AA syllables are maximally bimoraic including superheavy syllables such as CVVC and CVCC as evident from stress rules which do not distinguish between superheavy and heavy syllables. To account for the bimoraicity of superheavy syllables word-internally, I will adopt Kiparsky’s (2003) semisyllable approach to account for CVCC syllables and Broselow’s (1997) and Watson’s (2007) mora sharing approach to account for CVVC syllables, as will be explained in §4.3. Consonants in the onset are nonmoraic as they do not generally contribute to weight cross-linguistically (cf. Hayes 1995; but see Davis 1988 for counterevidence).

The motivation for adopting moraic theory rather than other theories such as CV or X-slot theory or Onset-Rhyme theory relates to the following reasons. First, moraic theory does not give equal status to all consonants. Only weight bearing units are recognized. Therefore, it is better able to account for the fact that onset consonants do not bear weight in AA. Also, moraic theory is better equipped to account for compensatory lengthening which occurs if a weight bearing unit is deleted while an onset, which does not contribute weight, does not invoke compensatory lengthening (see Hayes 1989; Watson 2002). Also, moraic theory is better able to account for metrical structure. Only moraic theory is able to group LL syllables into a foot and equate them prosodically with a heavy syllable (Watson 2002). Furthermore, moraic theory better captures the representation of geminates which pattern in a way that supports moraic weight representation, as will be explained in §5.2 (cf. Davis & Ragheb 2014).

2.7.2 Stratal OT

The prosodic analysis of loanwords as well as some phonological processes in AA are analysed adopting the framework of OT. The Classic/Parallel model of OT will be used to account for the adaptation of stress and gemination in Chapter five as all loanwords are investigated in their simple morphological forms from the perspective of AA. However, Stratal OT will be used to account for syllable structure and vowel epenthesis as these two aspects cannot be readily accounted for using Classic OT, as will be shown in Chapter four. I assume that the reader has a general familiarity of Classic OT. Therefore, a brief overview of Stratal OT only is provided below.

The failure of Classic OT to account for opacity and cyclicity, i.e. overapplication or underapplication of a phonological process, has given birth to modified versions of Classic OT. A number of attempts have been proposed in the literature to account for such cases. Stratal OT (Kiparsky 2000; Bermúdez-Otero 2003), Sympathy Theory (McCarthy 1999, 2003), where a sympathetic candidate chosen by a selector constraint affects the optimal output (see McCarthy 1999, 2003 for more details) and Output-Output Correspondence, which requires correspondence between independently occurring surface outputs (Benua 1997; Kager 2000) represent the most famous attempts to account for opacity and cyclicity. However, as it will be demonstrated below, the most successful attempt is Stratal OT. First, I present a brief introduction of Stratal OT and then I briefly show why it is superior to other accounts (for more arguments in favour of Stratal OT, see Kiparsky 2000; Bermúdez-Otero 2003).

Like Classic OT, Stratal OT is a theory of constraint interaction that does without rules at all (cf. Kiparsky 2000; Bermúdez-Otero 2003). It has the same four main components: the Lexicon that contains all the possible input forms; the Gen(erator), which produces an infinite number of candidates; the Eval(uator), which evaluates the output using a set of violable ranked Con(straints), which constitute the fourth component (ibid).

On the other hand, Stratal OT, unlike Classic OT, is a hybrid model that incorporates the insights of Stratal models like Lexical Phonology and Morphology (ibid). That is, it is a serial version of OT that echoes the lexical phonology and morphology interaction where constraints apply at different strata (Kiparsky 2000, 2003).

The main idea of this theory is that constraints apply at different levels and their ranking status may differ according to the level (e.g. stem, word, postlexical for AA; see §4.3.2) where they apply.[26] So constraints apply at the stem level yielding an output that serves as the input to the constraints at the word level which in turn functions as the input to the postlexical level. To illustrate, in AA, /katab+t/ 'I m.s. wrote' is assigned stress at the lexical level yielding *ka'tabt* according to AA stress constraints where a superheavy syllable at the right edge of the word is stressed (see §5.1.4 on stress). Later at the postlexical level, epenthesis is induced to break up the consonant cluster yielding *ka'tabit* giving rise to opaque stress assignment on a light penult, as will be shown in §4.3. Moreover, other processes such as long vowel shortening do not apply across the board in AA. Shortening applies in /ʃaaf-na/ > *ʃufna* 'we saw' but it fails to apply in /ʃaaf-ha/ > *ʃaafha* 'he saw her'. According to Stratal OT, closed syllable shortening applies at the stem level where subject suffixes are added while it does not apply at the word level where object suffixes apply (cf. Kiparsky 2000, 2003; Kabrah 2004; Watson 2007; Abu-Rakhieh 2009).

Stratal OT is superior to other attempts to account for cyclicity and opacity. Kiparsky (2000) argues that Stratal OT, unlike other models that account for opacity and cyclicity, keeps the well-defined and restrictive set of OT constraints and it is explanatory adequate "by relating the stratification motivated by opacity and cyclicity to the intrinsic morphological and prosodic constituency of words and phrases" (ibid: 351). He goes on to say that sympathy constraints as well as Output-Output (O/O) constraints weaken OT power. For example, Kager's (2000) O/O constraint HEADMAX-BA, which requires faithfulness between a stressed syllable in the base and a derived form is replaced by a standard faithfulness constraint MAX-ˈV that

[26] See Kabra (2004) and Abu-Rakhieh (2009) for the motivation of lexical strata.

requires a stressed syllable in the input to be faithfully mapped in the output (ibid: 11). Kiparsky points out that Kager's constraint does not take into account the fact that epenthetic vowels are not only unstressable but also invisible to stress and other prosodic processes, e.g. CVVC syllables are shortened although they get opened by postlexical epenthesis cf. /ʃaaf-t/ > *ʃufit*. 'I saw'. Therefore, O/O Correspondence fails to distinguish between lexical and postlexical epenthesis (Kiparsky 2000), which Stratal OT captures by positing different constraint rankings across multiple strata.

In terms of learnability, Kiparsky (2000) argues that Stratal OT fits better with learnability as it equates learning the stem level phonology with learning lexical representations, which can be different from constraints at other levels. In the same vein, Bermudez-Otero (2003: 25) argues that Stratal OT is superior to Sympathy Theory as the latter's principles are "conceptually problematic and/or empirically untenable" and therefore pose a serious learnability problem. In contrast, Stratal OT accounts for opacity in a straightforward manner by relating opacity to the serial interaction between strata (ibid: 28-9). Moreover, Sympathy Theory would require many sympathy constraints for different opaque cases, which complicates the grammar (Kiparsky 2000).

In Chapter four, I will use Stratal OT to account for complex margins in AA where the notion of a semisyllable, i.e. moras that are not linked to syllables but attach directly to the prosodic word, will be introduced (see §4.3.2). It will be shown that a semisyllable is allowed at a lexical level but banned postlexically if the two-consonant coda is ill-formed in AA.

Before I move to Chapter three, a final note on the Emergence of the Unmarked is in order.

2.7.3 The Emergence of the Unmarked

For loanword adaptation, I assume that markedness constraints will play the major part. If a loan form is not faithfully mapped onto the recipient language, then it should do so to satisfy a higher ranked markedness constraint. That is, words should usually look like the source word unless the form in question violates AA markedness constraints. However, sometimes they might do so even though a similar form is attested in native words. In this case, I argue that these represent cases of the

Emergence of the Unmarked (henceforth TETU), as will be shown throughout the thesis.

TETU, first proposed by McCarthy & Prince (1994), denotes the phenomenon whereby a marked structure is generally allowed in a language, e.g. a coda, but banned in certain structures, e.g. in a reduplicant, so the unmarked value emerges, e.g. a codaless syllable (cf. Becker & Potts 2011). That is, the unmarked value of a certain feature surfaces when faithfulness is not at stake. This happens where the output does not have a correspondent in the input. For example, an epenthetic segment, which does not have a correspondent in the input, satisfies faithfulness constraints vacuously, so the unmarked feature of the segment in question is expected to surface in such contexts.

TETU is consistent with OT theory in that OT posits that markedness outranks faithfulness in the initial state of first language acquisition (Gnanadesikan 2004). Later on, as a child is exposed to positive evidence from the environment, she will promote faithfulness constraints over markedness constraints leading to a re-ranking of violable constraints. Moreover, the fact that OT constraints are violable fits well with TETU. In earlier accounts, e.g. parameters, once a constraint is switched off it cannot be switched on again. For example, the cross-linguistic preference for codaless syllables over closed syllables is more compatible with OT, which is accounted for by TETU (cf. Becker & Potts 2011). In loanwords, a dominated markedness constraint becomes active as faithfulness is not pressing. This is presumed to occur suggesting that adults still have access to UG, which manifests itself in the appearance of unmarked outputs that are not motivated by the native phonology (cf. Shinohara 2004; Cohen 2009). In the corpus of this study, final obstruent devoicing, intervocalic voicing, guttural vowel harmony, left-edge alignment of the prosodic word with a foot as well as some cases of gemination could represent cases of TETU, as will be shown in chapters three through six.

2.8. Conclusion

This chapter has given an overview of AA phonological and morphological systems. It has reviewed the most relevant literature to the present study and outlined the purpose and design of the study including a brief discussion of the theoretical background adopted in the thesis.

It has pointed out that neither a purely phonological model nor a purely phonetic model is able to account for the adaptation of loanwords in general. Rather, a model that combines both taking into account the role of orthography would be the most suitable one.

It has been revealed that earlier studies on loanwords in JA fail to account for the phonological adaptation of English loanwords. Almost all of them are restricted to a superficial analysis that excludes suprasegmental analyses; hence the motivation of this study.

Moreover, it has been shown that the methodology used in the previous studies is generally flawed so the present study, informed by earlier studies, avoids these flaws by using loanwords that are accessible only to monolinguals and eliciting the pronunciation of these loanwords as they are pronounced by monolinguals rather than bilinguals. Moreover, the present study will draw on acoustic analysis to further verify stress position and final geminates within loanwords. The following chapters report on the findings of the study.

Chapter three

Segmental adaptation within loanwords

This chapter discusses the segmental adaptation of English phonemes into AA and the most common phonological processes that affect the mapping of English segments onto AA. This will shed light on the segmental phonology of AA and will enhance our understanding of phonology in general by highlighting, e.g. the role of markedness and phonological features in the adaptation process.

It will be demonstrated that the adaptation process is mainly phonological and the overwhelming majority of source segments are mapped onto their AA phonological equivalents rather than acoustic or phonetic equivalents. However, the role of perception is not entirely ruled out as the behaviour of /p/ and emphatics show. In fact, results show that perception is based on the phonological status of the feature in L1. That is, it is L1 referenced. Moreover, the unfaithful mapping of some source segments is rooted in markedness in that it renders the output less marked in AA. This occurs mainly for assimilation, vowel harmony, and morphological reasons, and, above all, to satisfy AA metrical structure constraints.

To be able to draw definitive conclusions from the adaptation process, we need to look at recurrent patterns and exclude isolated idiosyncrasies (cf. Paradis & LaCharite 2011). Therefore, adaptations that occur once by one single informant are not considered here.

The chapter is organized as follows. In §3.1.1, I present an analysis of consonant adaptation where phonemes are presented according to their phonological classes.

This is followed by an examination of the most common phonological processes affecting consonant adaptation, namely emphasis, assimilation, lenition and fortition in §3.1.2. Then, the role and behaviour of phonological features is addressed in §3.1.3. In §3.2, I account for vowel adaptation. First, I account for short vowels (§3.2.1), followed by long vowels (§3.2.2), and then diphthongs (§3.2.3). This is followed by examining vowel adaptation in terms of length, backness and height in §3.2.4. In §3.2.5, vowel formants of AA and British English are compared to check out the role of acoustic similarity between vowels in the adaptation process. This is followed by an account of the most common phonological processes that bear on vowel adaptation, namely lengthening (§3.2.7.1), shortening (§3.2.7.2), monophthongisation (§3.2.7.3) and vowel harmony (§3.2.7.4). §3.3 explores the factors that affect the segmental adaptation of loanwords and §3.4 concludes the chapter.

3.1 Consonant adaptation

This section shows how English consonants are adapted into AA. Of particular importance will be the adaptation of English consonants that do not have a phonological correspondent in AA. It is expected that the 19 shared consonants between AA and English will be readily mapped onto AA. This is the case for 14565 out of 16049 cases (about 91%).[1] It will be shown that when a consonant is missing in AA, it is usually the closest corresponding phoneme that is chosen by AA adapters. Similarity is calculated in terms of articulatory phonological features rather than acoustic and phonetic ones. For example, English voiced stops are realised without vocal fold vibration in initial position (de Yong & Cho 2012: 345) so they would be acoustically very close to AA voiceless ones; nevertheless, they are almost always adapted as voiced ones. However, certain consonants are not faithfully mapped despite being legitimate AA phonemes. This happens mostly for markedness constraints.

The 264 cases of consonant deletion, as in *ʔaks* ‘axle’ and *kuntak* ‘contact’ are almost always related to phonotactic well-formedness and will be dealt with in §4.4.2. Moreover, there are 546 cases of gemination, which will be examined in §5.2.

[1] Number of cases in consonant adaptation refers to number of tokens. For example, a loanword that is attested by 10 speakers is counted 10 times.

Before I present an analysis of each consonant, I provide an overview of consonant adaptation in Table 3.1 below.

Table 3.1 Overview of consonant adaptation

Class		English source	Typical AA realisation	Other realisations
Obstruents	Plosives	p	b (90%)	ø, bb, m
		b	b (98%)	bb
		t	t (88%)	ṭ, tt, ø
		d	d (92%)	t, ḍ, ø
		k	k (94%)	kk, ʃ, g
		g	g (88%)	k
	Fricatives	f	f (95%)	v
		v	v (70%)	f, b
		θ	t (61%)	θ
		s	s (86%)	ṣ, ṣṣ, z, ø
		z	z (85%)	s, ø
		ʃ	ʃ (99%)	dʒ, ʃʃ
		ʒ	dʒ (100%)	
		h	h (100%)	
	Affricates	tʃ	ʃ (63%)	tʃ
		dʒ	dʒ (100%)	(ʒ)
Sonorants	Liquids	l	l (88%)	ll, ø, n
		r	r (97%)	ø, l
	Nasals	m	m (97%)	n, mm
		n	n (96%)	nn, l, mm ø
		ŋ	ng (67%)	m, n
	Glides	j	ø (51%)	j (49%)
		w	w (100%)	

A quick look at these statistics reveals that the adaptation process is mainly phonological. The other realisations, which are not faithful to the source phoneme, are attributed to markedness factors. The high percentage of deletion in the adaptation of the palatal glide is attributed to phonotactic reasons. This is consistent with Paradis & LaCharite's (1997, 2011) findings where constraints to higher level phonological constituents have priority over lower level ones. That is, deleting the melody is tolerated as long as it satisfies syllable structure constraints, as will be shown in Chapter four.

The remainder of this section proceeds as follows: In the following subsection (§3.1.1), I present the results of consonant adaptation in terms of their phonological classes. In §3.1.2, I examine the phonological processes affecting consonants such as emphasis and lenition and in §3.1.3, I account for the role and behaviour of phonological features in the adaptation process.

3.1.1 Adaptation in terms of phonological classes

In this subsection, results are presented according to phonological classes. First, I address stops in §3.1.1.1 and then fricatives in §3.1.1.2 followed by affricates, nasals, liquids and glides, respectively.

3.1.1.1 Adaptation of stops

Adaptation of stops is generally faithful with over 90% of cases are mapped onto their AA phonemic counterparts except for /p/, which AA lacks. This is almost always mapped onto its phonological AA counterpart and never imported due to its phonetic marked status, as will be shown below. In the majority of the rest of unfaithful cases, voiced segments devoice and render the output less marked.

3.1.1.1.1 Adaptation of the voiceless bilabial stop /p/

[p], which is attested in AA as an allophone only, appears 831 times in different contexts. It is almost always (90.3%) realised as the voiced counterpart of /p/. This is expected given that changing the voice value of the segment is the least perceptible trait (cf. Steriade 2001; Adler 2006; among others). Steriade (2001: 4) demonstrates that a change in [voice] is minimal in that it does not affect the phonotactics of the variety in question while any other change would render the input and the output less

similar. Phonologically, a change in [voice] affects a terminal feature that is lowest in the feature geometry.

Also, /p/ is realised as the labial nasal /m/ in one loanword, namely ‘pick up’ by the twelve informants yielding *bikam*. Two features are affected: voicing and nasality are added, which suggests that a nasal is a better coda than a plosive (see adaptation of liquids below for more details on nasal codas). It suffices here to say that this is in line with a cross-linguistic preference for more sonorous codas (Prince & Smolensky 1993/2004).

Unlike the labiodental voiced phoneme /v/, /p/ is not imported at all into AA. It seems that this is phonetically motivated as the size of the oral chamber renders the production of this sound very difficult. Also, the voiceless bilabial stop is among the most difficult to perceive (cf. Hayes 1995; Gussenhoven & Jacobs 2005).[2] Therefore, its phonetic inefficiency, as pointed out by Hayes (2004) and Gussenhoven & Jacobs (2005), overrides the fact that its importation into AA would make the phoneme inventory of AA more symmetrical (see §3.1.1.2.2).[3]

3.1.1.1.2 Adaptation of the voiced bilabial stop /b/

Of the 634 tokens of /b/, /b/ is realised as a single voiced bilabial plosive except for one word, where it is geminated, namely ‘night club’. (See §5.2 on gemination).

3.1.1.1.3 Adaptation of the voiceless alveolar stop /t/

The alveolar voiceless stop appears 1620 times. In 1467 cases it is realised as [t]. This is not surprising as this phoneme is cross-linguistically the least marked coronal (cf. Paradis & LaCharite 2001) and it is the lexical default segment in Arabic dialects (cf. Watson 1989 for Sana’ni Arabic). In the remaining cases, it undergoes gemination, emphasis or it is deleted, which will be discussed later.

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[2] Gussenhoven & Jacobs (2005: 31), explaining system gaps, maintain that the voiceless plosive [p] is difficult to hear so it is not efficient for listeners “because the stop burst, which is one of the major cues to the presence of a plosive, is of much lower intensity in the case of [p] than in the case of other plosives, due to the lack of a resonating cavity in front of the point of release where the burst is created.”

[3] Historically, /p/ was adapted as /f/ in CA, e.g. Greek ‘paradhisos’ > *firdaws* and Persian ‘pelpel’ > *filfil*.

3.1.1.1.4 Adaptation of the voiced alveolar stop /d/

As expected, because this phoneme is a legitimate phoneme in AA, it is realised as [d] in all but 8% of cases where it is devoiced as in (1) below.

(1)	English source	AA pronunciation
	a) headphone	hitfon/hitifon[4]
	b) manifold	manavult
	c) spade	sbaati[5]
	d) vodka	vootka/vutika

Devoicing here is generally expected as it is consistent with universal markedness constraints where obstruents tend to devoice in coda position or word-finally (cf. Iverson & Salmons 2011; among others). Moreover, devoicing is considered a universal repair strategy in loanword adaptation (Kenstowicz 2007). Cases (1a) and (1d) represent a well-established AA constraint that requires obstruent clusters to agree in voicing where the second consonant determines the voice value of the cluster (for more details see §3.1.2.2.1).

3.1.1.1.5 Adaptation of the voiceless velar stop /k/

The voiceless velar stop /k/ appears 1727 times. It is not affected in about 94% of cases as /k/ forms part of the phoneme inventory of AA. However, it is realised as [ʃ] in one form, namely ‘archive’. It seems that this word has entered the dialect from French via Egyptian or Syrian Arabic as it is the only case where /k/ is palatalised. This may also result from spelling as the grapheme sequence ‘ch’ is usually pronounced [tʃ] in English. Therefore, it could be the case that AA bilinguals, who have different L2 abilities, mistakenly thought it was realised as an affricate (cf. the adaptation of /tʃ/ below). Its gemination will be discussed in Chapter five.

[4] Note that some loanwords have more than one pronunciation. This will be accounted for if it is attested by more than one participant.

[5] The vowel ‘i’ as an adjectival suffix.

3.1.1.1.6 Adaptation of the voiced velar stop /g/

There are 292 cases of the voiced velar stop /g/. It is retained in 88% of cases, while it undergoes devoicing in about 10% of cases, as shown in (2).

(2)	a) airbag	ʔerbaak
	b) geyser	kiizar
	c) grapefruit	karafoot
	d) spaghetti	sbaakitti

These cases of devoicing along with other similar cases might represent cases of TETU where the default value of obstruents manifests itself in the adaptation process despite the fact that voiced obstruents are legitimate in AA (cf. Becker & Potts 2011). Recall that the unmarked value of obstruents is voiceless for phonetic factors (Blevins 2004; Hayes 2004; Silverman 2006; among others). Note that in ‘airbag’, devoicing is completely natural and unmarked according to the aerodynamic consequence where velars are the most expected to devoice word-finally as voicing is most difficult to maintain the backer the sound is (cf. Ohala 1983, cited in Blevins 2004). Note here that intervocalic voicing is overridden by devoicing in (d), which is attested also as *sbaagitti*.

3.1.1.2 Adaptation of fricatives

Fricatives behave like stops and faithfulness is over 85% for all fricatives except for /v/, /θ/ and /ʒ/. /v/ is not an AA phoneme and /θ/ is undergoing a change in progress into a stop in native AA phonology. /ʒ/ is always mapped onto [dʒ], since both are allophones of the same phoneme /dʒ/ in AA. Of particular interest is the adaptation of the labiodental voiced fricative /v/. Unlike the voiceless bilabial stop /p/, it is imported in 70% of cases for AA phonology-internal reasons, as will be explained below.

3.1.1.2.1 Adaptation of the voiceless labiodental fricative /f/

The voiceless labiodental fricative /f/ occurs in 540 tokens. It is realised as [f] in 95% of cases. It undergoes voicing as in (3) below.

(3)	manifold	manavult
	wafer	weevar

These cases represent voicing intervocalically, which is phonetically motivated and renders the output less marked as voicing of obstruents intervocalically is attributed to aerodynamic factors (cf. Silverman 2006: 163). Also, it is perceptually motivated in that voicing cues are very strong between sonorants (Yu 2011: 1901).

Note that intervocalic voicing is not a productive feature of AA although it is attested in few AA native words, e.g. *fuzdug* < *fustug* ‘pistachio’. Accordingly, this could be a case of TETU.

3.1.1.2.2 Adaptation of the voiced labiodental fricative /v/

/v/ is not a phoneme in AA; rather it is an allophone of /f/. This is attested in AA native words as a result of parasitic voicing in clusters or intervocalically. For example, /f/ in *fazar* ‘tore m.s.’ surfaces as [v] in *yivzur* ‘he tears’.[6]

Despite its allophonic status in AA native phonology, /v/ is imported in 213 cases (about 70% of cases). This is especially true for new borrowings, e.g. ‘van’, and ‘vanilla’. Note that /v/ is gaining more ground in AA as the pronunciation of words such as ‘video’ indicates where a pronunciation with a voiceless initial fricative is stigmatised in AA and is considered old fashioned. In contrast, twenty years ago, this was not the case as previous studies on loanwords in AA point out that the voiced fricative was usually devoiced (cf. Al-Saqqa 2001).

Importation of this phoneme results from increasing bilingualism in AA community and is closely linked to economy and symmetry principles of the feature system. The importation of a new segment that does not need to introduce new features into the dialect will be easier than introducing one with totally new features. All the features that make the voiced labiodental fricative are already employed contrastively in AA so incorporating it does not require the addition of any new features or combination of features into AA (cf. Cohen 2009: 8 for Hebrew). Therefore incorporating this sound will fill in a phonological gap in AA and accordingly renders it more symmetrical and maximises its feature economy index (cf. Davis 1994; Clements 2003). AA feature economy index will increase as one more sound is added to the phoneme inventory of

[6] Interestingly, the French word ‘Eiffel’ appears as *ʔiivil* and never as *ʔiifil* in AA, although the source pronunciation has the voiceless labiodental fricative.

AA without adding any new feature because incorporating this sound will make use of the same features that already exist in AA (see Clements 2003).

Nonetheless, the status of this sound as a phoneme in AA is not yet well-established as it undergoes devoicing in 18.5% of cases as shown in (4).

(4)	a) archive	arʃiif
	b) caviar	kafyaar
	c) microwave	maykruweef
	d) valve	balf

Finally, it is realised as a bilabial voiced stop in 36 tokens, as in *balf* ‘valve’ and *kamboy* ‘convoy’, which could be linked to misperception.

3.1.1.2.3 Adaptation of the voiceless dental fricative /θ/

It appears 67 times. It is retained in 26 times while it undergoes occlusivisation and hardens into [t] in 41 cases –a tendency in Arabic that is attested in other Arabic dialects (cf. Broselow 2007) and in AA (Al-Wer 2007).

(5)	naphthalene	niftaliin
	thermos	teermus
	thinner	tinar
	cf.	
	earth	ʔeerθ
	marathon	maraθoon
	thermostat	θeermostaat ~ teermostaat

The position of the interdental voiceless fricative seems to affect the adaptation process. Word-initially it tends to occlusivise while medially and finally it does not.[7] The word ‘thermostat’ does not follow suit as it is a less common word that is more used by male speakers, which could justify retention of the interdental as occlusivisation of interdentals is less among male speakers in AA.

[7] Note that this is not the case in *niftaliin*.

3.1.1.2.4 Adaptation of the voiceless alveolar fricative /s/

Being the unmarked fricative cross-linguistically (Paradis & LaCharite 2001) and a legitimate AA phoneme, the voiceless alveolar fricative /s/ is expected to be faithfully adapted in the corpus. This is the case for 86 % of cases (1422/1653). The remaining unfaithful cases are attributed to markedness factors. For example, it is voiced in one form, namely *biidza* for obstruent-cluster conditions (see §3.1.2.2.1). It is mapped onto its emphatic counterpart /ṣ/ in 11% of cases. It is also geminated and emphaticised in *buṣṣ* 'boss'. Unexpectedly, it is voiced word-finally in one word, namely 'Rolls Royce', which is realised as *rozraayz*. This might be a case of voicing harmony where voicing is easier to maintain across the whole word.

3.1.1.2.5 Adaptation of the voiced alveolar fricative /z/

Of the 307 cases, the voiced alveolar fricative /z/ is kept intact in 261 cases. It is devoiced in two loanwords, i.e. 'foolscap', and 'ribs', which are realised as *fuluskaab,* and *ribs* respectively. Like the previous case of devoicing, these cases are expected and unmarked. For *fuluskaab*, /z/ assimilates in voice to the voiceless velar stop as expected in AA obstruent clusters. In 'ribs' it is also unmarked in that it is devoiced word-finally and it could also relate to the unspecified voice value of AA labial stop (see §3.1.2.2.1 for arguments that /b/ is underlyingly unspecified for voice).

3.1.1.2.6 Adaptation of the voiceless palato-alveolar fricative /ʃ/

The palato-alveolar voiceless fricative /ʃ/ is part of the phonemic inventory of AA, hence it is maintained in AA across the board except for one case that shows free variation within subject speech, i.e. 'cashew', which is realised either as *kaaʃu* or *kaadʒu*. The latter again represents intervocalic voicing, which could be another case of TETU.

3.1.1.2.7 Adaptation of the voiced palato-alveolar fricative /ʒ/

The voiced palato-alveolar fricative /ʒ/ appears 36 times in the corpus and is realised as a voiced affricate, i.e. [dʒ]. Note that /ʒ/ appears in AA as an allophone of the phoneme /dʒ/, which tends to be de-affricated among especially young female speakers in Amman (cf. Al-Wer 2007). Although rare, de-affrication is sometimes attested in free variation by the youngest female participant.

3.1.1.2.8 Adaptation of the voiceless glottal fricative /h/

The voiceless glottal fricative /h/appears 157 times and it is realised as such in all loanwords where it is pronounced in English. It appears in onset position either word-initially for the majority of loanwords or word-medially in three words, namely ‘carbohydrate’, ‘hula-hoop’, and ‘manhole’, However, the silent grapheme ‘h’ appears in five English words, namely ‘cheetah’, ‘exhaust’, ‘night club’, ‘spaghetti’ and ‘tights’. Interestingly, it is not realised in all these five words in AA (see §.3.3.2 on the role of orthography).

3.1.1.3 Adaptation of affricates

AA has only one affricate, namely /dʒ/. Its voiceless counterpart is not a phoneme. Rather it is a sequence of two phonemes as its treatment within loanwords shows below. Expectedly, the adaptation of the voiceless affricate is not faithful while the voiced one is always mapped onto its phonological AA counterpart.

3.1.1.3.1 Adaptation of the voiceless palato-alveolar affricate /tʃ/

It appears 147 times and it is either retained or de-affricated, yielding [ʃ]. It seems that orthography is at play here. The norm is to de-affricate it losing its stop part unless the word is spelt with the grapheme ‘t’. The examples in (6) compare the different realisations of the palatoalveolar voiceless affricate.

(6) a)	clutch	klatʃ
b)	hatchback	hatʃbaak
c)	ketchup	katʃabb ~ katʃʔabb
d)	switch	switʃ
cf.		
e)	chance	ʃanṣ
f)	chat	ʃaat
g)	chips	ʃibs
h)	chimpanzee	ʃambaazi ~ ʃambaanzi

The position of the affricate seems to have a role in the adaptation process. Word-initially it is de-affricated to avoid complex onsets as a markedness preference while word-medially it is retained as complex clusters are less marked in coda position than in onsets and the two sounds could be syllabified across the two syllables as coda and onset, respectively as in (6c).

Concerning the nature of this affricate, results show that AA treats it as a sequence of two phonemes, as example (6c) above shows where /t/ occupies the coda position in the first syllable. More evidence for this comes from realisations such as *klaṭiʃ* attested among older AA speakers. Further evidence for the bisegmental status comes from gemination where a form such as *klaṭʃ* does not undergo gemination to render the form bimoraic to satisfy minimality, as will be shown in §5.2.2.1(see Davis & Abu-Elhij'a Mahajna (to appear) for the status of derived affricates in Arabic).

One word that does not have ‘t’ in its spelling is nevertheless realised as an affricate, namely ‘cappuccino’. It should be mentioned that this word is a recent borrowing and is more likely to have been borrowed orally via the media; hence retaining the affricate.

3.1.1.3.2 Adaptation of the voiced palato-alveolar affricate /dʒ/

The voiced palato-alveolar affricate is the only affricate phoneme in AA. There seems to be a change in progress where the affricate loses its initial occlusive part yielding its allophone /ʒ/ (cf. Holes 1995; Al-Wer 2007). /dʒ/ appears 288 times in the corpus and is realised as such, with /ʒ/ in free variation for the youngest female participant.

3.1.1.4 Adaptation of nasals

AA and English share two nasals and so they are almost always mapped faithfully while the velar nasal, which AA lacks, unpacks into /ng/ most of the time. Again, unfaithful realisations of nasals are attributed to markedness.

3.1.1.4.1 Adaptation of the bilabial nasal /m/

The bilabial nasal is attested in 856 tokens. About 97% of cases are realised unchanged. Besides being geminated in one loanword, it changes its place of articulation yielding /n/ in 14 tokens as shown below in (7).

(7)	a) samsonite	sansunaayt ~ samsunaayt
	b) trump	ṭarniib

These cases can be accounted for in terms of place assimilation in the first example and a case of dissimilation or OCP on the labial tier in (7b).[8] The Obligatory Contour Principle (OCP) bans identical elements on the same melodic tier (McCarthy 1986). It is well-known that Arabic roots with more than one labial consonant are avoided (McCarthy 1994; Zemanek 2007), so one way to abide by this gradient constraint in Arabic is to change the labial feature of the nasal yielding an alveolar nasal. However, one wonders why such co-occurrence restrictions do not manifest themselves with regard to other consonants, e.g. coronals. According to Frisch et al.'s (2004: 198) similarity metric of Arabic consonants where similarity is measured by the number of shared classes divided by the number of shared classes plus the number of unshared classes, labials have stronger similarity indexes as the number of labials in Arabic is quite small in comparison with coronals and to a lesser degree dorsals and pharyngeals. More examples of this type would support the psychological reality of OCP-place in Arabic.[9] AA borrowers would have acquired a gradient constraint that bans forms with OCP-place violations that manifests itself in the adaptation process (cf. Frisch et al. 2004: 211).

To test the psychological reality of such a constraint, I checked all loanwords and found that there is no evidence for a productive ban on similar consonants within the same word or even within the same foot. Violations of this OCP-Place abound in the corpus. Consonants of the same class co-occur freely with each other and there does not seem to be any attempt by borrowers to fix it. A few examples are given in (8) below.

(8)	baby	bubbu
	acid	ʔasiid
	aids	ʔeedz
	cakes	kiks
	chenille	ʃanil

[8] Cross-linguistically, labial dissimilation is the most common type of place dissimilation (cf. Bye 2011).

[9] In the same vein, Frisch & Zawaydeh (2001) found that Jordanian informants judged nonce words with no OCP-place violations to be more word-like than those with OCP-place violations.

The examples above show that the ban is not attested in words that have similar adjacent segments, which is expected to be stronger (cf. Frisch et al. 2004: 501).

These findings are not surprising for two reasons. First, OCP-Place applies to Arabic verbs more than to Arabic nominals and the majority of loanwords are nouns.[10] Second, quite a few AA words such as *faram* ‘he ground’, *fihim* ‘he understood’, *baṣam* ‘he learned by heart’ violate this constraint. So the very few cases of adaptation due to OCP-place do not necessarily mean that the constraint is not active. Rather this indicates that the ban is not absolute and affects mainly verbs. Moreover, it could be that the borrowability of a certain form is strongly correlated to its well-formedness in AA so the more well-formed a loanword is, the more likely it is to be borrowed (cf. Frisch et al. 2004: 212).

3.1.1.4.2 Adaptation of the alveolar nasal /n/

The alveolar nasal is mapped onto its AA phonological counterpart. It occurs 1664 times of which 97% of cases are realised unchanged. This is followed by gemination in 24 tokens. Moreover, it is realised as a labial nasal in *kamboy* ‘convoy’ due to assimilation. It is also realised as a lateral in *staallis* ‘stainless’ where the nasal assimilates in manner to the lateral yielding a geminate.

3.1.1.4.3 Adaptation of the velar nasal /ŋ/[11]

The velar nasal is not a phoneme in AA so it is expected that it will not be imported. Logically, it could be realised as an alveolar nasal, a velar stop or it could undergo unpacking yielding a sequence of an alveolar nasal and a velar voiced stop (cf. Paradis & Prunet 2000 for other languages).

The most common strategy used in our corpus is unpacking with 49 tokens, as in ‘hanger’, ‘Kung Fu’ and ‘ring’. This makes sense in that it retains as much information as possible of the source form, especially the written form. Also, this might relate to perception as most English speakers hear this sound as /ng/ unless they are trained otherwise (Linegbaugh, 2016 June. p.c.).The second strategy is adapting it as an alveolar nasal, as in *kunfuu* by some informants. It seems that this results from

[10] Three verbs out of five violate OCP-Place, though.

[11] Source allophonic realisations of /n/ as /ŋ/ are ignored in the adaptation process.

cluster simplification where ‘g’ is deleted. Finally, /ŋ/ is adapted as [m] in ‘baking powder’ as a result of assimilation to the place of the following labial stop.

3.1.1.5 Adaptation of liquids

The two English liquids are also AA phonemes so they are mapped faithfully into AA about 90% of the time. Unfaithfulness occurs due to harmony, markedness or perceptual factors. The adaptation of dark /l/ is particularly interesting as it sheds light on the status of this allophone in AA.

3.1.1.5.1 Adaptation of the lateral /l/

The lateral liquid appears 1307 times. Since it is a well-established phoneme in AA it is expected not to undergo any adaptation. This is the case for 89% of cases. However, its realisation is sometimes unfaithful as can be seen in (9).

(9)	emulsion	ʔaminʃin
	goal	goon

Adaptation of /l/ to [n] is undoubtedly a result of nasal harmony in the first example. The lateral takes on the nasal feature progressively from the nasal trigger. For the word ‘goal’, its nasalisation could be related to saliency effects as nasals are more perceptible than liquids in coda position (cf. Steriade 2001). Steriade (2001) argues that nasals in coda position are more distinctive and therefore perceptually more salient than obstruents and obstruents are more salient than liquids. This may suggest that a nasal could be a better coda than a lateral. Alternations like these are also attested in native words, e.g. the proper names *dʒibriil* and *ʔismaʕiil* are realised as *dʒibriin* and *ʔismaʕiin* respectively. Moreover, other Arabic dialects, e.g. Sudanese, opt for [n] rather than [l] in adapting the word ‘goal’. Moreover, the adaptation of ‘penalty’ as *balanti* points to the same conclusion where metathesis renders the liquid in onset position and the nasal in coda position. This change is also attested in world languages. For example, Apichai (2007) reports that Thai maps /l/ into /n/ in adapting codas in English loanwords into Thai.

Some might argue that this is a case of dissimilation. Given that coda /l/ (as well as /r/) shares great acoustic similarity with back vowels (Espy-Wilson 1992; Dickins 2011), it is realised as [n] to avoid similarity with the back vowel [oo]. This suggestion is immediately rejected in AA as it cannot account for native words, i.e. *dʒibriin* and *ʔismaʕiin.*

Moreover, this could be related to markedness factors. First, nasals are the unmarked sonorants: some languages have nasals, but may lack liquids (Rice 2007); some languages allow only nasals in coda, e.g. Gilbertese (Blevins 2004: 116) and Mandarin Chinese where nasals are the only singleton codas (Miao 2006). Of the nasals, the most unmarked segment seems to be the coronal nasal so these cases can be a sort of neutralisation to the unmarked.[12]

On the whole, whatever the reason behind this adaptation is; it looks natural due to the similarity between /l/ and /n/. They are homorganic and lateral sounds are most similar to nasals as they appear on spectrograms (Hayward 2000: 201; see §3.1.1.5.3 on the similarity of these sounds).

3.1.1.5.1.1 Adaptation of dark /l/

Many researchers claim that Arabic, including AA, has two lateral phonemes: dark (albeit marginal) and light (cf. Butros 1963; Watson 2002; Abu-Abbas 2003). I assume that if AA has these two phonemes, it is very likely that AA borrowers will pay attention to this distinction and map them accordingly. To test this, I checked all cases of the lateral phoneme in the source words. Clear /l/ appears in 46 words and its dark counterpart appears in 33 words in the corpus. The adaptation process shows that the mapping of the two allophones is not faithful. Many times the dark variant is mapped onto a clear one and vice versa. This shows that AA has only one lateral phoneme with two allophones.

The table below presents the distribution and adaptation of the lateral phoneme into AA.

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[12] Heselwood et al. (2011: 64, cited in El-Ramli 2012) note that the nasal coronal is the weakest among sonorants as it is always a target but never a trigger of assimilation.

Table 3.2 Adaptation and distribution of the lateral allophones

	Adapted as clear l	Examples	Adapted as dark l	
Clear l	35	metallic, collage	11	balance, satellite
Dark l	30	drill, crystal, single	3	manifold, sold

Table 3.2 shows that the status of the phoneme in the source word does not affect its realisation in AA. Whether it is adapted as clear or dark in AA depends on its adapted context. It is realised as dark in the vicinity of low/mid back vowels, as in *balanṣ* ‘balance’, *satalaayt* ‘satellite’ and *ṣ[o]ld* ‘solid’. However, it is realised slightly dark next to back vowels, as in *ditool* ‘dettol’ and *diluks* ‘de lux’ and *manavult* ‘manifold’ as Table 3.3 below shows while it is mapped onto a clear [l] next to high front vowels and front low vowels, as in *liigu* ‘lego’ and *balf* ‘valve’. Table 3.3 below compares formant measurements of clear and dark allophones that lend support to my analysis. It can be seen that clear allophones have F2 values above 1600s while the dark allophones have F2 readings around 1200s. Allophones with F2 around 1400s are in-between; they are perceived as slightly dark.

Table 3.3 Mean formant values of lateral allophones as they are adapted in AA (male speaker)

Source word	de lux	lego	militia	dettol	shell	valve	ambulance	manifold	solid	satellite
F1	416	349	339	336	336	342	557	313	341	436
F2	1424	1664	2232	1421	1692	1488	1205	1448	1309	1290
F3	2605	2801	2656	2844	2836	2906	2846	2651	2636	3037

To summarise, /l/ is velarised in AA if it is next to low/mid back vowels while it is realised as a plain lateral next to front vowels and realised with a little velarisation next to back vowels. These facts point to phonetic co-articulatory effects rather than phonological ones. Therefore, I reject the idea that AA has a dark /l/ phoneme.

3.1.1.5.2 Adaptation of the rhotic /r/

The rhotic /r/ appears 2255 times. Although it is not pronounced in British English postvocalically, it is realised in all positions in AA except for few cases. This tempts one to postulate that the source language could be American English. However, this is not necessarily the case.[13] Most of these borrowings could have entered the dialect through writing or that AA speakers tend to keep the rhotic sound as they do in their second language acquisition of English (cf. Sulaiman 1985). It seems that spelling makes it more salient and difficult to dispense with the rhotic given that bilinguals have access to the written form. However, word-final /r/ is deleted in ‘compressor’ and ‘trailer’ by all informants. It could be the case that these two words were borrowed orally by people who did not have access to writing. Other cases of deletion are related to syllable structure and will be dealt with in §4.4.2.

Moreover, /r/ is mapped onto a lateral as a result of manner assimilation in (10a) below, dissimilation in (10b) or misperception in (10c).

(10)	a) charleston	ʃallistun (~ ʃarlistun)
	b) corner	koornal (~ koornar)
	reverse	lavirs (~ rivirs)
	tupperware	ṭabarweel (~ ṭabarweer)
	c) nectarine	naktaliin (~ naktariin)
	jerry can	dʒalkan (~ dʒarkan)

Note that similar cases of alternation among coronal sonorants are attested in other Arabic dialects, e.g. Moroccan Arabic where Heath (1989) attributes this to random interchange without trying to offer a phonological or phonetic explanation.

[13] Note that I do not argue that American English cannot be the source language for many loanwords. Recall that given that the source variety cannot be ascertained, I assume that English loanwords come from British English for consistency of analysis and because Jordan has had long relations with Britain and the educational curriculum adopted in Jordan in teaching English was mainly a British one.

Liquid dissimilation is attributed to two factors. The first is articulatory where similar items are difficult to produce (cf. Dell, Schwartz, Martin, Saffran & Gagnon 1997) cf. tongue twisters. The second is related to perceptual confusion where listeners tend to reverse a perceived co-articulation (Ohala 1981, 1993, 2003, cited in Bye 2011). This usually obtains between segments with extended acoustic properties that become vulnerable to reanalysis on the part of listeners, e.g. rhotics (Blevins 2004).

Before I close this section on the adaptation of liquids and the nasal coronal, I look in detail at their alternations.

3.1.1.5.3 Alveolar sonorant alternations

Sound alternations are usually attested among segments that are minimally different acoustically and/or articulatorily (cf. Yip 2011: 737). If they are acoustically similar, they might be misperceived and if they are articulatorily similar, they might be misarticulated. In the following table, I show how much the liquids and the nasal alveolar are similar, which would justify their alternations in the adaptation process.

Table 3.4 Arabic alveolar sonorants

	r	l	n
Duration	80-120	80-120	80-100
F1	260	250	250
F2	1500	1500-1600	1500-1600
F3	lower than l’s	2400-2500	2800-3000

Source: Al-Ani (1970: 31-33).

As can be seen, in addition to identical place and voicing values, these sounds are similar in length. Also, their formant structures are very similar. They differ mainly in their F3. It is highest for the nasal, lower for the lateral and lowest for the rhotic (Al-Ani 1970: 31-33). Hence, their alternation is highly likely.

3.1.1.6 Adaptation of glides

The two English glides are mapped onto their AA phonological counterparts. However, /j/ is deleted 51% of cases to satisfy AA phonotactics.

3.1.1.6.1 Adaptation of the palatal /j/

The palatal glide appears 205 times. Whenever it is mapped it is always realised as such. This is the case for 49% of cases. However, it is deleted in the rest of cases as shown in (11) below.

(11)	ambulance	ʔambalanṣ
	bermuda	barmooda
	duplex	dubliks

Deletion is most probably attributed to phonotactic factors. For example, in ‘bermuda’, the onset cluster /mj/ appears marked in AA. In native words, glides turn into vowels when they appear next to consonants; however, this repair is not possible here as it would lead to hiatus, which is also forbidden in AA (see §4.2.1.2 on complex onsets).

3.1.1.6.2 Adaptation of the labio-velar /w/

The labio-velar glide /w/ is retained in all its 171 appearances where it is always realised as [w]. It appears in 15 loanwords such as ‘between’, ‘kiwi’, twitter’ and ‘wafer’.

To briefly conclude this subsection, the adaptation of English consonants shows that the adaptation process is mainly phonological. English phonemes are mapped onto their AA phonemic rather than phonetic counterparts. I turn now to the phonological processes that AA uses to account for unfaithful mappings of English consonants.

3.1.2 Phonological processes affecting consonants

In this subsection, I explore the most important and common phonological processes that manifest themselves in adapting consonants. First, I conduct an examination of emphasis followed by a quick analysis of assimilation and lenition processes and finally I touch on fortition. It will be shown that these processes are invoked to render the adapted form less marked in AA.

3.1.2.1 Emphasis

Emphasis is a very common phenomenon in AA that is recurrent in the adaptation process. The occurrence of emphatic consonants in the adaptation process is intriguing as English does not have emphatic consonants. Apparently, this points to a perceptual effect and suggests that the adaptation is perceptual. However, I argue that this phenomenon in the loanwords is still phonologically based from the perspective of AA. Since AA contrasts emphatic coronals and plain coronals, borrowers would pay attention to the source phonetic feature, which is phonological in AA; hence the faithful adaptation of emphasis. First, I address emphasis in AA then I account for emphasis in loanwords.

3.1.2.1.1 Emphasis in AA

Emphasis in Arabic can be defined as the production of certain dental/alveolar consonants with a non-primary constriction at the pharyngeal zone although there is no consensus on the exact region where the non-primary constriction takes place (cf. Davis 1995; Watson 2002; Youssef 2013; Mashaqba 2015). Emphasis spread is a type of place assimilation whereby a non-primary feature spreads locally and non-locally (cf. Herzallah 1990; Watson 2002; Youssef 2013). Emphatic segments in AA include the emphatic coronals /ṭ, ṣ, ḍ/zˤ, (ẓ)/ and the sonorant approximant /r/. For the representation of emphatics, see §2.1.3.5. Secondary emphatics in AA, namely /l, b, m/ represent peripheral phonemes or rather allophones that are restricted to very few items and are always found next to back low vowels.[14] This casts doubt on their specification as contrastive emphatic sounds underlyingly (cf. Youssef 2013 for Cairene Arabic and Baghdadi Arabic). It seems that they acquire emphasis as a sort of coarticulation from the low vowel. The adaptation of dark /l/ within loanwords implies that these pharyngealised sounds are not phonemes in AA (see §3.1.1.5.1 on adaptation of /l/).

Phonetically, emphasis correlates with an overall pharyngeal constriction (Davis 1995; Watson 1999), hence pharyngealisation. Auditorily, emphatics give a feeling of darkening that results from enlargement of the oral cavity, which corresponds to a lowering of F2 and a reduction of the pharyngeal cavity, which correlates with raising

[14] cf. *walla* ‘went away’ vs. *w*ɑ*ll*ɑ ‘by God’, *mayy*,‘female name’ vs. *mayy* ‘water’.

F1 (cf. Herzallah 1990; Watson 2002; Youssef 2013). The main acoustic effects of pharyngealisation, i.e. F2 lowering, can sometimes be enhanced by labialisation where the thematic vowel of the imperfect appears as /u/ or /a/ instead of /i/, e.g. *biṭug* ‘it crashes’ vs. *binzil* ‘he goes down’. This will increase the vocal tract volume and thus lower F2 further. Recall that emphatics are represented with non-primary [guttural], which captures the different degrees of pharyngeal constriction of all emphatics (cf. Watson 2002, see §2.1.3 for choice of features).

Emphasis applies minimally to a CV syllable and maximally within the phonological word (cf. Watson 2002: 268 for Cairene Arabic).[15] This means that a coarticulation condition obtains between the vowel and the consonant. If one of them has the emphatic feature, the other must bear it. This will account for emphasis in loanwords, as will be seen below. Like other Arabic dialects, emphasis spreads bidirectionally in AA. Leftward spread is unbounded and spreads even to prefixes, e.g. <u>*xayyaaṭ*</u> ‘tailor’ and <u>*b*</u>*a*<u>*ṭl*</u>*a*<u>*ʕ*</u> ‘I go up’ cf. [banzil] ‘I go down’. However, rightward spread is bounded and blocked by high segments, i.e. / i, ii, ee, j, ʃ, dʒ/, as in the following examples.[16]

(12) ṭ<u>ii</u>nak ‘your m.s. mud’ vs. <u>suuf</u>ɑ<u>k</u> ‘your m. wool’

<u>ʕ</u>ɑ<u>ṭ</u>ʃaan ‘thirsty m.s.’ vs. ḍɑ<u>ʕf</u>ɑɑ<u>n</u> ‘getting weaker m.’

ṣɑyyaad ‘a hunter’ vs. ṣɑ<u>*l*</u>ɑɑ ‘prayer’

Emphasis blocking is phonetically motivated as all these segments share a high F2 feature, which is incompatible with the lowered F2 feature of emphatics (Watson 2002; Youssef 2013). Thus, these segments are assigned the non-primary feature [dor] (cf. Watson 2002). (See §2.1.3.3).

Explaining why these high segments block rightward emphasis but not leftward, Watson (1999) argues that this is physiologically grounded and results from an asymmetry between primary and secondary articulations. She adds that:

> “[I]n pharyngealisation, the pharynx narrows prior to the hold phase of the primary articulation; thus, pharyngealisation is

[15] Although emphasis might spread beyond the word domain if an emphatic trigger is re-syllabified with a preceding or a following word, this issue will not be considered further here.

[16] Zawaydeh (1999), studying Ammani Jordanian Arabic, claims that emphasis spread is not blocked in both directions and that it is phonetic rather than phonological. Unfortunately, Zawaydeh does not mention which dialect she designates by Ammani Jordanian Arabic.

> anchored more on the onset of the primary articulation, which results in the anticipatory nature of spread of pharyngealisation as with velarisation” (ibid: 298).

In contrast to Cairene Arabic (Watson 2002; Youssef 2013), blocking in AA takes place whether the high segment is tautosyllabic or non-tautosyllabic with the emphatic trigger. If the high segment is tautosyllabic with the emphatic trigger, it seems to undergo emphasis and the whole syllable is emphatic.[17] However, it blocks its spread to subsequent segments. To test this, I measured the F2 of segments following emphatic and non-emphatic segments shown in the table below.[18]

Table 3.5 F2 readings in emphatic and non-emphatic contexts

ṯilʕat	F2[19]	tilʕab	F2
i	1492	i	1720
l	1673	l	2212
a	1603	a	1660

The two examples above show that the F2 readings of the vowel /i/ and the lateral /l/ drop significantly following the emphatic /ṭ/. This means that emphasis spread affects the whole syllable as it spreads to the lateral, i.e. tautosyllabic high segments undergo emphasis. However, the F2 readings of the low vowel in the following syllable show that tautosyllabic high segments weaken emphasis as a type of co-articulatory effect.[20, 21]

[17] This applies unless the coda is the first leg of a geminate, as in *ṣayy*aa*d*. Failure to undergo spread can be attributed to geminate integrity. If one leg is emphatic then the other leg must be emphatic as well, so it seems that de-emphasis due to the high segment in the following syllable overrides the influence of emphasis spread from the emphatic trigger.

[18] The measurements are done by PRAAT as they are produced by a male native speaker of AA.

[19] This refers to the mean reading across the whole sound.

[20] It should be noted that the effect of the spread differs according to the quality of the following vowel. Low vowels are fully emphaticised regardless of the distance from the trigger unless emphasis is blocked (cf. Herzallah 1990; Shahin 1997) while high vowels tend not to show a remarkable degree of emphasis even when they are adjacent to the emphatic consonant. Moreover, it seems that the intensity

3.1.2.1.2 Emphasis in loanwords

The adaptation of loanwords in AA shows that emphasis is attested in 25 loanwords for /ṣ/ followed by 13 cases for /ṭ/ and two cases for /ḍ/.[22] However, not all loanwords are realised with emphasis by all informants. Only 12 loanwords containing /ṣ/ and four words containing /ṭ/ are emphaticised by all informants, to which I will restrict my analysis. Below are some illustrative examples.

(13) Emphasis in AA loanwords

a) ṣ

ambulance	ʔambalanṣ
boss	buṣṣ
ounce	ʔoonṣa
pass	baaṣ
snubbers	ṣnoobarṣ

b) ṭ

football	faṭbul
short (circuit)	ʃurṭ
trump	ṭarniib

Whether a sound is realised as emphatic or not is judged impressionistically by the researcher. However, to support my judgment, I resorted to two main sources. The first is acoustic. Therefore, I measured the VOT of emphatic sounds and compared it with their plain counterparts by the same speaker presented in Table 3.6 below. I found that /ṭ/ tends to have a lower VOT, which suggests that it is emphatic.

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of emphasis spread is related to the various acoustic qualities of the triggers. Hanafieh (2011: 129) orders the emphatics in SA in terms of the degree of emphasis depending on their articulatory scope, which results from the overall volume of resonance cavities, as follows: /ṣ/, /zˤ/, /ṭ/ and /ḍ/, respectively.

[21] In OT emphasis has been accounted for in other dialects by using Alignment constraints that require the emphatic feature non-primary [guttural] to be aligned with left or right edges of the prosodic domain (see Youssef 2013) .

[22] Emphasis is also triggered by /r/. However, this is left for further study.

Table 3.6 VOT measurements of plain and emphatic alveolar voiceless stops

English	AA	M1	M2	M3	F1	F2	F3
t							
tank	tank	32	42	21	23	35	13
tuna	tuuna	43	37	22	27	52	28
ṭ							
trump	ṭarniib	28	25	13	19	20	13
tuna	ṭunn[23]	22	27	19	17	22	12

The second type of evidence for the emphatic realisation of consonants comes from AA orthography. I checked the spelling of these sounds in the *Dictionary of Everyday Language in Jordan* (2006) and found that eight of these words appear in the Dictionary. All of them are spelt with an emphatic consonant except for 'clutch'. Moreover, I checked the spelling of these words on Arabic signs and advertisements and found that all of them are spelt with emphatic consonants except for 'Christmas' and 'clutch'.

Results show that leftward emphasis is unbounded and it spreads to the whole word, as in *ʔambalanṣ*. However, rightward spread is attested in one word only, namely *ṭarniib* and it is blocked by the high long vowel. Unfortunately, no definitive conclusions can be drawn from this only example.

3.1.2.1.2.1 Where does emphasis come from?

Given that English does not have emphatic phonemes, I argue that emphasis in loanwords is attributed to two factors. The first and chief one is a coarticulation effect. Here, the source of emphasis lies in the vowel where a reinterpretation of a co-occurrence restriction between /ʌ, ʊ, uː, ɑː, ɒ, ɔː, aʊ/[24] and emphatic consonants is established. This co-occurrence is strongest between low back vowels and emphatics and gets weaker the fronter and the higher the vowel is. This relates to markedness as

[23] This is a loanword from French and is used only for measurement purposes as it has the emphatic segment in word-initial position.

[24] To these we can add the schwa before clusters, as in /əns/.

emphasis spreads minimally to CV. Therefore, the unmarked status for a vowel and a consonant in the same syllable is to bear the same features.

A second factor relates to the source consonant. It has been noticed by the researcher that English coronals in these contexts are realised with some degree of phonetic emphasis. Because emphasis in AA is phonemic, it follows that borrowers can perceive it and thus map the consonant onto its closest AA phoneme, which is the emphatic consonant. This occurs when the source phonetic feature is able to re-anchor with the consonant. That is, if the source consonant has an emphatic counterpart in AA, emphasis obtains; otherwise it is lost. For example, the consonant /f/ in 'backfire' would be realised with some degree of emphasis due to its adjacency to the back vowel, i.e. the first element of the diphthong; however, this is ignored as /f/ does not have a contrastive emphatic counterpart in AA.

However, this cannot account for all cases as not all these vowels induce emphasis in the adaptation process. To account for this asymmetry, I argue that upon the introduction of loanwords, if AA borrowers map the source vowel as a low back vowel then the coronal will be emphaticised, otherwise it will be realised as a plain coronal. For example, the low back vowel in 'double' is realised as /u/ yielding *dubul* while the same vowel in 'clutch' *klʌtʃ* is realised as a low back vowel in AA yielding *klaṭʃ*. That the same vowel is mapped differently relates to the complicated process of borrowing, as discussed in Chapter two. In 'double' it seems that borrowing is based on orthography, while in 'clutch' it is oral. Thus, I argue that it is the adapted form that determines whether emphasis will obtain or not. However, the propensity that a source vowel will trigger emphasis increases with backer and lower vowels. These vowels can be ordered in terms of backness and lowness as follows:

ɒ, ʌ, ɑː, ɔː >> ʌɪ, aʊ >> ʊ, uː >> oɪ >> ə.[25]

According to this hierarchy, it is expected that AA borrowers are more likely to interpret a plain English consonant as emphatic in the vicinity of the first set of vowels, i.e. /ɒ, ʌ, ɑː, ɔː / than in the others.

To sum up, markedness factors are invoked to account for emphasis in loanwords. It renders the output less marked as a consonant and a vowel share the same features.

[25] This applies to the schwa only if it is followed by a consonant cluster.

However, more work is still required to enhance our understanding of emphasis in AA. First, a thorough acoustic analysis involving more examples and participants would clarify emphasis spread. Second, a study that investigates emphasis spread that is triggered by /r/ is recommended to shed more light on this phoneme. I turn now to another common phonological process that also renders the output less marked.

3.1.2.2 Assimilation

This subsection reports on assimilatory processes in loanwords. Although the elicitation context is not conducive for phonological processes such as assimilation and lenition as the setting is semi-formal and such processes appear mostly in relaxed speech (cf. Gurevich 2011: 1565), a number of assimilation processes appear in the corpus.

The cross-linguistically most common phonological process, assimilation, refers to a process by which segments come to share certain features (Zsiga 2011: 1919). It could be partial where one or more features are shared or complete where all features are shared resulting in a false geminate (ibid). The assimilation processes in the corpus are divided into four types, presented in the subsections below.

3.1.2.2.1 Voice assimilation

Voice assimilation refers to a process whereby adjacent consonants agree in voicing. As can be seen in the examples in (14), the voiceless obstruents /f/ and /k/ trigger voice assimilation in the first three cases and target the voiced /d/ and /z/. In (d), the voiced alveolar fricative spreads voice to the voiceless alveolar stop.

(14)	a) headphone	hitfon ~ hitifon
	b) foolscap	fuluskaab
	c) vodka	vootka ~ votika
	d) pizza	biidza

This voice assimilation is attributed to the cross-linguistic markedness requirement that obstruent clusters agree in voicing where the last obstruent functions as the trigger (cf. Itô, Mester & Padgett 1995; Lombardi 1999). To check whether this represents a case of TETU or it is an active AA constraint, I checked AA native words and found that this constraint is attested in AA as the examples in (15) show.

(15) ʔagsaam > ʔaksaam ‘sections’ cf. gisim ‘section’
wagt > wakt ‘time’ cf. ʔawgaat ‘times’
ʔafḍaʕ > ʔavḍaʕ ‘more terrible’, cf. faḍiiʕ ‘terrible’
bit-ziid > bidziid ‘you m.s. increase’

Moreover, I checked the whole corpus of loanwords to see if there were any cases that violate this constraint. No such cases were found except for clusters involving the voiced labial /b/. The behaviour of /b/ is also attested in native words, as in *ʔakbar* ‘older’ *xuṭb*[*e*] ‘engagement’, where voice does not spread to the preceding voiceless stop. Therefore, I argue that /b/, being the only labial stop, could be underlyingly unspecified for voice in AA (cf. Abu-Mansour 1996). More loanwords that show that /b/ does not spread voice are given in (16).

(16) Voiceless obstruent-b clusters

facebook	feesbuk
football	faṭbul
spare	sbeer

The corpus also shows that voice does not spread from a sonorant to an obstruent in obstruent-sonorant clusters. The same is found in native words. This again suggests that sonorants in AA are not specified for voice underlyingly (cf. Abu-Mansour 1996). A few examples are given in (17).

(17) Voiceless obstruent-sonorant clusters

cholesterol	kulistrool
christmas	kriṣmaṣ
syringe	srindʒ[e]

3.1.2.2.2 Place assimilation

Place assimilation is rare in the corpus and appears in two words given in (18).

(18)	convoy	kamboy
	baking powder	bikimbawdar

The trigger is a labial while the target is a nasal. This is consistent with cross-linguistic literature on assimilation and is reminiscent of the markedness hierarchy where dorsal and labial sounds are more marked than coronals (Mohanan 1993).This implies that coronals are the least marked in AA. This is motivated phonetically as coronals have weak cues of place of articulation, which are superseded by the stronger cues of labials and dorsals (Hall 2011).

3.1.2.2.3 Complete assimilation

Complete assimilation appears in two words only given in (19).

(19)	charleston	ʃallistun
	stainless	staallis

In the first example, the lateral functions as a trigger and the rhotic is the target. This is unnatural as it is expected that the weaker lateral sound assimilates to the stronger rhotic sound (cf. Heselwood et al. 2011, cited in El-Ramli 2012). This is also attested in native words such as /jiɣfir lak/ > *jixfillak* 'he forgives you m.s.'. It seems that the position of the trigger is the decisive factor with regressive assimilation overriding progressive one.

Moreover, it is noticed that the two cases of complete assimilation affect consonants that are very similar (see Table 3.4 above) where it obtains between /r/ and /l/ on the one hand, and between /n/ and /l/ on the other (cf. Zsiga 2011: 1925). In fact, it is believed that all types of assimilation in AA tend to require great similarities between triggers and targets; the more similar they are the more likely assimilation is expected to occur (cf. Zuraiq & Abu-Joudeh 2013 for other Jordanian dialects). More evidence for this comes from the fact that obstruent gutturals such as /ʕ/ do not spread voice like other obstruents in obstruent clusters (e.g. *tʕaani* 'you suffer'. Some researchers, e.g. Zawaydeh (1999), argue that /ʕ/ is a sonorant. Rather, I think that the similarity between this sound and other obstruents is not enough to trigger assimilation. Note that assimilation in all the cases above is regressive, which is in line with markedness criteria.

A last type of assimilation also appears in consonant-to-vowel assimilation as in (20) below.

(20)	a) baby	bubbu
	b) pedicure	budikiir
	c) trump	ṭarniib

d) balance balanṣ
e) jersey dʒurzaay[e]

In (20a-b), the labial consonant triggers rounding of the vowel. Similarly, the non-primary [guttural] consonants /r/ and /ṣ/ lower and back the vowels in (20c) and (20d). Finally, vowel rounding in (20e) is induced by the alveopalatal affricate, as will be discussed in §3.2.2.5 below. Note that cases of final devoicing could also represent a case of assimilation to silence (Hock 1999, cited in Iverson & Salmons 2011).

To account for assimilation, I follow Zsiga (2011) and argue that it is perceptually and articulatorily motivated. If perceptual cues of a segment are weak or overlap with an adjacent segment, a listener might misperceive the signal and produce the other segment (ibid). Articulatorily, it renders production easier.[26]

3.1.2.3 Lenition

Lenition refers to a group of sound changes that consonants undergo which results in weakening of articulatory effort (cf. Gurevich 2011). Recall that the elicitation context is not conducive for lenition processes due to the semi-formal setting; nevertheless, many lenition processes are attested in the corpus.

Lenition manifests itself in voicing of intervocalic obstruents as shown in (21).

(21) manifold manavult
transit tranziit
wafer weevar

Recall that intervocalic voicing is not a productive feature of the dialect although it appears in a few words, e.g. *fuzdug* > *fustuq* ‘pistachio’**.** Evidence for this comes from the fact that many loanwords escape this phonetically motivated requirement, e.g. *ʔasitun*, *ʔasiid*, and *ʃiita*.

Lenition is also attested in de-aspiration of voiceless stops. Almost all source aspirated voiceless stops are realised in AA with no aspiration, e.g. *tank* and *tinar* except for a few cases that represent free variation.

[26] To account for assimilation formally, the OT literature suggests constraints such as AGREE while the faithful mapping of onset features are accounted for by positional constraints such as IDENT-F(ONSET), (Lombardi 1999). In the same vein, Steriade (2001) opts for a perceptibility-based account, which is based on the idea that prevocalic consonants have stronger place cues than postvocalic ones.

Moreover, de-affrication of the voiceless affricate /tʃ/ is another form of lenition. Recall that this obtains when the source spelling does not contain ‘t’ (see §3.1.1.3.1). Finally, the strongest from of lenition, i.e. deletion of a consonant, appears in the corpus where consonants are deleted to account for illicit consonant clusters. To summarize, it appears that lenition is one of the most common phonological processes that affects source consonants in the adaptation process.

3.1.2.3.1 Motivation for lenition

Usually lenition is attributed to effort minimisation (Kirchner 1998, cited in Gurevich 2011). However, this contention is challenged by Kingston (2008). He shows that the difference in effort between the lenited and the unlenited realisation of a segment is so minuscule that it cannot be attributed to effort minimisation. He argues that lenition is called for “to increase intensity and thereby reduce the extent to which the affected consonants interrupt the stream of speech” (ibid: 17).[27]

3.1.2.4 Fortition

Fortition is a type of consonant strengthening whereby a consonant becomes less sonorous (cf. Grijzenhout 2011). Three fortition processes are attested in consonant adaptation. The first is gemination and it will be investigated in Chapter six. The other processes relate to devoicing and occlusivisation/ hardening.[28]

3.1.2.4.1 Devoicing

Final obstruent devoicing is attested in a few examples, some of which are given in (22) below.

(22)	aids	ʔeeds
	manifold	manavult
	microwave	maykruweef
	valve	balf

[27] In OT literature, lenition is said to result from a constraint called ‘LAZY’ that requires ease of articulation (see Gurevich 2011 for more details).

[28] Vowel lengthening in adapting vowels represents another form of fortition.

Although final devoicing can be argued to be lenition, I follow Gordon (2011a: 828) and consider it a case of fortition. Final devoicing is motivated phonetically where it is difficult to keep voicing utterance finally for aerodynamic factors where subglottal pressure that is needed to maintain voicing is already low (Hayes 2004; Gordon 2007: 65).

It is also motivated perceptually due to the fact that the voicing cues are not very strong in this position (Yu 2011: 1901). This is especially true for stops when they are not released (Blevins 2004). Finally, it relates to markedness criteria where marked features are suspended in weak positions (cf. Kiparsky 2006).

3.1.2.4.2 Occlusivisation

Occlusivisation refers to the realisation of fricatives as plosives. This is a process in progress in AA native phonology and it targets mainly the interdental voiceless fricative, as in (23) below.

(23)	naphthalene	niftaliin
	thermos	teermus
	thermostat	teermustaat
	thinner	tinar

This phenomenon is very common in Arabic dialects (cf. Holes 1995; Al-Wer 2007) and can be attributed to markedness factors in that an interdental fricative is more marked than a stop.

3.1.3 Phonological features in the adaptation process

This subsection examines the role and behaviour of phonological features in the adaptation process. This is of crucial importance as it will shed more light on the AA phonological system and will enhance our understanding of the debated role and organization of phonological features in phonological theory. First, I will examine the behaviour of features in the adaptation process and then I will explain the factors that account for the behaviour of features in consonant adaptation. For the representation of features in AA, see §2.1.3.

3.1.3.1. Behaviour of features in the adaptation process[29]

Features do not behave alike in the adaptation process. Some features are never affected while others are frequently changed. Major class features, namely [sonorant], and [consonantal] are rarely affected –they don’t delink or spread (cf. McCarthy 1988: 87; Morén 2003: 196; among others). This gives more evidence to justifying their attachment to the root node in feature geometries. On the other hand, laryngeal features, namely [voice] and [spread glottis] are the most affected. Manner features in the adaptation process come in-between. Finally, major place features turn out to have a vital role in the adaptation process.

3.1.3.1.1 Laryngeal features

The relevant laryngeal features for the adaptation process are [voice] and [spread glottis]. I argue here that AA, unlike English which is an [aspirating] language, is a voicing language. [voice] is the most single affected feature in the adaptation process where voiced consonants lose their specification for [voice] and voiceless consonants acquire it as the examples in (24) show.

(24) a) Voicing: packet > baakeet, Rolls Royce > rozraayz, wafer > weevar
b) Devoicing: geyser > kiizar, service > sarfiis, valve > balf

The second most affected laryngeal feature is [spread glottis]. Aspiration is argued to be phonemic in English (Iverson & Salmons 2006). On the other hand, it does not seem to be phonemic in AA. To verify this, the VOT values of AA voiced and voiceless stops were tested and it was found that AA voiced stops are produced with a negative VOT or one that is close to zero while voiceless stops are produced with a VOT of 30msc on average. Given these facts, it follows that AA does not use aspiration contrastively so it is expected not to be mapped faithfully. This is the case for almost all cases where source aspirated voiceless stops are de-aspirated in AA, as in *tank* ‘tank’.[30]

[29] An earlier version of this section was presented at the ACCENTS conference, Poland 2013.

30 The alveolar stop /t/ is sometimes aspirated by some informants.

3.1.3.1.2 Manner features

Manner features are not always mapped faithfully. The most violated manner feature is [continuant] while the feature [Strident] is never violated in the adaptation process. Other features are sometimes violated for assimilation or dissimilation factors as shown in (25) below.

(25) a) [ ] > [continuant]: check > ʃakk
b) [continuant] > [ ]: thinner > tinar, valve > balf
c) [lateral] > [nasal]: goal > goon
d) [rhotic] > [lateral]: Charleston >ʃallistun
e) [nasal] > [lateral]: > stainless > staallis
f) [strident] is never violated[31]

3.1.3.1.3 Place features

Place features have a unique status in that major place features are rarely violated while violations within the same major phonological class are tolerated. That is, faithfulness to the phonological class of the consonant is respected such that another consonant from the same phonological class could replace the problematic consonant.[32] The following phonological classes in (26) are hardly ever violated:

(26) [labial] (m,f,v,p,b) > [labial]
[coronal] (l,r,n,t,d,θ,ð,s,z) > [coronal]
[dorsal] (j, ʃ, ʒ, tʃ, dʒ, k, g, w)> [dorsal]
[pharyngeal] (h,ʔ …) > [pharyngeal]

Take for example the consonant /p/. According to its phonological place class it could be replaced by any of the other members of its class, i.e. [m, f, v, b]. This is the case in AA adaptation processes. The labial is adapted either as [b] or [m].[33] It should be emphasised that this should be interpreted as a gradient rule rather than an absolute one.

[31] Note that a strident is deleted in one case though.

[32] This is in line with the general observation that similarity avoidance in Arabic roots is mostly based on place features (see Frisch et al. 2004).

[33] Recall that /p/ was also realised as /f/ in old borrowings from Greek and Persian.

A final note on allophonic features is in order. Source allophonic features are either ignored, as in aspiration [spread glottis], or retained such as vowel backness. It seems that allophonic source features that are also allophonic in the borrowing language are ignored since they are not easily perceived by AA adapters and thus immaterial in the adaptation process whereas those that are phonemic in the borrowing language are faithfully adapted. This lends support to the phonological nature of the adaptation process.

The above observations on the behaviour of phonological features in the adaptation process indicate that the adaptation process is generally grounded on phonological articulatory features rather than phonetic ones. That is, loanwords are adapted in terms of L1 distinctive features where proximity in feature geometry and articulatory features better account for the adaptation process where repairs usually target terminal features. Moreover, faithfulness to place features is top ranked in AA while those to laryngeal features are bottom ranked.

Manner features are violated more frequently than place features, which appears to contradict Steriade's (2001) and Miao's (2006) claims that the perceptibility scale of featural distinctiveness is: Manner >> Place >> Voicing/Aspiration.

The primacy of place features receives support from other studies that report that faithfulness to place features is more respected than to manner and laryngeal features (cf. Broselow 2001; Apichai 2007; Wetzels 2009: 257; de Jong & Cho 2012). My findings support views advocated by articulatory-based approaches, which give primacy to articulation rather than acoustic terms.

3.1.3.2 Implications for phonological theories

Results suggest that a bigger role should be given to phonological place features in the *Feature Geometry*: a place featural description of consonants that is based on articulatory place features seems to be a better approach. This is consistent with the contention that active articulators only are argued to have cognitive reality (cf. Roca & Johnson 1999: 88). Moreover, major class features never delink or spread. This lends support to their association directly to the root node.

Findings are also relevant to Underspecification Theory. It can be argued that sonorants and the voiced labial stop are underspecified for [voice] in AA, as discussed in §3.1.2.2.1. Coronals are specified in AA but they are the least marked. Moreover, results suggest that the nasal coronal is the least marked sonorant in AA. This might also apply to Arabic dialects in general, which is worth investigating.

Results also pertain to foreign language acquisition theories. Findings show that perception is guided by L1 phonemic status of features so extra attention should be given to perceptual training in language acquisition.

3.1.4 Section summary

This section has accounted for the adaptation of English consonants in AA. It has been shown that the adaptation is phonological in nature. For example, the labiodental /v/ is auditorily close to the velar glide /w/ (cf. Peperkamp & Dupoux 2003 for Cantonese);[34] nevertheless, it is adapted phonologically as /f/ or rarely as /b/. It should be emphasized that it is the phonological status of the source segment in AA that determines the adaptation. A source phonetic feature that is phonemic in AA is mapped faithfully in AA cf. emphasis, while a phonemic source feature that is allophonic in AA is ignored cf. /p/.

With respect to the role of phonological features it has been shown that place features have a bigger role than manner and laryngeal features. Moreover, the adaptation process tends to seek to render the AA feature system more symmetrical. Incorporating the labiodental voiced fricative /v/, which is the norm in many loanwords, increases the system economy and symmetry. However, this is not the case for the bilabial voiceless stop due to its phonetic inefficiency.

It has been shown that markedness has a great role in the adaptation. The adaptation process is geared towards unmarkedness in that the least marked output surfaces. This manifests itself also in TETU, as pointed out throughout the section. This section has shed more light on AA segmental phonology. For example, results indicate that dark /l/ is an allophone rather than an independent phoneme in AA, which could extend to other secondary emphatics in AA and in Arabic in general. Findings also confirm that occlusivisation of the interdental voiceless fricative is a productive process in

[34] Peperkamp & Dupoux (2003: 378) add that "Cantonese lacks the voiced fricative [v]. In loanwords from English, it is changed into [w], not [f], arguably because [w] more closely approximates the acoustic properties of English [v]."

progress. Finally, results point to the unmarked status of nasal codas in AA. In the following section, I turn to the adaptation of English vowels, which is expected to show more variance.

3.2 Vowel adaptation

This section accounts for vowel adaptation within loanwords. In contrast to consonant adaptation, vowel adaptation is expected to be more complicated and show more asymmetry due to the apparent discrepancy between English and AA vowel systems. AA has eight vowels: three short vowels (with two positional allophones), three long vowels and two diphthongs that are monophthongised most of the time. On the other hand, British English has a very rich vocalic system. It has 20 vowels (excluding triphthongs): seven short vowels, five long ones and eight diphthongs (Roach 2000). That is, English has double the number of AA vowels. Therefore, there would be no one to one correspondence between AA and English vowels. Moreover, vowels do not carry as much information as consonants (Nespor, Peña & Mehler 2003: 205) so vowel adaptation is expected to be less faithful than that of consonants.

Ideally, we expect an English vowel to be mapped faithfully to its closest AA counterpart, if there is one. However, this is not always the case. Sometimes, vowels are mapped onto less similar vowels acoustically and phonologically. Factors that account for the unfaithful mapping of English vowels onto AA include, but not restricted to, vowel harmony, consonant-to-vowel harmony, prosodic factors such as stress, foot-binarity, morphology and non-phonological factors such as orthography.

First, I summarise the mapping of English vowels onto AA in Table 3.7.

Table 3.7 Adaptation of English vowels into AA

Class	English source	Typical AA realisation	Other realisations
Short vowels			
	ɪ	i	ii/ee/aa, a, ø[35]
	e	i	a, ee, ii, u, ɑ
	æ	a/aa	i, u

[35] English long vowels are transcribed with a colon while AA ones by doubling. Vowel realisations are ordered according to their frequency.

Class	English source	Typical AA realisation	Other realisations
	ɒ	u/o	oo , a/ɑ, uu
	ʊ	u/o	a, ɑ
	ʌ	a/ɑ	u, aa, i
	ə	a	u/o, oo/uu, i, ee, aa, ɑ
Long vowels			
	i:	ii	i, a
	u:	uu/oo	u/o
	ɔ:	oo	o, a
	ɑ:	aa/ɑɑ	a, ɑ, ee
	ɜ:	ee	u, a, i
Diphthongs			
	ɪə	ii	ya/yu, yaa
	eə	eer	er (free variation)
	ʊə	iir/eer	u
	əʊ	u/o	oo, uu, a
	aʊ	aw	a, u, oo
	eɪ	ee	aa, ii, i/a/u/e
	aɪ	ay	ii, i, a, ø
	ɔɪ	oy	

It can be seen from the table that there is no one to one mapping between source and adapted vowels; nevertheless, the majority of the adaptation is phonological, as will be shown throughout this section. Moreover, vowel deletion is rare, which is consistent with the literature on loanwords (cf. Paradis & LaCharite 1997, 2011; among others). Monophthongisation of English diphthongs is the norm except for three diphthongs. Finally, vowels undergo shortening and lengthening processes for different reasons, as will be explained.

The subsections below highlight the most important aspects of vowel adaptation in the corpus of English loanwords in AA. First, in §3.2.1, I present the results of adapting short vowels, then I proceed to the adaptation of long vowels in §3.2.2, then to integration of diphthongs in §3.2.3. §3.2.4 addresses the adaptation of vowels in terms of backness, height and length and §3.2.5 compares AA vowel formants and their English counterparts to find out whether correspondence is acoustic or phonological and finally §3.2.7 reports on the most common phonological processes that affect vowel adaptation, namely lengthening, shortening, monophthongisation and harmony.

3.2.1 Adaptation of short vowels

The adaptation of short vowels is phonological such that an English short vowel is adapted into its closest phonological short or long AA counterpart. However, it is not faithful due to markedness factors such as STRESS-TO-WEIGHT Principle (SWP), FOOT-BINARITY and harmony. Moreover, orthography and morphology play a noticeable role in integrating short vowels.

3.2.1.1 Adaptation of / ɪ/

The majority of cases of the English short high front vowel /ɪ/ are realised as AA [i]. It is lengthened in 21 cases and realised as [ii] as in *ʔasiid* ‘acid’, [ee] as in *baakeet* ‘packet’, or [aa] as in *borsalaan* ‘porcelain’.[36] All these cases have stress on the lengthened vowel so this could relate to markedness principles that favour stressed syllables to be heavy, as will be discussed in §3.2.7.1. Spelling could account for a few cases such as ‘porcelain’ and jersey’.

It is realised as [a] in 18 cases. This can be accounted for in terms of vowel harmony, as in ‘corr**i**dor’ and ‘man**i**fold’ (see §3.2.7.4. on vowel harmony). [37] In ‘between’ > *batwan* and ‘fabr**i**cate’ > *fabrak*, it is realised as /a/ to fit into the prosodic morphological verb templates in AA. Morphological factors also account for the realisation of final /i/ in words such as ‘biology’ and ‘technology’ as [a] where these words are assigned feminine gender in AA, so they need to be marked morphologically as such.

It is deleted in seven cases, as in ‘caf**e**teria’, and ‘s**y**ringe’. All these cases represent the productive syncope rule in Arabic that deletes high vowels in open syllables (see

[36] The number of cases refers to actual loanwords not to tokens realised by informants due to the high number of tokens.

[37] The vowel in question will be marked in bold when the need arises.

§4.4.3). On the other hand, the high front vowel is inserted in 16 cases for phonotactic reasons, as will be examined in §4.4.4.

The adaptation of /ɪ/ into [a] could also be a case of strengthening open syllables, as in *ʔa.mil.ʃin* '**e**mulsion' and *ma.liiʃ.ya* 'm**i**litia'. Lowering the vowel renders it more sonorous and therefore it strengthens open syllables that are otherwise weak (Farwaneh 2009: 104; Gordon 2011a: 929).

3.2.1.2 Adaptation of /æ/

The two most common realisations of the source /æ/ are its short [a] or long [aa] counterparts in AA, with [a] in the majority of cases. Its mapping onto AA [aa] is considered faithful as I assume that the source vowel /æ/ corresponds to the long AA vowel /aa/ and the schwa corresponds to the short AA vowel /a/. This is motivated on the grounds that its length is retained if one consonant follows while shortened if two consonants follow, as in *ʃanṣ* 'chance' and *ʔaks* 'axle'. Moreover, the adaptation of words such as 'baggy' and 'chat' follows the norms adopted to map long vowels in the adaptation process. Also, AA spelling shows that AA treats it as a long vowel. Moreover, this vowel is longer than the schwa in English and it is long in American English, from which some words might have been borrowed. Finally, the researcher has noticed that AA bilinguals pronounce it as a long vowel in their interlanguage. All in all, whether this is assumed to be long or short will not affect our analysis substantially as the vowel undergoes length modifications to satisfy AA metrical markedness constraints.

Again, /æ/ is shortened in many cases due to foot binarity, as in *ʔalbuum* 'album', *manavult* 'manifold' and *tank* 'tank' (see §3.2.7.2). It is realised as [i] in five cases, as in 'n**a**phthalene' and 'r**a**cquet' and as [u] in one case, namely 'm**a**nhole' > *munhul*, for consonant-to-vowel assimilation from the labial nasal or vowel harmony triggered by the following round vowel.

3.2.1.3 Adaptation of /e/

Although [e] appears in AA as the feminine suffix, I argue that this is only a positional allophone and the suffix is underlyingly /a/. Evidence for this comes from the adaptation process where /e/ is never imported. Were it an underlying phoneme in AA, it would manifest itself in the adaptation process. In the majority of cases, /e/ in the source word is raised to the phonologically closest AA counterpart, i.e. [i]. Some examples are given in (27).

(27)	desk	disk
	extra	ʔikistra
	h**ea**dphone	hitfun
	gel	dʒill
	net	nitt

In five cases it is adapted as [ee] as shown in (28).

(28)	carbur**e**ttor	karbureetar
	compr**e**ssor	kumbreesa
	etiqu**e**tte	ʔitikeet
	georg**e**tte	dʒurdʒeet
	moqu**e**tte	mookeet (~ mukeet)

In all these cases, the source /e/ is lengthened and stressed. Also it could be the case that the last three words came from French, where they are pronounced with a long [ee]. Similarly, it is lengthened to [ii] in four cases, such as *liigu* ‘lego’ and *swiitar* ‘sweater’.

It is lowered to [a] in ten cases such as ‘ketchup’ and ‘nectarine’ for vowel harmony. Likewise, morphological reasons account for *santar* ‘centre’. The English noun ‘centre’ is used as a verb in AA and consequently needs to fit into the morphological prosodic verb template in AA, which has the vowel /a/. Vowel harmony also accounts for cases such as ‘chol**e**sterol’ and ‘professor’, where /e/ is realised as [u] to harmonise with the preceding round vowel. Labial harmony is attested in ‘pedicure’ > *budikiir*, where /e/ is labialised and backed following the labial consonant. In *ʔaṣanṣ* ‘essence’, /e/ is realised as a low back vowel [ɑ] due to emphasis (for more details on emphasis see §3.1.2.1).

3.2.1.4 Adaptation of /ʊ/

In the majority of cases the short high back vowel is realised as [u], as in *full* ‘full’ or lowered to its AA allophone [o] due to emphasis or labial consonants, as in *feesb*[*o*]*k* ‘facebook’. It is also lowered to [a] or its allophone [ɑ] in four cases, namely ‘ambulance’, ‘cappuccino’, bulldozer’ and ‘football’. In the first two words it could be due to vowel harmony where /ʊ/ harmonises with the preceding low vowel. ‘football’ is usually realised with [ɑ] but with [o] by two female informants. Interestingly, in ‘distributor’ > *disbaratoor*, /ʊ/ is adapted as [a] where a number of other phonological processes affect this word to render it well-formed in AA. Suffices it to say here that its realisation as [a] could result from vowel harmony, as will be explained in §3.2.7.4.

3.2.1.5 Adaptation of /ʌ/

The closest AA vowel to this vowel is the emphatic allophone of the low front short vowel /a/, i.e. [ɑ]. So it is expected that a faithful mapping of this phoneme would yield [ɑ]. Unexpectedly, this is not the case as only 6/21 cases are realised as such, as shown in (29).

(29)	clutch	klɑtʃ
	hard luck	hɑɑrd lɑkk
	hummer	hɑmɑr
	nightclub	nɑjtiklɑbb
	seven up	sivin ʔɑbb
	tupperware	ṭɑbɑrweer

In eight cases, (38%), /ʌ/ is realised as the non-emphatic [a], as in ‘custard’, ‘cut-out’ and ‘pick up’. Naturally, the emphatic counterpart is the expected realisation; nevertheless, it seems that the actual adaptation goes with the general tendency in AA towards de-emphaticisation (cf. Khattab, Al-Tamimi, & Heselwood 2006).

Also /ʌ/ is adapted as [u] in ‘d**u**md**u**m’, lux’ and ‘snubbers’. Although it is tempting to attribute this adaptation to spelling, it remains unclear why the same does not hold for the majority of other forms that are spelt with ‘u’ as well.

In ‘em**u**lsion’ > *ʔamilʃin*, /ʌ/ is adapted as [i] by all informants. This could be attributed to vowel harmony that is triggered by the following vowel, which is realised as [i] apparently due to spelling pronunciation or as a weakening process of the closed vowel (cf. Farwaneh 2009). Finally, it is lengthened in three words in (30).

(30)	jumbo	dʒaambu
	rubbish	rɑɑbiʃ
	trump	ṭarniib

The lengthened vowel receives stress in the three examples. Again, this shows a high correlation between stress and syllable weight, as will be shown in Chapter five. (See also §3.2.7.1).

3.2.1.6 Adaptation of /ɒ/

In the majority of cases it is adapted to its closest AA phoneme, /u/, or its allophone [o]. Some illustrative examples are given in (31).

(31)	boss	b[o]ṣṣ
	stock	stukk
	morris	m[o]ris

It is also lengthened in seven cases and realised as [oo], e.g. ‘dettol’ > *diitool* and as [uu] in ‘lobby’ > *luubi*. Again, all these lengthened cases are stressed on the lengthened syllable.

In four cases, it is realised as [ɑ] or [a] as in (32)

(32)	body	bɑdi
	coffee shop	kɑfiʃub
	convoy	kɑmboj
	corridor	karadoor

These words, especially the first two, are recent borrowings and most probably have entered the dialect through American English where /ɒ/ is pronounced as [ɑ]. Compare this with the old borrowing ‘body’ > *budi*. Moreover, in *karadoor*, it could also result from vowel harmony to the following vowel, which is pronounced with a schwa in American English or it could be the case that the short high front vowel is lowered due to the rhotic sound, which is realised as an emphatic in AA. That is, the rhotic lowers the vowel that in turn triggers harmony.

3.2.1.7 Adaptation of /ə/

The adaptation of the most common vowel sound in the adaptation process, the schwa, is expected to vary considerably. This relates to the fact that its variable phonetic qualities depend on context and its being stressless induces shortening which leads to contrast loss that leads to co-articulation (cf. Kato 2006: 107; Silverman 2011: 632). Also orthographically, it is spelt in many different ways.

The closest AA phoneme to English schwa is the low front short vowel /a/. Therefore, it is expected that the majority of cases will opt for /a/ in the adaptation process. The results show that this is the case. It is also adapted as [a] followed by /r/ in many words; all of them are spelt with a following 'r' in the source language. Consider the following illustrative examples in (33) that show how /r/ is kept in the adaptation.

(33)	boiler	bojlar
	cancer	kaansar
	centre	santar
	geyser	kiizar

Less faithful adaptations are attested in its realisation as [ɑ] in five cases due to emphasis, as in 'ambul**a**nce' and 'bal**a**nce'. It is also realised as [i] in 18 cases such as 'aspir**i**n', 'condition', 'gent**l**e', 'pix**e**l' and 'syst**e**m'. These cases are due to spelling, as in 'aspir**i**n' and 'pix**e**l' or to the unpacking of the syllabic /n/ or /l/ as AA does not have syllabic consonants in coda position so a syllabic consonant is realised with a default /i/.[38]

It is backed and rounded in 32 cases and realised as [u] or [o] as shown in (34).

(34)	cholesterol	kulistrool
	compressor	kumbreesa
	computer	kumbjuutar
	control	kuntrool

Note that all these 32 words, except for one, are spelt either with 'o' or 'u'. This shows that orthography is behind this adaptation. The only exception relates to the

[38] The question whether /i/ is the default vowel in AA is examined in §3.2.7.4 below.

word ‘**a**ccordion’ where it is spelt with ‘a’. Its realisation as [u] is attributed to vowel harmony.

Lengthening is attested in 22 cases. It is realised as [oo] or [uu] in 11 cases where the source vowel is spelt with ‘o’ or ‘u’ as in *maraθoon* ‘marathon’. The lengthened vowel also carries stress. In the other forms it is realised as [ee] in ‘pan**e**l’ and round**e**l’, which could have come via French, or as [aa] in nine cases such as ‘continent**a**l, and ‘j**a**cuzzi’. For these nine cases, it could be argued that lengthening is due to foot-binarity and/or to stress, as discussed in §3.2.7.1.

Note that although word-final schwa is more stable than word medial ones (Flemming 2007), this does not affect its realisation in AA, which indicates that its phonetic qualities do not affect its adaptation, contrary to perceptual models’ predictions.

3.2.2 Adaptation of long vowels

Given that long vowels are more salient than short vowels, they should be mapped more faithfully than short ones in the adaptation process according to perceptual models. If this turned out to be true that would give support to perceptual models. However, results show that this is not the case and only 47% of long vowels retain their length in the adaptation process. It will be demonstrated that faithfulness to length will be violated to satisfy metrical structure. Below, I present the adaptation of each long vowel on its own.

3.2.2.1 Adaptation of /i:/

This English vowel is very close to AA /ii/, so it is realised as such in the overwhelming majority of cases as shown in (35).

(35)	bikini	bikkiini
	camellia	kamiilya
	cheetah	ʃiita
	diesel	diizil
	heater	hiitar

However, it is shortened to [i] in six cases given in (36).

(36)	a) chimpanz**ee**	ʃambɑɑzi
	b) kiw**i**	kiiwi
	c) chen**i**lle	ʃanil
	d) j**ea**ns	dʒinz
	e) n**e**on	nijun
	f) k**ey**board	kiboord

Shortening in (36a-b) can be attributed to a tendency in AA that shortens unstressed open long syllables word-finally while shortening in (36c-d) could be accounted for in terms of foot-binarity (see §3.2.7.2.3 below). However, shortening in (36e-f) is a postlexical process whereby long vowels are shortened before stressed ones (cf. Watson 2002 for Cairene Arabic), which I will call pretonic long vowel shortening in §3.2.7.2.3. This is corroborated by the fact that 'keyboard' is produced with a long vowel by some informants. Finally, it is realised as [a] in 'between' to fit into the prosodic verb template in AA.

3.2.2.2 Adaptation of /u:/

AA has a very close counterpart to the English long high vowel /u:/. Of the 50 occurrences of this vowel in the corpus, unexpectedly only 19 cases are adapted into AA [uu]. In 13 cases, its length is maintained but lowered to [oo]. Illustrative examples are given in (37).

(37) a) /u:/ > uu

cooler	kuular
roof	ruuf
shoot	ʃuut
tattoo	tattuu

b) /u:/ > oo

boot	boot
cruiser	kroozar
nougat	nooga
routine	rootiin

It is shortened either to [u] or to [o] in 13 other cases. On the face of it, this suggests that the process is not phonological. On closer inspection it is found that shortening, as well as lengthening, as will be shown in §3.2.7.1 and §3.2.7.2, is invoked to satisfy prosodic constraints. This is consistent with Paradis & LaCharite's (1997) observation that faithfulness to higher phonological levels is more crucial than to lower levels. So shortening here results from pretonic long vowel shortening, as in *kuboon* 'coupon' or from final long vowel shortening in open syllables, as in 'shampoo'. See §3.2.7.2 for more details.

3.2.2.3 Adaptation of /ɑ:/

This low back long vowel has an allophonic counterpart in AA, i.e. /ɑɑ/, which is found in emphatic contexts.[39] 31 out of 47 cases are adapted as either [aa] or [ɑɑ] or sometimes with both realisations for the same form by different informants. This is again related to the tendency of de-emphasis among AA speakers. Some examples are shown in (38).

(38)	a) collage	kullaadʒ
	kata	kaata
	massage	masaadʒ ~ massaadʒ
	montage	muntaadʒ
	b) caviar	kavjaar
	plaster	blaastar
	x-large	ʔiks laardʒ
	starter	staartar
	c) bravo	brɑɑvu
	fibreglass	fiibɑriglɑɑṣ
	hard luck	hɑɑrd lɑkk
	pass	bɑɑṣ

The examples in (a) are always realised with [aa] with no free variation with a front vowel among all informants. However, the examples in (b) are produced with a front vowel by some informants and with a back vowel by others. Backing could be an attempt by borrowers to map the vowel faithfully or a case of coarticulation from the

[39] Note that in American English this phoneme is pronounced as a front /æ/ in many cases --a fact that might affect the adaptation process if the word enters the dialect through American English, which is probable due to American influence in Jordan especially through the cinema.

rhotic sound or the velar voiceless stop. Finally, the examples in (c) are always produced with a back vowel. This is very much related to emphasis in AA (see §3.1.2.1).

/ɑ:/ undergoes shortening in 15 cases, of which 14 cases show shortening to [a] so it keeps its height feature while sacrificing its backness. Again, the majority of these shortening cases are due to foot-binarity, as in 'c**a**rbon', 'c**a**rburettor' and c**a**sket'. In two cases, shortening is attributed to long vowel shortening word-finally in open syllables, as in *kaata* 'kat**a**' and *nooga* 'noug**a**t'.

Finally, it is realised as [ee] in 'derby' by all informants. This could be attributed to spelling or to American English pronunciation where it is pronounced with the central long vowel /ɜː/.

3.2.2.4 Adaptation of /ɔː/

This vowel is close to the mid long vowel that results from monophthongising the diphthong /aw/ in AA. It appears 21 times in the source words, of which 11 cases are mapped faithfully into [oo] as shown in (39).

(39)	corner	koornar
	folklore	fulukloor
	mall	mool

In the other cases it is shortened to [o]. Similarly, shortening is attributed to the same factors that apply to /u:/ and / ɑ:/ above. Some illustrative examples are given in (40).

(40)	cortisone	k[o]rtizoon
	exhaust	ʔigz[o]st
	seesaw	siis[o]
	short	ʃ[o]rṭ

3.2.2.5 Adaptation of /ɜː/

This central vowel appears 10 times only. It is realised as [ee] in six words such as 'earth', 'nurse' and 'thermos'. It is shortened into [u] in two words, namely 'hamb**u**rger' and 'j**e**rsey' while it shortens to [a] in 's**e**rvice' and to [i] in 'surf'. The same arguments for shortening above apply here. Moreover, spelling could be behind the adaptation of ‘hamburger’. For ‘jersey’ it seems plausible that the affricate /dʒ/ induces rounding as this phoneme has a rounding enhancement feature in English (Hoole & Honda 2011). The same could be argued for AA as some native words in AA have a round vowel following /dʒ/. For example, the adjective *dʒiʕaan* ‘hungry m.s’ appears as *dʒuʕaan* among many AA speakers.

3.2.3 Adaptation of diphthongs

It is expected that the least faithful mapping of vowels in the adaptation process will belong to diphthongs. British English has eight diphthongs in addition to triphthongs. In contrast, AA has only two diphthongs that undergo monophthongisation most of the time. I assume here that a diphthong is more marked than a monophthong and therefore if the adaptation process leads to monophthongisation then it is geared toward unmarkedness. The corpus shows that this is the case as only 24% of diphthongs are realised as diphthongs. All these cases relate to three diphthongs only, namely /aɪ/, /aʊ/ and /ɔɪ/.[40] This is not surprising given that the first two diphthongs have AA counterparts. In addition, these three are heterogeneous diphthongs that have extreme aperture between the two vocalic elements, which makes them perceptually and phonetically less marked.

3.2.3.1 Adaptation of /ɪə/

The diphthong /ɪə/ appears 12 times, all of which are monophthongised. It is realised as [ii] retaining the quality of the first member in five words, namely ‘cafet**e**ria’, ‘cash**ie**r’, ‘gear’, ‘st**ee**ring’ and ‘st**e**reo’. Glide formation is attested in the other forms, which is due to reanalysing the V-V formant transitions (Blevins 2004: 166). The glide is either followed by the short vowel [a] or [u] depending on spelling, or by the long vowel [aa] in two forms that receive stress on that long vowel. Some illustrative examples are given in (41).

(41)	cafeteria	kaftiirja
	mafia	maafja
	pancreas	bankirjaas
	valium	vaaljum

[40] Note that these are true diphthongs in American English, where some loanwords might have come from.

3.2.3.2 Adaptation of /eə/[41]

It appears six times and it is always realised as a long monophthong followed by [r], i.e. [eer]. The monophthongisation process is faithful to length and retains the quality of the first high member. It also shows variation for two forms only where the vowel seems to be shorter in ‘airbus’ and ‘airbag’. The other four words are given in (42).

(42)	billionaire	biljuneer
	millionaire	maljuneer
	spare	sbeer
	tupperware	ṭɑbɑrweer

3.2.3.3 Adaptation of /ʊə/

This is one of the least common diphthongs in the corpus. It appears in four loanwords only and undergoes monophthongisation across the board. It also undergoes shortening in one form, namely ‘fluoride’ yielding [u] while in the other forms it is realised as a long [ii] or [ee] followed by the rhotic consonant, as in *manakiir* ‘manicure’ and *kwaafeer* ‘coiffure’.

3.2.3.4 Adaptation of /əʊ/

In 63% of cases (31/49) it is shortened. It appears as [u] or its allophone [o] in 30 forms. All these shortening processes are attributed to the same factors that account for shortening above.

(43) a. shortening word-finally

bravo	brɑɑv[o]
disco	diisk[o]
lego	liig[o]

b. shortening for foot-binarity

flow master	fulumɑɑstɑr
manifold	manavult

c. pretonic long vowel shortening

[41] Although the Oxford dictionary differentiates between /ɛː/ in ‘billionaire’ and the diphthong /eə/ in ‘airbag’, I will follow the mainstream transcription and treat them as diphthongs as there are only a few cases of both.

mobile	m[o]bajl
ozone	ʔuzoon
sonar	sunaar

Moreover, its length is maintained but its gliding movement is dispensed with in 17 cases where it is realised as [oo], as in ‘control’ and ‘remote’. In almost all these 17 forms stress falls on the long vowel which forms the rightmost foot in the word (see §5.1.4 for stress assignment). This indicates that a loanword that has a potential stress carrier in AA, i.e. it has a heavy syllable that occurs at the right edge of the word, its vowel would be more likely preserved. However, the three words that are not stressed, namely ‘mobile’, ‘ozone’ and ‘protein’, are followed by a potential stress carrier in AA and hence unstressed. Also they undergo shortening by some informants.

It is also realised as [uu] in one word, i.e. ‘mauve’ and it shortens to [a] in another word, i.e. ‘motor > *matoor*. The latter form is spelt in Arabic with a long /aa/ so it could be that it is adapted as [aa] in AA and shortening applies postlexically due to pretonic long vowel shortening.

In almost all cases, the quality of the monophthong is governed by the round member of the source diphthong, unlike the previous cases where the first member determines the quality of the resulting diphthong. This suggests that the quality of the adapted monophthong is determined by robustness, where the schwa is weaker than other vowels.

3.2.3.5 Adaptation of /aʊ/

It appears 10 times in the corpus.[42] It is adapted as [aw] in seven loanwords such as ‘counter’ and ‘foul’. In two words it undergoes shortening. In ‘cowboy’ it shortens to [a] due to pretonic long vowel shortening and in ‘roundel’ it shortens to [u] due to foot-binarity. It is monophthongised into [oo] only in *ʔoonṣa* ‘ounce’.

3.2.3.6 Adaptation of /eɪ/

It appears 47 times in the corpus and it is always monophthongised where the first vocalic element usually determines the quality of the coalesced vowel. Interestingly, no glide formation is attested in the adaptation of this diphthong at all. It is realised as

[42] One more form could have this diphthong, namely ‘sauna’ (from American English).

a long vowel in 23 loanwords where the closest AA vowel, [ee], appears. A few examples are shown in (44).

(44)	cake	keek
	laser	leezar
	trailer	treella
	wafer	weevar

In five loanwords, e.g. 'prostate' and 'stainless', it is realised as [aa] and it receives stress. Its length is maintained in three more cases where it is realised as [ii], as in *kukaʔiin* 'cocaine'. For the remaining 17 loanwords it is shortened into [i], [a], [u] or [e] as shown in (45).

(45) a. /eɪ/ > [i]

cornflakes	kurnifliks ~ koornifliks
cakes	kiks
range	rindʒ

b. /eɪ/ > [a]

grapefruit	karafoot
patron	batroon[e]
baking powder	bakimbawdar

c. /eɪ/ > [u]

baby	bubu
radiator	rudeetar
regime	rudʒiim

d. /eɪ/ > [e]

fabricate	fabrak[e]

Its shortening can be ascribed to the reasons that apply to shortening in general (see §3.2.7.2). However, the choice between short vowels requires some comment. It is noticed that the diphthong shortens to [i] if it appears in a closed syllable while to [a] in an open syllable. This might relate to two phonological reasons. The first relates to the syncope rule that affects high vowels in open syllables in AA and the second relates to sonority and weight. As [a] is more sonorous than [i], it seems that AA tends to use a strengthening process as an open syllable with /a/ in the nucleus is stronger than that with /i/ (cf. Farwaneh 2009: 104; Gordon 2011a: 929).

For [u], it is a result of labial harmony in ‘baby’ and the effect of /r/ and probably /dʒ/ in the other examples. The last example in (d) shows a morphological effect where the consonants of the English verb are extrapolated to make a noun according to AA morphological templates. The extra fifth consonant /t/ is deleted and the feminine suffix marker appears as [e].

3.2.3.7 Adaptation of /aɪ/

This diphthong appears 29 times. Faithfulness to its length is extraordinarily maintained as it undergoes shortening in two forms only, namely ‘biology’, and ‘niagara’. Also, its gliding quality is preserved in 21 cases. This could be attributed to three factors. First, it has an AA counterpart. Second, its vocalic elements have a very wide aperture that makes it less marked. Finally, the majority of words containing this diphthong are less familiar words to lay people (most of them have an Arabic equivalent). In fact, many of which are recent borrowings, e.g. ‘antivirus’, ‘bye’, ‘mobile’ and ‘off side’. More examples are given in (46).

(46)	carbohydrate	karbuhajdraat
	microscope	majkruskoob
	minus	majnus
	topsider	tubsajdar

It is realised as a long monophthong in five words, namely ‘archive’, ‘cyanide’, ‘fibreglass’, ‘primus’ and ‘siphon’. Finally, it shortens to either [i] or [u] in ‘biology’ and to [i] or [a] followed by a glide in ‘niagara’ > *n(a/i)yaagra*.

It is deleted in only one word, namely *bulistriin* ‘polyst**y**rene’. Apparently, it is syncopated by borrowers assuming that it is a short high vowel due to spelling.

3.2.3.8 Adaptation of /ɔɪ/

This vowel is also rare in the corpus and appears six times. Again, all these cases are realised as [oj], as in ‘coil’, ‘cowboy’ and ‘boiler’. The same factors that apply to retaining the diphthong /ai/ above could account for preserving this diphthong as well.[43]

To summarize, English diphthongs are monophthongised in the majority of cases while faithfulness to length is mostly respected unless overridden by metrical constraints. As has been shown, coalescence tends to be determined by two factors: robustness where the quality of the schwa is lost and position where the first vocalic member determines the quality. This is not surprising given that the first vocalic part in the source diphthong is longer and stronger than the second part (Roach 2000: 20).

3.2.4 Adaptation in terms of backness, height and length

To further understand the adaptation of vowels, this subsection addresses the adaptation of vowels in terms of three dimensions: length, backness and height. It will be shown that the adaptation is usually faithful to these dimensions although AA has an impoverished vowel system. As shown in the previous subsection, vowel adaptations are usually faithful unless they conflict with metrical constraints and other non-phonological factors.

The tables below give percentages of vowel adaptation in terms of the three dimensions. On the whole, it can be seen that the adaptation process is usually faithful with overall percentages ranging from 55% (411/749) for F1 axis to 63% (468/746) for F2 axis to 74% (695/939) for length. Details are given in the tables below with the most relevant percentages in bold for ease of comparison.

Table 3.8 Adaptation in terms of length

	Long	(%)	Short	(%)	Total
Long	106	**47**	119	53	225
Short	64	12	484	**88**	548

[43] Triphthongs appear only six times in the corpus and will not be dealt with here.

Table 3.9 Adaptation of diphthongs

	Diphthong	(%)	Long	%	Short	(%)	Total
Diphthong	41	**24.7**	64	**38.5**	61	36.7	166

The most faithful mapping of vowels relates to length, which is preserved about 74% of times. That is, a source long vowel is usually realised as a long vowel and a source short vowel is usually realised as a short vowel. A diphthong is counted as faithfully mapped in terms of length if it is realised as a diphthong or a long vowel in AA. Without diphthongs the rate goes up to 76%. The percentage for diphthongs on their own drops to about 63%.

Faithfulness on the length dimension is very much respected because AA contrasts short and long vowels and there are only two variables (either long or short). In fact, many of unfaithful mappings of length relate to prosodic factors rather than melodic ones. Faithfulness to length supports a phonological adaptation process. If the adaptation was not mainly phonological, it would be expected that long vowels, which are perceptually more salient, would be mapped faithfully more than short ones. As the table above shows this is not the case. Long vowels are mapped faithfully in 47% of cases while short vowels are realised faithfully in 88% of cases.

However, the attested variability of vowel adaptation does not contradict with a phonological basis. Rather, the adaptation process is phonological from the perspective of L1 as violations are induced to render the output more well-formed in AA especially at prosodic levels, satisfying phonological constraints at higher levels.

Faithfulness on the backness dimension is also very important, at 63%. On the horizontal axis, a front vowel is mapped 98% of cases as a front vowel in AA while the percentage for back vowels drops to 71%. The overall percentage decreases due to the effect of central vowels as AA makes basically a two-way opposition in terms of backness. All English central vowels are either realised as front (69%) or as back (31%).

Table 3.10 Adaptation in terms of backness

	Front	(%)	Back	(%)	Total
Front	339	**98**	6	2	345
Central	151	69	69	31	220
Back	52	29	129	**71**	181

Finally, Table 3.11 below shows that the overall faithfulness on the height dimension is relatively low at 55%, most probably due to the influence of mid vowels. High and low vowels are realised as high and low vowels 75% of cases respectively while mid vowels are realised faithfully 22% of the time. Again this is due to the limited number of mid vowels in AA. Taking the high and low vowels on their own, we notice that faithfulness is relatively high. This is not surprising given that vowel height is very crucial cross-linguistically as languages tend to make use of height more than other dimensions. Recall that the most common vowel triangle in world languages is /i, u, a/ (Pulleyblank 2011: 494).

Table 3.11 Adaptation in terms of height

	High	(%)	Mid	(%)	Low	(%)	Total
High	184	**75**	35	14	26	11	245
Mid	88	31	61	**22**	134	47	283
Low	29	13	26	12	166	**75**	221

To sum up, the adaptation on the three vowel dimensions further support a phonological rather than phonetic adaptation process. Salient features like length are not generally realised more faithfully than others. Apparent differences in the adaptation of vowel backness and height are better attributed to the native contrasts that AA makes use of in the vowel space while variance at the length dimension is attributed to AA metrical constraints.

3.2.5 Vowel formants

This subsection compares formants of AA monophthongs with those of Southern Standard British English in order to find out whether the mapping of English vowels could be acoustically based as proponents of perceptual models would claim (see

§2.3.3). It will be shown that the mapping of English vowels is mostly phonological as Table 3.7 above shows.

To control for variables that affect vowel formants such as context and gender, I compare the formants of male data measured in context for both varieties. Also, the measurements refer to the steady sate of the formants only as they are more reliable cues of vowel formants (cf. Hayward 2000: 146). The tables below compare vowel formants of AA monophthongs as measured by Anani (1999) with Standard Southern British English (SSBE) monophthongs as measured by Deterding (1997) and Ferragne & Pellegrino (2010). Moreover, some researchers (e.g. Cohen 2009) claim that an F1-F2 difference is a better indicator of vowels' quality. To this end, I also measure the F1-F2 differences between vowels to test this hypothesis.

Table 3.12 Formants of AA monophthongs (Anani 1999)[44]

	ii	i	aa	a	uu	u	ɑɑ	ɑ	ee	oo
F1	251	327	638	506	288	365	693	626	256	380
F2	1928	1890	1680	1730	2329	1548	1730	1549	2092	1614
F1-F2	1677	1563	1042	1224	2041	1183	1037	923	1836	1023

Table 3.13 Formants of SSBE monophthongs

	i:	ɪ	e	æ	ɑ:	ɒ	ɔ:	ʊ	u:	ʌ	ɜ:
Deterding (1997)											
F1	280	367	494	690	646	558	415	379	316	644	478
F2	2249	1757	1650	1550	1155	1044	828	1173	1191	1259	1436
F2-F1	1969	1390	1156	860	509	486	413	794	875	615	958
Ferragne & Pellegrino (2010)											
	i:	ɪ	e	æ	ɑ:	ɒ	ɔ:	ʊ	u:	ʌ	ɜ:
F1	273	386	527	751	655	552	452	397	291	623	527
F2	2289	2038	1801	1558	1044	986	793	1550	1672	1370	1528
F2-F1	2016	1652	1274	807	389	434	341	1153	1381	747	1001

[44] His six informants are from Amman.

Table 3.14 Comparison of actual and predicted monophthong adaptation

English vowel	Typical AA realisation	Predicted (Deterding)	Predicted F2–F1 (Deterding)	Predicted (Ferragne & Pellegrino)	Predicted F2-F1 (Ferragne & Pellegrino)
i:	ii	uu, ee[45]	uu, ee	uu, ee	uu, ee
ɪ	i	oo, u	a, i	oo, i	ii, i
e	i	a, oo	u, a	a, aa	a, u
æ	a, aa	ɑɑ, aa	ɑ	ɑɑ, aa	ɑ
ɑ:	aa, ɑɑ	aa, ɑ	ɑ	aa, ɑ	ɑ
ɒ	u/o	ɑ, a	ɑ	ɑ, a	ɑ
ɔ:	oo, o	oo, a	ɑ	a, oo	ɑ
ʊ	u/o	u, oo	ɑ	i, u	u, a
u:	uu/oo	u, i	ɑ	a	a, i
ʌ	a/ɑ	ɑ, aa	ɑ, ɑɑ	ɑ, aa	ɑ
ɜ:	ee	a	ɑ, ɑɑ	a, ɑ	oo, ɑɑ

From Table 3.14, we see that although acoustic similarity predicts correctly the adaptation of some phonemes, it fails to account for the majority of cases. Neither raw measurements of F1 and F2 nor the difference between them can correctly account for the mapping of English monophthongs onto AA. In fact, the F1-F2 difference criterion fails totally as it predicts that six to eight source vowels should be mapped onto /ɑ/. The acoustic similarity especially fails when AA lacks a phonological counterpart of the English source vowel. Take for example English /e/; acoustic measurements predict that AA should opt for /a/, / u/, or / ɑ/. However, this phoneme is typically adapted into its phonological AA counterpart /i/. Another example relates to /ɒ/, which AA lacks. If the mapping was based on acoustic similarity, it would be realised as /ɑ/ or /a/. However, it is typically mapped onto its closest phonological counterpart /u/ or its allophone [o]. To sum up, results show that the vowels are matched into their phonological AA counterparts. However, whenever

[45] The table shows the best two predicted vowels. When in doubt, priority is given to F1.

a mapping deviates, it does so for metrical reasons, assimilatory or morphological factors, as I have shown above.[46]

3.2.6 Interim summary

It has been shown that although the adaptation of English vowels is generally phonological whereby source vowels are mapped onto their AA closest phonological counterparts, the adaptation still shows some variation due to other factors especially orthography as in the case of English schwa and other phonological factors such as vowel harmony, and metrical structure, as will be shown in the following section. It has been shown that sometimes different source vowels are adapted similarly into AA and the same vowel is realised differently in AA, e.g. schwa. It has also been shown that markedness plays a major role in the adaptation process where less marked vowels surface in the adaptation process as in the adaptation of diphthongs.

3.2.7 Phonological processes affecting vowels

As discussed in the previous section, source vowels are sometimes mapped unfaithfully. In this subsection, I examine the most common phonological processes that are related to this unfaithfulness. Note at the outset that all these processes contribute to the unmarkedness of the output. I first touch on vowel lengthening in §3.2.7.1. This is followed by a detailed analysis of vowel shortening, monophthongisation and finally vowel harmony in §3.2.7.2, 3.2.7.3, and 3.2.7.4, respectively.

3.2.7.1 Lengthening

There are 65 cases of short vowel lengthening in the corpus. All vowels are lengthened except for /ʊ/. Schwa and /ɪ/ are the most lengthened as they are also the most frequent vowels in the corpus. Most of the time, when a vowel lengthens it tends to retain its featural quality as much as possible. For instance, when /ɪ/ lengthens, it usually lengthens into [ii] or [ee] unless other non-phonological factors such as orthography are at play. The majority of lengthening cases can be attributed to SWP, which favours stressed syllables to be heavy (see §5.1.2.2) as the lengthened vowel

[46] These results are tentative and acoustic similarity might play a bigger role than the one reported here. A study that involves more data and participants would give more reliable and valid results. This is left for further investigation.

receives stress as in (47). This is a cross-linguistic markedness constraint that lengthens stressed syllables (Hayes 1995: 83; Gordon 2011a: 828).

(47)	van**i**lla	vaa'neella
	v**i**deo	'viidyu
	carbur**e**ttor	karbu'reetar
	rubbish	'rɑɑbiʃ
	lobby	'luubi

Lengthening is also attested word-finally, as in *ʔasiid ‘acid’* and *ʔintarbool* ‘interpol’ This lengthening is related to SWP as the lengthened syllable is also stressed; however, it is better accounted for in terms of word-final lengthening. Lengthening here is related to phonetic factors as it “facilitates the crowding of intonational tones onto final syllables” (Wightman et al. 1992, cited in van der Hulst 2014). Final stress has a clear demarcative function that facilities perception (van der Hulst 2014: 107). This is not surprising in that many languages have stress near word edges (ibid) and AA is a right-oriented stress language, as will be seen in §5.1.2.1.

Another reason for lengthening is foot-binarity. For example in *dʒaa'kuuzi* ‘j**a**cuzzi’ the schwa lengthens to render the first syllable bimoraic and this makes the form less marked as it is left-aligned with a foot (see §5.1.4.3.3). However, it should be pointed out that lengthening for foot-binarity is not common in AA. Rather, AA tends to resort to gemination in order to achieve binarity, as will be discussed in detail in §5.2.2. A last reason relates to orthography; sometimes a short vowel is lengthened due to spelling pronunciation, as in *swiitar* ‘sweater’ and *boorsalaan* ‘porcelain’ (see §3.3.2 for more details on the role of orthography).

3.2.7.2 Shortening

Long vowel shortening in AA native words is a very common process that affects unstressed long vowels internally and long vowels word-finally. In this subsection, I review these two cases and see how loanwords give evidence to these processes.

3.2.7.2.1 Shortening long vowels internally in AA

In principle, AA, like PA (cf. Abu-Salim 1982: 114) shortens unstressed underlying long vowels. Consider the following examples in (48) which demonstrate vowel shortening internally.

(48)	a. baab ‘door’	ba'been	cf. 'baabhum
	b. ʔa'siir ‘prisoner’	ʔasi'reen	cf. ʔa'siirna
	c. ʕaa'muud ‘pole’	ʕamu'deen	cf. ʕa'muudak
	d. ma'kaatib ‘offices’	maka'tibna	cf. ma'kaatbak
	e. 'dʒaara(t) ‘neighbor f.’	dʒaar'teen	cf. dʒa'ritna

As these examples show, whenever stress shifts from the long vowel, the long vowel is shortened. This is phonetically motivated in that it gives the stressed syllable more prominence. However, in the last example, *dʒaar'teen*, the long vowel does not undergo shortening because underlyingly there is a vowel between these two syllables. A short low vowel is deleted cf. /dʒaarateen/ yielding *dʒaarteen*. Abu-Salim (1982: 116) argues that the vowel does not undergo shortening because it is not in an open syllable. This does not seem to be the case as vowel shortening applies even to closed syllables, e.g. *sammaaʕa* ‘a loud speaker’ *sammaʕteen* ‘two loudspeakers’. Rather, I argue that unstressed syllables are shortened if shortening does not compromise a contrast in the dialect. To illustrate, shortening the vowel in *dʒaar'teen* will confuse it with *dʒarteen* ‘two jars’; hence shortening is blocked.

In column three in (48a) to (48d), we notice that the vowels do not shorten as they are still stressed and followed by light syllables, thus stress does not shift rightward. In brief, it seems that shortening occurs for two reasons: either to give prominence to stressed syllables and/or to optimise syllable structure by forming bimoraic feet, as in *ʔasi'reen*, where two bimoraic feet are constructed.

3.2.7.2.2 Final vowel shortening in AA

Another case of vowel shortening affects long vowels word-finally (Abu-Salim 1982; Abu-Abbas 2003), as the following examples in (49) taken from Abu-Salim (1982: 134) demonstrate.

(49) saʔal-u ‘they asked’ vs. saʔaluuha ‘they asked her’

ḍarab-ni ‘he hit me’ vs. maḍarab-niiʃ ‘he did not hit me’

Following Abu-Salim (1982), Mobaidin (2003) and McCarthy (2005), I posit that these vowels are underlyingly long and shorten word-finally. However, it could be argued otherwise. One might argue that they are short and lengthen when they are followed by a consonant-initial suffix and stressed (cf. Broselow 1976 for Egyptian Arabic; Kenstowicz 1981, cited in Mobaidin 2003 for PA; Watson 2002). It seems the first option is more plausible than the second. First, such vowels are realised as long in other PA dialects such as Bedouin dialects. Second, the SA reflex of this vowel is long, too cf. *ḍarabaniy*‘he hit me m.’ (Mobaidin 2003: 108). This suggests that it is more likely that this vowel could have shortened historically. Most importantly, vowel lengthening in prefixal position is not attested in languages (McCarthy 2005). Further evidence comes from many loanwords that end in a long vowel in open syllables such as ‘shampoo’ that surface with a short unstressed vowel in AA with a stress shift to the initial syllable, as shown in §3.2.7.2.3 below.

3.2.7.2.3 Shortening in loanwords

As has been shown in the adaptation of long vowels and diphthongs, shortening appears 224 times affecting both long vowels and diphthongs.The most common type of shortening in the corpus is shortening of long vowels before other long vowels and in unstressed positions. The only vowel that never shortens is /ɔɪ/ followed by /aʊ/ with two cases and /aɪ/ with three cases. This suggests that these three diphthongs are not treated in AA as true diphthongs. Were they treated as diphthongs they would undergo more shortening like other English diphthongs and long vowels.[47]

Like lengthening, shortening is invoked for markedness criteria rendering the output less marked and occurs for three main reasons. First, it occurs as a sort of dissimilation when two long vowels are found adjacent to each other resulting in a clash. This form is marked so AA avoids it by shortening the unstressed one, which is always found on the left affecting very often open syllables. Illustrative examples are shown in (50) below.

[47] /eə/ undergoes shortening only by some informants as a type of free variation.

(50)	b**ou**tique	butiik
	c**ou**pon	kuboon
	k**ey**board	kiboord

Again, shortening is invoked to optimise foot structure by making it binary as in (51) below.

(51)	cakes	kiks
	c**a**rbon	karboon
	cornflakes	kurnifliks
	j**ea**ns	dʒinz
	range	rindʒ
	short	ʃurṭ

A third reason relates to long vowel shortening in open syllables word-finally as AA tends to avoid long vowels word-finally. Recall the debate on whether long vowels in final position are underlyingly long or short above. Long vowel shortening word-finally in loanwords lends support to the suggestion that native vowels are underlyingly long and shorten when in open syllables word-finally. This is evident from the many cases that are attested in loanwords as the examples in (52) show.

(52)	disc**o**	diisku
	kiw**i**	kiiwi
	leg**o**	liigu
	shamp**oo**	ʃaambu
	sees**aw**	siisu
	turb**o**	teerbu

One last case of vowel shortening in loanwords relates to morphology. This is attested in one case, namely *batwan* 'betw**ee**n', as discussed earlier.

In general, the first two main reasons for shortening can be linked to the unmarkedness of the output. This is linked to the common tendency for vowels to shorten in unstressed syllables cross-linguistically (Gordon 2011a: 829).

3.2.7.3 Monophthongisation

This subsection examines monophthongisation of English diphthongs in the adaptation process.[48] It will shed light on a debated issue in Arabic phonology, namely whether monophthongisation is a diachronic (e.g. Broselow (1976) cited in Watson 2002) or a synchronic process (e.g. Watson 2002; Youssef 2013). Based on the adaptation process, I argue that this is not a synchronic productive process despite the fact that the majority of English diphthongs are monophthongised in the adaptation process.

Recall from §2.1.1 that AA has two diphthongs that are monophthongised most of the time. This process results from the coalescence of the two vocalic elements of the diphthongs *aj and *aw yielding [ee] and [oo] respectively. However, monophthongisation does not apply across the board in AA. Rather, the two diphthongs are retained in certain morphologically and phonologically derived contexts as in *ʔawsaʕ* ‘wider’, sayṭar ‘he disappointed’, in forms with geminate glides as in *sawwa* ‘made’, in nouns and verbs derived from quadriliteral roots as in *lawlab* ‘spiral’,[49] word-finally as in *fayy* ‘shade’ and in borrowed words as in *ʕawlama* ‘globalisation’ and *naajlun* ‘nylon’ (cf. Youssef 2013; Mashaqba 2015).[50]

Results of the adaptation of diphthongs show that all source diphthongs are realised as monophthongs except for three diphthongs, namely /aɪ/, /aʊ/ and /ɔɪ/. /ɔɪ/ never monophthongises, whereas /aʊ/ and /aɪ/ are realised as monophthongs 20% and 29% of cases, respectively. The monophthongisation process of the other monophthongs usually involves deleting the second vocalic element and lengthening the first element especially if length is maintained. Monophthongisation is in harmony with markedness principles in that a diphthong is more marked than a monophthong.

The high percentage of monophthongisation in loanwords gives the impression that monophthongisation is a productive process. However, this generalisation is rather misleading and needs more elaboration. AA has only two diphthongs, so it is not surprising that the other English diphthongs monophthongise. Moreover, the failure of

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[48] This also includes the six triphthongs in the corpus.

[49] Quadriliteral forms alternate between diphthongs and monophthongs.

[50] Moreover, derived diphthongs with a long first element result from syncopating high short vowels, as in *ṭaawle* < ṭaa.wi.la ‘table’. As can be seen, the onset of the deleted nucleus is resyllabified as coda of the preceding vowel producing ‘ṭaaw’.

the two diphthongs that have AA counterparts, i.e. /aɪ/ and /aʊ/, to monophthongise lends support to this contention as their adaptation shows that the norm is to retain the diphthong. Moreover, the monophthongisation process of */ay/ in AA yields [ee]. Thus, we expect that if this process was productive it would also yield [ee]. In fact, none resulted in [ee]. For the other diphthong, /aʊ/, it is also realised as a diphthong most of the time. More importantly, when this diphthong monophthongises in native AA words, it results in [oo]. It follows that if the process was synchronic it would also yield [oo]. On the contrary, of all cases, it is realised as [oo] only in one word, namely ‘ounce’.

On the other hand, it is likely that these three diphthongs are not necessarily mapped onto true diphthongs in AA. Rather, the English off-glides are reanalysed as consonants especially when the glide is followed by a vowel. Consider the following examples in (53) that show that the off-glide is syllabified as an onset.

(53)	amplifier	ʔamb.li.faa.yar
	backfire	baak.faa.yar
	shower	ʃa.war
	power	ba.war

Functionally, we find the sequence /aw/, /oy/ and /ay/ in contexts where we also find a vowel plus a consonant. Compare *ʔawt* ‘out’ vs. *sabt* ‘Saturday’ and *ʔuf sayd* ‘off-side’ vs. *ṣaadd* ‘defending’. Moreover, the fact that the glide gets geminated in AA native words also suggests that it is not one segment.

Whether the source off-glide is syllabified as a coda or an onset of a following syllable in AA depends on the syllable structure of the word in question. If it is followed by a consonant, it is adapted as a coda, as in *kawn.tar*. In contrast, if it is followed by a vowel, it is realised as an onset, as in *ʃa.war*. Here, if it was a diphthong then it would require an onset for the second syllable.[51] Moreover, some old people pronounce forms that contain ‘aw’ with an epenthetic [i], as in *fawil* and *ʔawit*. This further supports the idea that AA treats such diphthongs as a vowel plus a consonant. Finally, results from epenthesis (see §4.4.4) show that the off-glide is treated as a

[51] This also gives more support to the claim that AA glides and their corresponding vowels are featurally identical.

consonant as epenthesis is invoked to break up the cluster, as in *drayikliin* ‘dry clean’, as will be explained in §4.4.4.

3.2.7.4 Vowel harmony

This subsection addresses vowel harmony, a common phonological process that affects vowels in AA. Loanwords will shed light on this process and they will give rise to another type of harmony—guttural harmony, which is attributed to TETU. I first address vowel harmony in native words then I account for harmony in loanwords.

3.2.7.4.1 Vowel harmony in AA

Vowel harmony is a phonological process whereby vowels within a certain domain come to share phonological features such as [back], [round], etc. (cf. Finely 2008; Gafos & Dye 2011). This process is most evident in epenthetic vowels as well as suffix vowel alternations.

Vowel harmony in native AA words has been reported to affect epenthetic vowels that are called upon to break up consonant clusters (cf. Abu-Salim 1982 for PA). Consider the following examples in (54) that show vowel alternation due to vowel harmony.

(54)	a. ʔakl > ʔakil ‘eating’	cf. ʔaklak ‘your eating’
	ʔaṣl > ʔṣil ‘origin’	cf. ʔaṣlak ‘your origin’
	b. ḍuhr > ḍuhur ‘noon’	cf. ḍuhrak ‘your noon’
	ṣuṭħ > ṣuṭuħ ‘roof’	cf. ṣuṭħak ‘your roof’
	c. baħr > baħar ‘sea’	cf. baħrak ‘your sea’
	cf. fadʒr > fadʒir ‘dawn’	cf. fadʒrak ‘your dawn’
	baṭn > baṭin ‘abdomen’	cf. baṭnak ‘your abdomen’

The examples above show that the default epenthetic vowel in AA is [i] (see details below on the default vowel), while [u] is realised due to vowel harmony induced by the stem vowel, as the examples in (54b) show. Examples in (54c) tempt one to conclude that AA has also vowel harmony after [a]; however, examples such as *fadʒir* and *baṭin* suggest that this is not the case.[52] In fact, the realisation of the epenthetic

[52] To the researcher’s knowledge, no previous study has tackled vowel harmony in the vicinity of [a].

vowel in (54c) results from consonant-to-vowel assimilation following guttural consonants (cf. Dickins 2011: 42)[53] as the default vowel [i] appears after non-guttural and sometimes guttural consonants where the stem vowel is [a].[54,55]

Evidence in support of positing [i] as the default epenthetic vowel in AA comes from three sources. First, [i] is the vowel that is always inserted to repair syllable structure word-internally and across word boundaries[56] when harmony or other phonological reasons are not involved, i.e. there is no spread of feature from other segments (cf. the examples in (54a) above). Also it is the target of assimilatory processes (cf. Watson 1989, 2002). For example, in vowel harmony it functions as a target and hardly ever as a trigger and it is the only transparent vowel (see more details on this below). Also it appears in the definite article *(ʔi)l* and in the relative pronoun *ʔilli* rather than (*ʔa)l* and *ʔalli* as in other Arabic dialects (cf. Watson 2002 for San'ani Arabic). More evidence comes from loanwords where /i/ is the only transparent vowel in vowel harmony. For example, in 'optics' > *ʔubtikus* we note that [round] spreads through [i] into the last epenthetic vowel. Also some items, e.g. *kurtizoon*, are attested in free variation where either a completely harmonic round vowel or the underspecified front high short vowel appears.[57]

The choice of this short high vowel in AA is phonetically motivated. High vowels are shorter than low ones so the closest vowel to zero would be a short high vowel (cf. Kenstowicz 2007). Moreover, [i] is the least sonorant vowel cross-linguistically (de Lacy 2007). That is, inserting [i] would constitute the least perceptible difference between input and output; hence, its function as a default epenthetic vowel (cf. Steriade 2001).

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53 Dickins (2011) accounts for such cases in Sudanese Arabic as a sort of coarticulation effect where the pharyngeal/guttural vowel surfaces with pharyngeal/guttural consonants in *faʕal* forms.

54 One might argue that harmony applies but is blocked by non-gutturals. However, this cannot account for harmony with round vowels.

55 Note that vowel harmony is blocked inter-morphemically; it does not apply across a stem and a following suffix, e.g. *ʃuf-t* > *ʃufit* (cf. Abu-Salim 1987 for PA). This might be related to the underlying quality of the stem vowel, which is not a round vowel.

56 E.g. *ween blaadak* > *wee.nib.laadak* 'where are you? (fig)'.

57 This contention may contradict with findings from emphasis spread. However, emphasis is blocked by non-primary [dorsal] so it could be that this vowel is specified only as non-primary [dorsal]. More investigation of this issue is required.

The above facts about /i/ in AA point to /i/ being phonologically different from other vowels. Thus, it would not be surprising if this vowel turns out to be underlyingly underspecified in AA, as I argue in this section.

The examples above suggest that AA has one type of vowel harmony, namely rounding harmony. This is in line with other studies on related dialects such as PA (cf. Abu-Salim 1987; Watson 1995; Mohanan 2002). However, a quick look at loanwords in AA reveals that AA has a more complicated system of vowel harmony. Therefore, I assume that native AA words do not give us a complete picture of the harmony processes in AA. Hence, a systematic investigation of vowel harmony in loanwords in AA would shed more light on this process unveiling the hidden constraints that account for this process as AA and English have different phonological structures.

3.2.7.4.2 Vowel harmony in AA loanwords

The following examples in (55) give English loanwords in AA that show two types of vowel harmony.

(55) a. Rounding harmony

1. Underlying vowels

AA realisation	Gloss
ʔukoordyun	‘accordion’
kulustrool	‘cholesterol’
ʔugzust ~ ʔigzust	‘exhaust’
munhul	‘manhole’
rumoot ~ rimoot	‘remote control’
sunsur	‘sensor’

2. Epenthetic vowels

dubul	‘double’
fulumaastar	‘flow master’
fulukloor	‘folklore’
ʔubtukus	‘optics’

b. Guttural harmony

1. Underlying vowels

ʃambaazi	‘chimpanzee’

ʔantarnitt	‘internet’
manakiir	‘manicure’
manavult	‘manifold’

2. Epenthetic vowels

kafayiin	‘caffeine’
karafoot	‘grapefruit’
salamun	‘salmon’

c. Default vowel

ʔikistra	‘extra’
bankiryaas	‘pancreas’
biksil	‘pixel’
sikraab	‘scrap’

Harmony cases above show that harmony does not only apply to epenthetic vowels, but also to underlying vowels. Harmony in (55a1) and (55b1) affects underlying vowels while in (55a2) and (55b2) it targets epenthetic vowels. The examples in (55c) provide further evidence that the default epenthetic vowel in AA is the short high front vowel [i]. As I have indicated above, native AA words have only rounding harmony; harmony that involves the guttural vowel [a] has not been reported. This makes the examples in (55b) particularly interesting for the study of vowel harmony in AA.

The following subsection attempts to give answers to the following questions.

1. What are harmony triggers in AA?
2. What are harmony targets in AA?
3. What is the domain of vowel harmony in AA?
4. What is the directionality of vowel harmony in AA?
5. What factors motivate vowel harmony in AA?

3.2.7.4.2.1 Harmony triggers

Harmony triggers are restricted to two sets of vowels in AA: round and guttural vowels. For rounding [58] harmony the triggers are the English long vowels /ɔː/ and /uː/, the diphthongs /əʊ/ and /ʊə/ and the short vowel /ɒ/. All these source vowels are realised in AA as either the short vowel [u] or its long counterpart [uu]. All these vowels share the feature [round], so we can safely postulate that the spreading feature is [round]. However, harmony is sometimes triggered by spelling such that a loanword is adapted into AA according to its spelling as a round vowel that in turn triggers rounding harmony. This is the case for seven cases, including ‘double’ and ‘sensor’.

For guttural harmony,[59] the trigger is always the adapted low front vowel in AA regardless of its source vowel in English. That is, the source vowel is realised as /a/ in AA and I believe that it is the adapted vowel /a/ that induces harmony. This vowel, [a], results from the mapping of English /a/, as in *saramiik* ‘ceramic’; of schwa, as in *ʔantarnit* ‘int**e**rnet’; of the long low vowel /a:/, as in *kawafeer* ‘coiffeur’ and of the diphthong /eɪ/, as in *karafoot* ‘grapefruit’. Again, in the last example, /eɪ/ could have been realised as [a] due to spelling.

For rounding harmony, the feature [round] targets the unspecified epenthetic vowel filling its feature specification while in the case of underlying vowels, it changes the feature specification of the guttural vowel [a] into [round] and adds the feature [round] to the underspecified dorsal vowel /i/. For guttural harmony, the epenthetic unspecified vowel takes on the feature [guttural] from the guttural vowel, while underlyingly underspecified front vowels add the feature [guttural] and surface as [a].

The examples above show that [round] and [guttural] vowels are the triggers affecting most of the time the underspecified dorsal vowel [i] or epenthetic vowels. However, in case the guttural and the round vowels conflict, it is the rightward vowel that

[58] I will adopt the feature [round] instead of [labial] for specifying labial vowels in conformity with the widespread use of this feature in the literature on vowel harmony.

[59] The coinage is mine. This is much related to [ATR] harmony in other languages but I will not use [ATR] as AA does not contrast [ATR] with [RTR] vowels.

induces harmony, as in *munhul* ‘manhole’. This is in line with the prevalent less marked regressive assimilation cross-linguistically.[60]

3.2.7.4.2.2 Harmony targets

As shown above, most harmony cases target the underspecified short non-primary dorsal vowel [i] and epenthetic vowels, which do not have a correspondent in the input. This means that these epenthetic vowels do not violate any faithfulness constraints as they vacuously satisfy faithfulness. Harmony also targets round and guttural vowels in a few cases especially when they are within the same foot. For rounding targets, the most common target is the English source schwa or the short front high vowel /i/. It also applies to epenthetic vowels in seven cases. For guttural harmony, the targets are short vowels (85% of cases belong to /i/) or epenthetic vowels. Therefore, it can be claimed that harmony targets short vowels and rarely targets long vowels (one case only) because long vowels are more salient acoustically and phonologically and they make up a foot by themselves (for foot structure in AA see §5.1.4). This is much related to phonological foot structure and perceptual factors, as I will demonstrate below.

3.2.7.4.2.3 Harmony domain

Harmony in AA loanwords applies at both the foot level and the phonological word level. However, it is noticed that it is stronger at the foot level as the examples in (56) show.[61] We notice that harmony applies at the foot level and may expand to a following or preceding syllable if the vowel is short. However, if it is long it does not undergo harmony. Consider the following illustrative examples in (56) that show harmony at foot and word levels.

(56) a. Harmony at the foot level: (feet are in brackets)

(dubul)	‘double’
(mana)(kiir)	‘manicure’
(mana)(vult)	‘manifold’

[60] Ignoring the only exception *kabatʃiinu* ‘cappuccino’, which can be attributed to the fact that the guttural vowel in the first syllable is more prominent as it is the head of the foot; hence triggers the harmony.

[61] Feet in AA are bimoraic trochees (see § 5.1 for more on foot structure).

b. Harmony at the word level:

ʔugzust ~ ʔigzust	‘exhaust’
munhul	‘manhole’
rumoot ~ rimoot	‘remote’

As can be seen, harmony at the foot level tends to be obligatory, while optional at the word level. For example, short vowels within the same foot harmonise for the same feature while vowels outside the foot tend to harmonise less. This also accounts for free variation in words such as *ʔugzust* ~ *ʔigzust* and *rumoot* ~ *rimoot*. However, there is no variation in forms such as *manakiir*. In the former examples, the first vowel does not belong to the same foot but in the latter, -*mana*- makes up a foot so variation is not possible.

3.2.7.4.2.4 Directionality

Harmony in AA is bidirectional whereby its direction interacts with many factors: morphological structure, foot structure, quality of vowels and markedness factors. Markedness factors prefer harmony to be regressive so the rightward vowel will function as the trigger, as in *munhul* ‘manhole’. Here the quality of the vowel does not determine the trigger. For quality of vowel, both guttural and round vowels trigger harmony of the underspecified non-primary dorsal vowel regardless of its position, as in *manakiir* ‘manicure’ and *rumoot* ‘remote’.[62]

For epenthetic vowels the picture is different. Directionality depends on the site of the epenthetic vowel whereby harmony spreads from the trigger into the epenthetic vowel regardless of its position in relation to the trigger. If the epenthetic vowel occurs left of the trigger spreading is also leftward and vice versa. For example, in *salamun* ‘salmon’, harmony is rightward but in *fulumaastar* ‘flow master’, it is leftward. That is, directionality is morphologically biased, which represents stem-controlled types of harmony (cf. Bakovic 2000). Moreover, directionality interacts with prosodic structure. Vowels within the same foot harmonise for the same feature. That is, if an epenthetic vowel is in the middle of two underlying vowels, then both vowels can be triggers. However, priority is given to the vowel with which it constitutes a foot. For

[62] There is only one exception where the short non-primary dorsal seems to trigger harmony, namely *ʔamilʃin* ‘emulsion’.

example, in *salamun*, ‘salmon’ the second epenthetic vowel receives its feature from the stressed initial vowel, with which it constitutes a foot rather than from the following round vowel.[63] That is, prosodic factors here override the widespread regressive harmony.

In general, rightward spread is more common due to the influence of epenthetic vowels. Left-to-right harmony appears in 60% of cases while right-to-left harmony appears in 40% of cases.

3.2.7.4.2.5 What motivates harmony?

The two types of vowel harmony in the corpus, rounding and guttural harmony, are related to saliency and sonorancy, respectively. [Round] is one of the most acoustically salient features among vowels and a guttural vowel is more sonorous than other non-low vowels (cf. Parker 2011: 1177). This indicates that vowel harmony is phonetically motivated as it enhances perception acoustically and eases articulation by minimising the number of features involved (Cole & Kissberth 1995).

On the other hand, that many of vowel harmony cases apply to epenthetic vowels (35% of cases) and that it affects short vowels in the recipient language means that harmony affects less salient features so that it renders the output less marked. It is more marked to change the feature specification of an already specified vowel and changing the features of a long vowel is both phonetically and phonologically a more marked process (cf. Kenstowicz 2007).

To summarize, this subsection has brought more insight into the phonological process of vowel harmony in AA, a neglected area in AA. While native AA words show rounding vowel harmony, loanwords shed more light on this phenomenon and show that AA has a hidden constraint that requires vowels to harmonise for [guttural] at the foot level. Rounding harmony is triggered by round vowels and targets mostly short high front vowels and featureless vowels. Guttural harmony is triggered by guttural vowels and targets the same vowels targeted by rounding harmony. High front vowels are almost always targets of vowel harmony and hardly ever function as triggers,[64] which can be attributed to both saliency and sonority. The more salient or

[63] This suggests that footing is left-to-right in AA, as will be seen in §5.1.4.

[64] Recall the only exception ‘emulsion’.

sonorous a vowel is the more likely it acts as a trigger. Furthermore, vowel harmony domain tends to be obligatory at the foot level and optional at the word level. Directionality is affected by the quality of vowels involved, prosodic structure, position of the vowel and above all it is stem-controlled where the stem vowel governs harmony.

It could also be argued that guttural vowel harmony represents a case of TETU given that native AA words do not require it as it lacks the phonological processes that induce this type of harmony (cf. Shinohara 2004; Kenstowicz & Suchato 2006: 846; Becker & Potts 2011).[65] Because native AA speakers have never been exposed to such type of harmony, it should have come from somewhere else.

In the following section, I turn to other linguistic factors affecting the adaptation processes other than those that relate to AA phonology.

3.3 Factors affecting segmental adaptation

As shown throughout this chapter, source segments are faithfully mapped onto their AA phonological counterparts as much as possible. Segment substitution sometimes occurs; however, it is minimal in that substitution opts for the phonologically most similar phoneme in AA and usually affects non-terminal features (cf. Paradis & LaCharite 1997, 2011). That is, the adaptation process is mostly governed by L1 phonology. However, this phonologically-based adaptation is not always the case. Sometimes other factors play a role. In this section, I explore the most important other linguistic factors that affect loanword adaptation in AA. In §3.3.1, I examine the role of perception and phonetics and in §3.3.2, I show the effect of source orthography on the adaptation process. Then I touch on the role of co-occurrence restrictions in §3.3.3. In §3.3.4, I shed light on the role of UG and conclude with an overview of other less common factors such as the effect of morphology and sociolinguistic factors in §3.3.5.

[65] The fact that the guttural vowel does not trigger harmony in native words can be related to anti-allomorphy factors. If harmony applies, a lexical contrast will be compromised. For example, *nasaf* ‘exploded’ is an established perfective verb in AA that contrasts with *nasif* ‘exploding’. If harmony applies to *nasif*, it would not be possible to distinguish it from *nasaf*.

3.3.1 Perception and phonetics

Phonetically and perceptually motivated adaptations are attested in the adaptation process. However, AA speakers do not deal with all possible cases similarly in that they are deaf to some aspects but not others. For instance, borrowers can easily detect the allophonic pharyngealisation in vowels and map it phonologically into AA. However, they cannot perceive certain non-contrastive features. This is corroborated by studies on second language acquisition. For example, Suleiman (1985) reports that Jordanian students of English at the university level could not perceive or produce the English phoneme /p/.

In contrast to Jacobs & Guseenhoven (2000), following Brown (1997, cited in Rose 1999), I assume that loanword perception is governed by the contrastive features of L1. That is, perception does not seem to lead production. In contrast, perception and production are governed by the phonological contrasts of the native language.

Of the many cases that can be attributed to perception and phonetics, I recall a few examples. Mapping English phonemes into AA emphatic ones is a prime example of the role of perception. Also, preservation of vowels and their feature qualities as well as consonants with strong acoustic cues, e.g. sibilants, is another example. Moreover, voicing and devoicing processes of consonants are rooted in phonetic bases. Likewise, all lenition and assimilation processes discussed above can be based on perceptual and phonetic factors in that they seek to ease articulation and affect segments with impoverished cues. Also, some deletion cases tend to affect non-salient segments. For example, the liquid deletes in stop-liquid clusters such as *ʔambifayar* ‘amplifier’ because the liquid here is very short (cf. Olive et al. 1993, cited in Yip 2011). Likewise, the phonetic closeness between some segments could lead to misperception in some cases, as in the adaptation of coronal sonorants. Finally, vowel insertion lends support to perceptual factors in that the least salient vowel is inserted when harmony and other factors are not involved, as demonstrated in §3.2.7.4.2.

It is worth noting that the role of phonetics and perception seems to be bigger in early borrowings as the level of bilingualism was lower among AA speakers. Recall the adaptation of /v/ into [b/w] in early borrowings compared with its faithful mapping in recent ones.

Note that perception fails to account for many adaptation patterns. For example, according to perceptibility principles (e.g. Steriade 2001; Miao 2006), when phoneme substitution takes place it should affect the least perceptible feature. They propose that the manner features nasality and continuancy are more perceptible than place features, so the adaptation process would be expected to violate place features more than manner features. This is not the case, as we have seen in §3.1.3.1. So this lends support to the fact that the adaptation process is more phonologically based.

3.3.2 The role of orthography

The role of orthography is evident especially if loanwords enter L1 via witting as these loanwords would not have source phonetic cues. This does not mean that pronunciation has no role; rather, adaptation depends on the way L1 speakers (predominantly bilinguals) pronounce such words. For English words, it can be argued that it is not always clear how non-native speakers would pronounce them given that English spelling is not isomorphic to pronunciation (cf. Finegan & Besnier 1989; Altmann 2006).

Orthography seems to be the most influential non-phonological/phonetic factor in loanword adaptation in the whole adaptation process (Paradis & LaCharite 2011). In a similar vein, Peperkamp & Dupoux (2003) point out that writing might play a tremendous role when borrowers have access to the source spelling. Blair & Ingram (1998) note that in cases where the spoken input is not available, borrowers will depend on the written form, which is very irregular in the case of English. Likewise, Vendelin & Peperkamp (2006) highlight the relevance of orthography to loanword adaptation and argue that adaptations would be different according to the mode of introducing the loanword. It seems that this is the case for a remarkable number of borrowings in AA.

Recall that the level of bilingualism in AA community is not conducive to the oral transfer of loanwords. The written form of the English source is primary as English is taught in schools and universities (cf. Atawne 2007). Errors from second language learning contexts in AA give evidence to this claim. For example, Suleiman (1985) reports many errors in English pronunciation made by AA bilinguals that can be attributed to orthography. It follows that the adaptation process can be influenced by spelling pronunciation given that many loanwords could have entered the dialect through writing. In fact, segments that might not be perceived through perception can be recognised through writing (Smith 2006).

In contrast to Paradis & LaCharite (1997, 2011) and LaCharite & Paradis (2005), who argue that orthography plays a minor role in the adaptation process, I argue that spelling pronunciation plays a major role in the adaptation of loanwords in AA, which is common across world languages (cf. Kertész 2006). Paradis & LaCharite (1997, 2011), argue that diagraphs are always pronounced correctly in loanwords and silent letters are rarely realised in loanwords. They conclude that the role of orthography cannot be inconsistent. That is, if it were responsible for some cases, it should also manifest itself in other cases. In principle, this is correct but I argue that the role of orthography can manifest itself in a different way. I believe that borrowers, being bilingual, especially false bilinguals, have access to spelling and it is the way they think the English word is pronounced that affects the realisation of the English loanword. That is, some aspects of English pronunciation are so well-known that they cannot escape the attention of second language learners while other aspects are difficult and many second language learners cannot master them. This is supported by studies of second language learners' pronunciation errors. In fact, very few bilinguals can achieve a native-like proficiency in foreign languages.

To recapitulate, I do not argue that borrowers adapt a loanword solely depending on the written form; rather it is the way they think it is pronounced that affects its realisation.[66] If a word was introduced by a false bilingual, where it was incorrectly pronounced, by the time other competent bilinguals had detected the erroneous pronunciation of the loanword, it would have spread into the community. In fact, attempts by bilinguals to correct the pronunciation of loanwords are stigmatised by AA monolinguals (personal experience).

Many English loanwords are supposed to be borrowed via writing as the adaptation process shows. A very clear example relates to the retention of the rhotic sound in postvocalic position, as has been pointed out in §3.1.1.5.2. In what follows, I present some cases which demonstrate the influence of orthography on the adaptation process.

[66] This does not mean that AA bilingual speakers are the only agents of borrowing.

The role of orthography is apparent where an English vowel phoneme has more than one spelling in English and its adaptation differs according to the grapheme that it represents when other phonological or phonetic reasons are not involved. As noted in §3.2, spelling pronunciation accounts for 15 % of vowel adaptation, as in *ʔalbuum* ‘album’, *dubul* ‘double’, *dumdum* ‘dumdum’ and *swiitar* ‘sweater’. The prime example that shows the effect of spelling pronunciation in the adaptation process is the English schwa. It is realised as [u] or [oo] in thirty six loanwords when the source spelling is ‘o’ or ‘u’. Moreover, it tends to be realised as [i] when source spelling is ‘i’ or ‘e’ (see §3.2.1.7). Other examples that show the effect of orthography are the unpacking of the velar nasal when source spelling is ‘ng’ and the faithful mapping of /tʃ/ when source spelling has ‘t’. Finally, individual words that show the effect of orthography abound in the adaptation process. Some examples are *fulukloor* ‘folklore’, *kukʔaiin* ‘cocaine’ and *kafayiin* ‘caffeine’.

3.3.3 Co-occurrence restrictions

These restrictions are of two types in the adaptation process. The first relates to restrictions at melodic levels while the second relates to features. For example, a violation of OCP on the [labial] tier forces the labial nasal to be realised as an alveolar in *ṭarniib* ‘trump’. Similarly, a co-occurrence restriction of the features [nasal] and [dorsal] on the segmental level disallows the faithful realisation of the velar nasal /ŋ/. Finally, co-occurrence restrictions between back/mid vowels and plain consonants account for the realisation of emphatic consonants.

Recall that these restrictions are also motivated phonetically. OCP can be attributed to functional phonetic patterns (Hayes & Steriade 2004). They argue that ‘functionally’ forms without repetition are easier to produce, perceive and hold in short term memory.

3.3.4 The Emergence of the Unmarked

As explained in §2.7.3, TETU represents cases where source features are mapped onto unmarked features despite the fact that the source features are licit features in AA. Final devoicing of obstruents is a case in point as voice in obstruents is unrestricted in AA. Moreover, guttural harmony is another case (see §3.2.7.4). Also, intervocalic voicing, which is attested in the adaptation of some voiceless consonants, is another case of TETU. Finally, cases of vowel shortening and lengthening to render feet bimoraic or heavy when stressed can be considered cases of TETU.

Anticipating the discussion of the suprasegmental adaptation, chapters four and five will show more cases of TETU such as the unnecessary vowel epenthesis, lengthening stressed syllables and gemination.

3.3.5 Other linguistic factors

Other minor factors affecting the adaptation of loanwords in AA are L1 morphology, age of borrowing and sociolinguistic factors.

L1 morphology affects the adaptation process in that it dictates certain segmental changes to make the new form conform to AA morphological templates. This is clear in loanwords that are realised as verbs in AA such as *batwan* ‘between’ and *santar* ‘centre’ where the output needs to comply with AA morphological prosodic verb templates. Also the effect of morphology is attested in loanwords that are marked with the feminine marker *–a(t),* as in *tiknuloodʒya* ‘technology’, as already pointed out in §3.2.1.1.

Another factor relates to the age of borrowing. Old loanwords tend to adhere to stricter phonological constraints in L1 while recent words seem to be less obedient to such native constraints (Ohso 1991, cited in Mutsukawa 2006). This is related to the process of borrowing in general where loanwords move from being less integrated to well-established over time. The longer the time the word stays in the language the more integrated it is. Although I have attempted to control for this by excluding words older than 60 years (see §2.6.1), still, the effect of the age of attestation can be discerned as the most recent words tend to be more faithful to the source. Take as an example words such as *didʒital* ‘digital’, which would be expected to have a long vowel in the ultimate syllable along with stress shift; however, given that this is a very recent loanword, it seems to resist adaptation especially with the increasing levels of bilingualism in AA community.

Sociolinguistic factors such as prestige and attitudes and level of bilingualism have a role in the adaptation process. Kang (2010) argues that the more direct contact with SL, the more likely the source is faithfully kept. Similarly, Hilton (2007, cited in Kang 2010) maintains that social factors affect preservation of source input. In AA, such factors might come into play especially as the degree of bilingualism is in the increase and attitudes toward English nowadays are positive (cf. Sulaiman 1985; Atawneh 2007). For example, the importation of English /v/ seems to be the norm now, as pointed out in §3.1.1.2.2.

To summarise, this section has shed light on linguistic factors other than those that refer to L1 phonology that bear on the adaptation of loanwords in AA. It has been shown that the most important three factors are related to phonetics, orthography and UG.

3.4 Conclusion

In this chapter, I have outlined how consonants and vowels of loanwords are mapped onto AA. Throughout the chapter, I have provided arguments in support of a phonological adaptation process of loanwords. In AA, one phonology governs both native and loan words. Evidence for the phonological nature of the adaptation process comes from many observations. For example, the overwhelming majority of source phonemes that have a phonological counterpart in AA are mapped faithfully onto their phonological counterparts. Also, acoustic similarity between AA and English vowels fails to account for the adaptation of vowels, as pointed out in §3.2.5. Moreover, salient features such as vowel length are not always mapped faithfully.

Variation in the adaptation process does not preclude a phonological process. Rather, it is accounted for by markedness and the phonological status of source features in L1. As has been seen throughout the chapter, the adaptation process is geared towards unmarkedness in that the least marked output surfaces. For example, many phonological processes such as harmony, assimilation, vowel shortening and lengthening and monophthongisation are induced to render the output less marked. Finally, the role of markedness is also witnessed in TETU in cases such as intervocalic voicing, devoicing and guttural harmony.

Although perceptual factors cannot be entirely precluded, cf. alveolar sonorant alternation, it has been shown that it is the phonological status of the source feature in L1 that determines the mapping of a segment. That is, perception is referenced by L1 phonological features, cf. emphasis.

Results have shed light on phonological features. For the adaptation of consonants, it has been found that place features have primacy over manner features, which have more importance than laryngeal ones. For vowels, it has been found that length features are more faithfully mapped than backness and height features, which is attributed to the fact that AA length contrasts are phonemic in AA and to the poverty of central and mid vowels in AA.

Again, the adaptation process has highlighted a number of AA phonological aspects. For example, the adaptation of the lateral phoneme suggests that dark /l/ is not an independent phoneme in AA. Also, the realisation of English /e/ points to the conclusion that the underlying feminine suffix in AA is the guttural vowel /a/ rather than /e/. Finally, facts from the different phonological processes attested in the adaptation process shed more light on the phonological specification of certain AA phonemes, e.g. the underspecification of sonorants and of /b/ for [voice] and the unmarkedness of nasal codas. Results have shown that some processes are productive such as occlusivisation and voice agreement in obstruent clusters while others such as monophthongisation are not.

Finally, it has been revealed that the adaptation of English segments is affected by non-phonological factors such as perception, morphology and orthography. Morphological AA templates dictate some segmental changes on source input to make it comply with morphological templates. Also, orthography plays an important role especially in the adaptation of segments. At least 15% of unfaithful mapping of vowels relates to orthography, as shown in §3.2.

The chapter to follow continues probing AA phonological system by analysing syllable structure and syllabification in loanwords.

Chapter four

Syllable structure and syllabification of loanwords

In the previous chapter, it has been noticed that some source segments, although licit in AA, are not faithfully mapped due to suprasegmental factors. This chapter and the following one will shed more light on such issues. These two chapters are of particular importance to Arabic phonology in general as studies on loanword phonology have not paid enough attention to suprasegmental aspects (cf. Davis & Ragheb 2014). In this chapter, I attempt to establish syllable structure in AA native loanwords and account for syllable structure and syllabification of adapted loanwords. Establishing syllable structure in native words is essential as no previous study has tackled this dialect before and the adaptation of syllable structure in loanwords will enhance our understanding of AA syllable structure by throwing light on issues such as the status of complex onsets and superheavy syllables as well as the bimoraicity of syllables. The analysis will adopt moraic theory within a Stratal OT framework. It will be shown that the maximum syllable is bimoraic in AA and CVVC syllables are licensed by mora sharing while CVCC syllables are licensed by analysing the stranded consonant as a semisyllable, which also accounts for complex onsets.

The chapter is organized as follows: §4.1 reviews syllable structure in native words with a focus on complex onsets and codas. This is followed by an outline of syllable structure in loanwords in §4.2. In §4.3, I present a syllabification algorithm that incorporates two notions: mora sharing and semisyllables to account for CVVC syllables and complex clusters, respectively. The results will be translated into OT constraints and a constraint hierarchy will be suggested in §4.3.2. §4.4 will discuss the most important phonological processes that AA uses to repair ill-formed syllables. The chapter concludes with a summary of results in §4.5.

4.1 Syllable structure in AA native words

In this section, I establish syllable structure in AA native words. This dialect has not been investigated before; however, studies on closely related dialects such as PA and JA abound and reference will be made to them when the need arises. This section will provide a background to the analysis of syllable structure in loanwords, which will enhance our understanding of complex margins and superheavy syllables attested in AA native words.

Like many modern Arabic dialects, AA shares with SA a basic syllable structure. However, it has additional syllable types as a result of phonological processes. The following syllable types in (1) are attested in AA. The first three represent the core syllable types that occur freely in all positions while the last four result from syncope or suffixation or are restricted to final positions (cf. Abu-Salim 1980, 1982; Angoujard 1990; Abu-Abbas 2003; Watson 2011).

(1) Syllable types in native words

a) /CV/ ka.ta.bu ‘they m. wrote’
b) /CVV/ **kaa**.tib ‘writer’
c) /CVC/ kaa.**tib** ‘writer’
d) /CVCC/ sadd ‘he blocked’
e) /CVVC/ maat ‘he m. died’
f) /CVVCC/ dʒaadd ‘serious sg. m.’
g) /CCVC/ **ktib.**lu ‘write m. to him’
h) /CCVCC/ mfakk ‘screwdriver’
i) /CCVVC/ ktaab ‘book’, nsuur ‘eagles’

Although superheavy syllables generally tend to be restricted to word-final position, /CVVC/ syllables, and to a lesser extent /CVCC/ syllables, can occur word-internally as a result of syncope, especially in suffixed forms, as in *ʕaar.fiin* < /ʕaa.ri.fiin/ ‘we m. know’ (cf. Abu-Abbas 2003; Bamakhramah 2009; Watson 2011) or on suffixation, as in /bint-na/ > *bintna* ‘our daughter’. The following words all contain superheavy syllables internally. (Superheavy syllables are underlined).

(2) ba.<u>naat</u>.ku ‘your pl. daughters’
<u>ʔuxt</u>.hum ‘their m. sister’
<u>naadʒ</u>.ħiin ‘successful f. pl.’

The fact that such syllables occur word-internally in many loanwords suggests that these superheavy syllables are basic syllable forms in AA and this needs to be accounted for in the representation of AA syllables. However, the status of these superheavy syllables is not clear-cut, as will be demonstrated in §4.3 below. They are banned word-internally at the lexical level whereby long vowel shortening is attested to avoid CVVC syllables, as in /staʃaar-na/ > *staʃar-na* ‘we consulted’ (cf. Abu-Abbas 2003: 140), and vowel epenthesis is induced to eliminate CVCC syllables if the two coda consonants do not form a well-formed coda in AA, as will be explained in §4.1.2, e.g. /dʒisrna/ > *dʒisirna* ‘our bridge’ and optionally if sonority is satisfied,[1] as in /bint-na/ > *binitna*. A formal representation of the syllable in AA needs to account for all these cases (see §4.3.1 for an examination of superheavy syllables).

/CVVCC/ syllables are restricted to geminate codas, which undergo de-gemination at the phonetic level according to Abu-Salim (1982). It seems this cannot be the case at least when this compromises a lexical contrast cf. *dʒaad* ‘a male name’ vs. *dʒaadd* ‘serious; and *ʕaad* ‘he returned’ vs. *ʕaadd* ‘is counting’. Evidence for this comes from loanwords such *ʔiidz* ‘AIDS’ and *ʔeerθ* ‘earth’, which do not undergo shortening or vowel epenthesis. This does not mean that they are unmarked in AA; rather this suggests that such syllables are licensed in AA although they are marked. AA does attempt to avoid this marked structure by resorting to other linguistic tools such as paraphrasing. It is not uncommon to hear *biħki dʒadd* ‘he is saying it seriously’ to avoid the marked syllable in *dʒaadd.* In the following subsections, I account for onsets and codas in native AA words.

4.1.1 Onsets

AA, like other Arabic dialects, does not permit onsetless syllables categorically. This requirement is never violated in native or in loan words. To prevent onsetless syllables

[1] This condition will be revised below.

from surfacing in the dialect, glottal stop /ʔ/ prosthesis applies to native words that undergo certain morphological processes cf. /ʃrab/ > //iʃrab// > *ʔiʃrab* ‘drink m.’ where vowel insertion invokes glottal stop prothesis to provide an onset to the otherwise onsetless syllable (cf. Abu-Abbas 2003) and onsetless loanwords, e.g. *ʔaṭlas* ‘atlas’.

Simplex onsets are the norm in AA; however, two consonant onsets are attested word-initially as a result of syncope (cf. Sakarna 1999; Al-Bay 2001; Abu-Abbas 2003; Btoosh 2006; Amer et al. 2011). They result from syncopating short vowels in unstressed open syllables as in (3) below (cf. Abu-Salim 1982) or from glottal stop and short vowel deletion, as in /ʔas.naan/ > *snaan* ‘teeth’ (ibid).[2]

(3) a. /bi'laad/ > 'blaad ‘countries’ cf. /balad/ > balad ‘country’
 b. /tu'raab/ > 'traab ‘sand’ cf. /'tuħ.fa/ > tuħfe ‘souvenir’

An interesting remark is in order here. All complex onsets in AA occur either in bimoraic syllables or are followed by another syllable which makes part of a bimoraic foot—a phenomenon that is worth investigating in AA, which will shed more light on bimoraicity in Arabic. Note that many loanwords with two-consonant clusters are imported into AA. This suggests that the above complex onsets could be basic in AA. However, it will be shown in §4.2.1 that this is not the case.

4.1.2 Codas

The optimal coda in AA is simple. Amer et al. (2011) argue that complex codas with a maximum of two consonants, despite being rare, appear both internally and finally in AA.[3] Complex codas are attested in three cases. The first one relates to true geminates (see Table 4.1). The other two cases relate to optional sonorant-obstruent or obstruent-obstruent sequences, which appear with or without an epenthetic vowel, as laid out in Table 4.1.

[2] The vowel and the glottal stop cannot always be deleted cf. /ʔalʕaab/ > *ʔal.ʕaab* ‘toys’.

[3] Amer et al. (2011) deal with AA in general as they do not specify the background of their subjects.

Table 4.1 Possible vs. impossible coda clusters in AA

A. Impossible CC codas					
obs+obs	obs+son	son+son	son+obs	heteromorphemic	
xubz > xubiz	ʔibn > ʔibin	ħilm > ħilim	malħ > maliħ	obs +obs	katab-t > katabit, kamaʃ-t > kamaʃit
nasf > nasif	sahl > sahil	ħiml > ħimil	balʕ > baliʕ	son +obs	ʔakal-t > ʔakalit, kasar-t >kasarit
ʕabd > ʕabid	baṣm > baṣim	ʕumr > ʕumur	salg > salig	fake geminates	sakat-t > sakatit, ma-faraʃ-ʃ > mafaraʃiʃ
ʕuʃb > ʕuʃub	ħuzn > ħuzun	dʒurn > dʒurun	ɣulb > ɣulub		
suṭħ > suṭuħ	kufr > kufur	samn > samin	ʕurf > ʕuruf		

B. Possible CC codas		
Geminate	son+obs	obs+obs
sitt > sitt	kalb > kalb ~ kalib	ʔuxt > ʔuxt, ~ʔuxut
ʔumm > ʔumm	ramz > ramz ~ ramiz	dist > dist, ~ disit
ʔamall > ʔamall	dʒanb > dʒamb ~ dʒanib	ʕaks > ʕaks, ~ ʕakis
ʔaxaff > ʔaxaff	burdgaan > burdgaan ~ buridgaan	wagt > wakt, ~ wagit

From Table 4.1, we can see that the norm is to disallow complex codas. Evidence for this comes from the fact that even when possible complex codas are allowed they are optional, except for true geminates. The only possible complex codas that AA allows are rather limited and are subject to different markedness constraints, as will be explained below. Moreover, heteromorphemic codas that have similar counterparts in tautomorphemic forms, which are expected to be legal coda clusters in AA, are disallowed. Also fake geminates are not allowed in AA.

Codas comprising an obstruent followed by a sonorant are categorically disallowed in AA due to a reversal in sonority as a sonorant is more sonorous than an obstruent according to the Sonority Sequencing Principle (henceforth SSP), given below in (4).

(4) SSP: the sonority profile of a syllable should increase maximally toward the peak and decrease gradually from the peak. (cf. Clements1990; Parker 2011)

This markedness constraint operates according to the sonority hierarchy that depicts the sonority profile of each natural class of segments below.

(5) Sonority Hierarchy (after Parker 2011: 1177): low vowels >> high vowels >> glides >> liquids >> nasals >> voiced obstruents (fricatives >> affricates >> stops) >> voiceless obstruents (fricatives >> voiceless affricates >> voiceless stops)

The sonority of sonorants (glides, liquids and nasals) is higher than that of obstruents (fricatives, affricates and stops) so a coda cluster made up of an obstruent followed by a sonorant appears with epenthesis, which is phonetically motivated (cf. Abu-Salim 1982). Moreover, codas made up of two sonorants, as in *ħilim* are also ruled out in AA although some of them do not violate SSP. This shows that AA avoids codas that do not have enough of a sonority drop.

Codas composed of a sonorant followed by an obstruent appear with or without an epenthetic vowel unless the obstruent is a guttural or a guttural is found within the same morpheme, as in /ɣulb/ > *ɣulub*. This suggests that although SSP is required for complex codas, it is not sufficient and it is overridden by morpheme structure constraints.

Codas with two obstruents show great variation. The norm is to disallow the cluster; however, they are optionally allowed only if both obstruents are voiceless and C_2 is the voiceless alveolar stop /t/ or the voiceless alveolar sibilant /s/, which is evident as devoicing applies in /wagt/ > *wakt*. Otherwise epenthesis is invoked. This suggests that the appearance of coda clusters relates to markedness (cf. Farwaneh 1995). The voiceless coronal stop is the least marked consonant in AA (ibid) and the voiceless alveolar sibilant is the least marked fricative, which has robust internal acoustic and phonetic cues that make it perceptually salient. This is not surprising as clusters involving the sibilant /s/ behave differently from other clusters as reported in the literature (cf. Goad 2011).

Similarly, voiceless obstruents followed by voiced obstruents are always broken up by epenthesis. This can be explained by a phonetic universal law known as Harms law, which asserts that once voicing is turned off, it cannot be resumed in the same syllable (Harms 1973, cited in Farwaneh 1995).[4]

Moreover, heteromorphemic coda clusters are not attested. For example /akal-t/ always appears as *ʔakalit* with an epenthetic vowel. Although these coda clusters are expected to surface in AA as they involve a sonorant and a non-guttural obstruent, they are split by epenthesis as the sonorant and the obstruent belong to different morphemes. This means that a legal coda cluster must be tautomorphemic.

To account for codas composed of geminates, I assume that their existence is attributed to geminate integrity which bans the separation of a true geminate (cf. Kenstowicz 1994; Davis 2011). This is corroborated by the fact that fake geminates in codas are split by epenthesis, as in *sakatit* above. Anticipating the discussion in §5.2, this suggests that true geminates should be represented as underlyingly moraic segments not as a single phoneme that is linked to two timing slots (cf. Hayes 1989; Davis & Ragheb 2011).

As shown above, sonority alone cannot account for coda clusters in AA as some codas are disallowed although they abide by sonority, e.g. a sonorant plus a guttural obstruent; whereas sonority plateaus are optionally allowed, as in *ʔuxt* ~ *ʔuxut* 'sister'. Similarly, a legitimate coda cluster cannot be related to the distance between

[4] Note that this is also connected with voice agreement in obstruent clusters, as discussed in §3.1.2.2.1.

consonants on the sonority scale as in other languages, e.g. English. To explain, epenthesis does not apply in *baxt* 'luck' where the two obstruents are very close on the sonority scale while it applies in *baliʕ* where the two consonants are further apart on the sonority scale.

Therefore, earlier accounts of coda clusters in terms of SSP (e.g. Abu-Salim 1982 for PA; Abu-Abbas 2003 for JA) cannot account for AA coda clusters. To circumvent this problem, Farwaneh (1995) attempted to account for such clusters in PA by proposing a modified version of SSP that requires coda clusters not to rise in sonority so as to allow sonority plateaux. However, this would predict that sonority plateaus of sonorant-sonorant or obstruent-obstruent should be legitimate codas. Moreover, this cannot account for sonorant-guttural obstruent codas, which are categorically banned in AA. Therefore, I suggest a constraint that I will call 'CODA CLUSTER CONDITION', given in (6), that incorporates the facts presented above about codas in AA.

(6) CODA CLUSTER CONDITION (henceforth CODACON): a two consonant coda must be well-formed.

A well-formed CC coda appears only tautomorphemically iff:

i) The first member is a sonorant and the second is an obstruent provided that no guttural sound is found within the same morpheme, or

ii) In the case of two obstruents, the first is voiceless and the second is either the voiceless alveolar stop or the voiceless alveolar sibilant,[5] or

iii) The CC coda is a geminate.

Having established the syllable structure in native AA words, I turn now to investigating syllable structure in loanwords, which will shed more light on the constraints that regulate syllable structure in AA as English has a more complex syllable structure than AA.

[5] The adaptation of coda clusters in loanwords such as *ʔiidz* 'AIDS' *klatʃ* 'clutch' and *disk* 'desk' indicates that two obstruents are allowed if they agree in voicing. These could represent accidental gaps in AA and so CODACON can be extended to cover such cases.

4.2 Syllable structure in loanwords

This section discusses syllable structure in loanwords. It will specifically show how source syllable structure is adapted into AA given that AA has a simpler syllable structure than English. I will first provide some statistics on the frequency of each syllable type in the adapted loanwords, then I will describe the adaptation of syllable onsets and codas and finally I focus on the adaptation of three and four consonant clusters word-internally.

The two most frequent syllable types in the adapted loanwords in AA are CVC and CV, respectively. The following table shows the frequency of the 11 syllable types attested in the adapted loanwords.

Table 4.2 Syllable type frequency

	Syllable type	Frequency	Example
1.	CVC	269	faṭ.bul
2.	CV	252	ha.mar
3.	CVVC	146	fees.buk
4.	CVV	121	fii.lee
5.	CVCC	74	sand.wiʃ
6.	CCVVC	22	sbaay.ki
7.	CVVCC	18	ʔiidz
8.	CCV	15	fla.ʃar
9.	CCVV	12	free.zar
10.	CCVC	11	brus.taat
11.	CCVCC	9	dramz, stikk

As can be seen, all syllables start with an onset. The most frequent types have a simple onset and a simple coda. However, complex onsets and complex codas are attested in about a quarter of cases. The most marked type where both the onset and the coda are complex is attested only nine times and belongs to whole words only, as in *dramz* ‘drums’. Likewise, type seven, which is also marked as it has a long vowel followed by a two-consonant coda, occurs only word-finally. Type five occurs mainly word-finally but also occurs medially in six compound words such as *kung fuu* and word-medially in non-compounds in four forms only, namely *kumb.ree.ṣa*, *kunt.rool*, *kung.ris* and *sand.wiʃ*.

4.2.1 Onsets

4.2.1.1 Simplex onsets

All English simplex onsets that are legitimate AA segments are realised as such in AA. Therefore, the only English simplex onset that is not mapped faithfully relates to the English phoneme /p/, which is realised as /b/ (see §3.1.1.1.1).

English onsetless syllables, which violate the undominated constraint in AA that requires all syllables to have onset, are augmented with a prosthetic glottal stop, as in *ʔakʃin* 'action'. Some examples of simplex onsets are given below.

(7) Simplex onsets

Class	Example
stops	band
fricatives	faṭbul
affricates	dʒinz
liquids	leezar
nasals	naasa
glides	weevar
onsetless	ʔiidz

4.2.1.2 Complex onsets

The overwhelming majority of source two-consonant complex onsets are mapped faithfully onto AA. On the face of it, one might assume that two-consonant complex onsets in AA native phonology are basic, which would explain the importation of these clusters in loanwords. However, I argue that such complex onsets are not basic in AA and the optimal onset is a simplex one.

Anticipating the discussion in §4.3.1, I assume that the first member of a complex onset is licensed as a semisyllable at the lexical level that is directly affiliated to the prosodic word. This is optionally realised with an epenthetic vowel to the left of the stranded consonant at the postlexical level (cf. Kiparsky 2003). The motivation for the above contention is threefold. First, complex onsets in native AA words are not basic;

rather they result from syncope of unstressed high short vowels in open non-final syllables or aphaeresis, i.e. the loss of sounds from the beginning of a word, as explained in §4.1.1. Second, there are no restrictions on these complex onsets in AA native words neither in terms of sonority nor homorganicity or voicing, which contradicts the cross-linguistically phenomenon whereby homorganic tautosyllabic consonants are not attested in onsets (Roca & Johnson 1999). That is, complex onsets such as /tl/, /dl/ and /dn/ are ill-formed; nevertheless, they are frequent in AA. In terms of sonority, AA has onset consonant clusters that comply with SSP as well as those that contravene it. All these complex onsets are restricted to word-initial position only (cf. Abu-Salim 1982; Btoosh 2006). Third, not all source complex onsets in loanwords are retained in AA despite the fact that they comply with SSP (see below), e.g. *fulumaaster* 'flow master' and *tarniib* 'trump'. Note also that source complex onsets are optionally preceded by a vowel and a glottal stop, e.g. *ʔavwaal* ~ *vwaal* 'voile'.

The following complex onsets appear in the corpus.

(8) Complex onsets (word-initial)

Obstruent	Sonorant	Example
f	r/l/y	freezar
b	r/l/y	blukke
d	r	dramm
k	r/l/w	kristaal
t	r/w/y	twiitar
g	l	glookooz
v	w	vwaal
s	t/b/n/r/w	staartar

Word-medially, source complex onsets in CCC clusters, as in 'control' and 'congress' are resyllabified in AA such that the first member is syllabified as part of a complex coda. Although it cannot be verified whether the middle consonant in a three-consonant cluster intervocalically syllabifies as part of a complex coda or a complex onset, I will adopt the former analysis and syllabify it as part of a complex coda. This is consistent with previous studies that postulate that complex onsets are not attested word-medially (cf. Abu-Salim 1982; Btoosh 2006). Moreover, the semisyllable analysis that will be adopted in §4.3.1, avoids this dilemma so it does not matter whether it is part of a coda or an onset as it will be adjoined to the prosodic word directly.

On the other hand, medial English complex onsets that are not preceded by a coda, as in *bat.wan* ‘between’ and *koob.ra* ‘cobra’ are always spread across the two syllables in AA. The first is always realised as a coda even in cases where the nucleus of the first syllable is bimoraic, as in *maas.tar* ‘master’ and *viid.yu* ‘video’ on the grounds that the second part of the vowel and the consonant share a mora, as will be shown in §4.3.2.3.1.

It is noticed that almost all source complex onsets satisfy sonority principles except for onsets that involve /s/. That is, they are unmarked as there is always a rise towards the nucleus, which will facilitate their importation into AA.

To sum up, source complex onsets are either realised as is word-initially or resyllabified across two syllables word-medially. However, deletion and epenthesis are also attested to fix some complex onsets. AA deletes the second segment where a glide is deleted in six words, e.g. ‘ambulance’ > *ʔambalanṣ* and ‘carburettor’ > *karbureetar* or the liquids /r/ and /l/ in one form each, namely ‘amplifier’ > *ambifayar* and ‘grapefruit’ > *karafoot* (see §4.4.2). Vowel epenthesis into complex onsets (see §4.4.4) occurs in nine loanwords, of which two words have three-consonant clusters (‘scrap’ > *sik.raab* and ‘spray’ > *sib.ree).* The other seven words relate to two-consonant clusters such as ‘trump’ > *ṭarniib* and ‘flow master’ > *fulumaastar*. This casts doubt on the status of complex onsets in native words, as will be shown below. Note that epenthesis in the middle of s-obstruent clusters contradicts Broselow’s (1992, cited in Gouskova 2001) contention that such clusters constitute complex segments. If the sibilant and the following obstruent were treated as complex segments epenthesis would not have occurred (see §4.4.4 on epenthesis).

4.2.2 Codas

4.2.2.1 Simplex codas

AA does not require a coda, but it does not ban codas so there are no restrictions on simplex codas in the corpus. All English simplex codas that have a counterpart in AA are realised as codas in AA. That is, no phonological processes conspire to avoid closing a syllable with a coda. On the contrary, results suggest that AA prefers closed syllables to open syllables, as will be seen in §5.2.

4.2.2.2 Complex codas

Almost all source CC codas in English loanwords are well-formed with respect to AA phonotactics. Very few cases, e.g. *klatʃ* and *ʔiidz*, where the second consonant is more sonorous are attested; however, the second consonant is always a sibilant. AA accommodates these words and the second consonant is licensed as a semisyllable word-internally or by consonant extrametricality word-finally, as will be demonstrated in the following section.

Three types of two-consonant complex codas are attested in the corpus:

(9) Two-consonant complex codas

A. Sonorant +obstruent/sonorant:

First member	Second member	Examples
Son	Obs/ son	
i. n	d/t/k/s/z/ṣ/dʒ/g	band, rindʒ
ii. r	t/d/g/ṭ/s/f/ṣ/θ/dʒ/	ʔeerθ, laardʒ
iii. y	t/d/k/z/m/l	roozraayz, ʔufsaayd
iv. w	t/n/l	ʔawt, fawl
v. m	z/b	dramz
vi. l	t/d/f/	balf, silf

B. Obstruent + obstruent

Obs	Obs	Examples
i. b	s	ʃibs
ii. d	z	ʔiidz
iii. t	ʃ	klatʃ, hatʃ.baak,
iv. k	s	triks
v. f	t	ʃift
vi. s	t/k	disk, difrust

C. Geminates

Obs +obs / son +son	Examples
i. bb	tibb
ii. tt	nitt
iii. kk	brikk
iv. ff	ʃiff
v. ʃʃ	diʃʃ
vi. nn	yann

From the table in (9a), it can be seen that all these codas are well-formed according to AA phonotactics as they are composed of a sonorant and a non-guttural obstruent. There are no codas that involve sonority reversal. In all these CC codas, the coda consists of a sonorant /m, n, l, r, w, y/ followed by a stop /t, d, k, g/, a fricative /f, θ/, an affricate /dʒ/ or a sibilant /s, z/. All these codas are unmarked as they satisfy SSP and all of them abide by the CODACON suggested in (6). The only exception relates to codas of two sonorants in (iii) and (iv) where the first member is a glide. Note that these belong to diphthongs in English.

Note here that a sonorant could be followed by a voiced or a voiceless obstruent. Again this suggests that sonorants could be underspecified for voice as there is no co-occurrence restriction in terms of voicing as is the case in group (9b) where obstruents agree in voicing except for /b/, which also suggests that it is underspecified for voice (see §3.1.2.2.1).

For (9b), all clusters are unmarked and phonetically motivated. Almost all of them are phonetically unmarked as they involve a sibilant, in particular /s/, which is acoustically salient, as explained earlier. The rest are unmarked in AA in that the second member is mainly a voiceless obstruent in particular /t/, the least marked consonant in AA. The importation of these coda clusters calls for a modification of the CODACON suggested earlier in (6). Some of these CC codas are not attested in AA such as those that end with voiced consonants or those that end in /ʃ/. I assume that these do not contradict CODACON; rather they represent accidental gaps in AA. Therefore, a small modification to the CODACON should be made to accommodate these codas. I suggest that the second condition in (6) is modified to read as follows:

In the case of two obstruents, the cluster must agree in voice and none of the consonants is a guttural. This stipulation accounts for imported source CC codas. Note that no epenthesis is attested in words that end with a long vowel followed by two consonants such as *ʔiidz* 'AIDS'. The last consonant is extrametrical and /d/ shares a mora with the second leg of the vowel, as will be explained in §4.3.2.3.1.

Finally, in group (c), a complex coda is realised as a geminate. Note that this geminate does not correspond to a geminate in the source. Rather it results from AA minimality constraints, as will be discussed in Chapter six.

To conclude, almost all source two-consonant codas are unchanged. This is because English complex codas are generally well-formed in terms of sonority and they satisfy AA phonotactic constraints. However, epenthesis and deletion are attested to render the syllable less marked, as will be discussed in §4.4.

4.2.3 Medial -CCC- clusters

Source -CCC- clusters are retained in ten loanwords, undergo vowel epenthesis in four cases, and deletion in six cases as laid out in (10) below.

(10) Treatment of CCC clusters (cluster is in bold)

a) Cluster retained

co**mpr**essor	kumb.ree.ṣa
co**ntr**ol	kunt.rool
ku**ng f**u	kung.fuu
la**nd r**over	land.roo.var
sa**ndw**ich	sand.wiʃ
x-large	ʔiks.laardʒ

b) Cluster broken up

di**str**ibutor	dis.ba.ra.toor
foo**lsc**ap	fu.lis.kaab
pa**ncr**eas	ban.kir.yaas

c) Consonant deleted

a**mpl**ifier	am.bi.fa.yar
gra**pefr**uit	ka.ra.foot

rol**ls r**oyce rooz.raayz

In (10a), these clusters are well-formed in AA as they do not flout the CODACON. As will be shown in §4.3.2.3.2, the second consonant will be licenced as a semisyllable. The majority of these clusters are composed of a sonorant especially a nasal followed by an obstruent or of two obstruents that satisfy CODACON.

The third consonant in these clusters is licensed as it forms the onset of the following syllable. Note also that the majority of loanwords with internal CCC clusters that do not undergo deletion or epenthesis are compound words in the source, which could mean that AA treats these clusters as belonging to separate words. Deletion and epenthesis will be accounted for in §4.4.

4.2.4 CCCC clusters

Four-consonant clusters are not common in the corpus. There are only five loanwords in the database that contain such clusters as shown in (11) below.

(11) Treatment of four-consonant clusters

a) Epenthesis

corn flakes	koornifliks
extra	ʔikis.tra
hand brake	handibreek
land cruiser	lan.dik.roo.zar

b) Deletion

puncture[6]	ban.ʃar

Four-consonant clusters are never retained. Either they undergo consonant deletion or vowel epenthesis. Deletion affects the less salient consonants /k,t/ in 'pu**nct**ure'. Epenthesis of the default vowel /i/ is the norm, as will be explained in §4.4.4.

To summarize, this section has outlined the syllable structure in loanwords. It has also shown that AA imports the majority of complex onsets and CVVC syllables as well as CVCC syllables that satisfy CODACON while it repairs more marked structures such

[6] I assume here that this word has a four-consonant cluster due to the voiceless affricate that is considered bisegmental in AA.

as four-coda clusters. The importation of such syllables calls for a modification of earlier analyses of syllabification of JA and PA in general, which is the topic of the next section.

4.3 Syllabification

This section accounts for the syllabification of loanwords in AA; however, the same analysis also applies to native words. This analysis will adopt moraic theory within a Stratal-OT framework, as laid out in §2.7.2. I assume that the maximum syllable is bimoraic so mora sharing is invoked to account for CVVC syllables and semisyllables are called for to account for complex margins. Onsets and vocalic nuclei are obligatory while codas are optional. Word-final consonants are extrametrical.[7]

Recall that under moraic theory only moras are represented to formally describe a syllable (see §2.7.1). Short vowels contribute one mora, while long vowels and diphthongs contribute two. Geminates contribute one mora, and non-final coda consonants are assigned a mora through the parametric constraint WBP. So a CV syllable is monomoraic while CVV and CVC syllables are bimoraic. A superheavy syllable such as CVVC and CVCC would be trimoraic according to moraic theory; however, these syllables are bimoraic in AA as evident from stress rules which do not distinguish between superheavy and heavy syllables so I argue that AA distinguishes two types of syllables: light and heavy. In word-final position, superheavy syllables are bimoraic due to consonant extrametricality in domain final position, which also accounts for the monomoraicity of CVC syllables word-finally (see §2.7.1).[8] Note, though, that I still use onset, rhyme and coda for organizational purposes only.

The remainder of this section is organized as follows: §4.3.1 presents a syllabification algorithm that incorporates semisyllables and mora sharing and §4.3.2 presents an OT analysis of syllable structure in loanwords.

[7] Kiparsky (2003) argues that such consonants are licenced as semisyllables in VC dialects (see the section below for details).

[8] This is motivated on the grounds that CVC syllables attract stress word-internally but reject it word-finally, as will be explained in §5.1.

4.3.1. Syllabification algorithm

Following Watson (2002, 2007), the following syllabification algorithm is suggested to assign syllabic positions within the prosodic word, which is assumed to be the domain of syllabification in AA. A dot will be used to designate syllable boundaries.

(12) Syllabification algorithm (after Clements 1990; Watson 2002)

I. Word-final consonant extrametricality: final consonants are extrametrical (this is placed between angled brackets). C > <C> /___]word.

II. Associate moraic segments to a syllable node.

III. Given P (an unsyllabified segment) preceding Q (a syllabified segment), adjoin P to the syllable containing Q iff P has a lower sonority rank than Q.

IV. Given Q (a syllabified segment) followed by R (an unsyllabified segment), assign a mora to R (Weight-by-Position) [iff R has a lower sonority rank than Q.

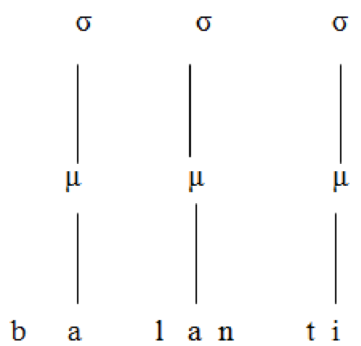
V. Adjoin moraic R to the syllable containing Q.

VI. Incorporate the extrametrical consonant to the final syllable.

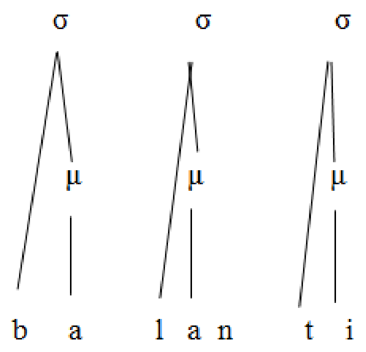
Let us illustrate this with an example below.

(13) A tree for *ba.lan.ti* ‘penalty’ (only the number of the relevant step is shown)

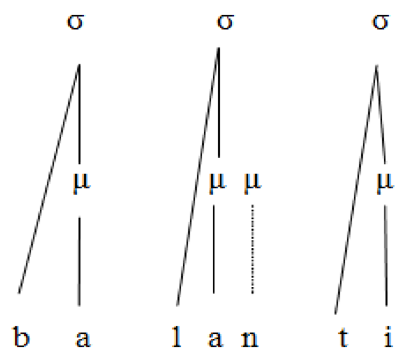
ii) Association of moraic segments to syllable node



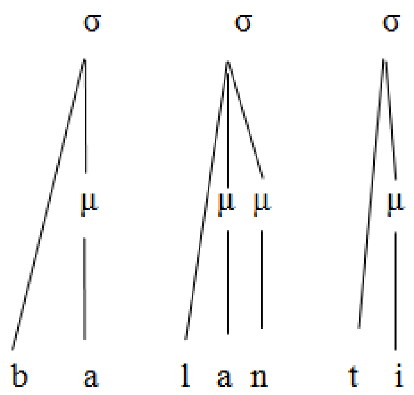
iii) Association of onset to syllable node



iv) Assignment of mora through WBP



v) Adjunction of WBP mora to syllable node



The above algorithm accounts well for syllables with simplex codas and onsets. However, complex margins and superheavy syllables require an amendment to this algorithm. Assuming that the maximum syllable in AA is bimoraic and complex margins are not allowed in AA, I adopt Kiparsky's (2003) semisyllable analysis and Broselow et al.'s (1997) and Watson's (2007) mora sharing analysis to account for ill-formed syllables.

4.3.1.1 Semisyllables and mora sharing

To account for superheavy syllables, complex onsets and the opacity of stress assignment in forms such as *ka'tabit* and *'ʔakilna*,[9] as already pointed out, Kiparsky (2003) puts forward an analysis that makes use of a semisyllable within a Stratal OT framework (see §2.7.2 for details on Stratal OT). Semisyllables are unsyllabified moras that are directly associated to the prosodic word so they are weightless as they are not affiliated with a foot or a syllable. Attaching semisyllables to the prosodic word violates the Strict Layering Hypothesis given in (14) below. Associating them to the syllable node will violate constraints against complex margins. However, associating them to the prosodic word is the safest option as size restrictions on prosodic words are weaker (Kiparsky 2003; Watson 2007).

(14) Strict Layering Hypothesis (henceforth SLC): A prosodic constituent of level n must immediately dominate a constituent of level n-1 only (Selkirk 1984).

So a semisyllable violates the constraint LICENSE-μ, which requires moras to be licensed by syllables (Kiparsky 2003). This means that LICENSE-μ is ranked below markedness constraints such as FTBIN and *COMPLEX, as will be demonstrated below.

Kiparsky proposes a classification of Arabic dialects according to their licensing of semisyllables. CV dialects (Farwaneh's (1995) Onset dialects, see §4.4.4) such as Cairene do not license semisyllables at any level so they resort to epenthesis and/or long vowel shortening to repair ill-formed structures. VC dialects (Farwaneh's (1995) Coda dialects)[10] such as PA license semisyllables at the lexical level only. C dialects license semisyllables at both levels. Based on this classification, AA would be described as a VC dialect so semisyllables would be allowed at the lexical level and vowel epenthesis would be invoked at the postlexical level as semisyllables are banned postlexically. However, it will be shown that AA does allow semisyllables at both levels.

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[9] According to stress constraints in AA (see §5.1.4), stress would fall on the initial syllable in *katabit* 'I wrote' and on the second in *ʔakilna* 'our food'. However, it opaquely falls on the second in *ka'tabit* and on the first in '*ʔakilna*.

[10] I mainly adopt the Coda dialect term; however the VC term will be used when a particular reference is made to Kiparsky's categorization.

To explain how semisyllables operate, let us take an example from a VC dialect, the focus of this study. According to Kiparsky, opacity of stress assignment in forms such as *ka'tabit*, is due to the different ranking of LICENSE-μ across the stratified grammar according to Stratal OT. Kiparsky argues that in a VC dialect, such as AA, LICENSE-μ is ranked low at the lexical level. So in a word such as /katab-t/, the last consonant is licensed as a semisyllable at the lexical level where stress applies yielding *ka'tabt* so here stress assignment is not opaque as stress falls correctly on the heavy ultimate syllable. Later at the postlexical level where semisyllables are not licensed, due to the promotion of LICENSE-μ, epenthesis is called for to repair the ill-formed coda cluster –bt yielding *ka'tabit*. However, this analysis is not without problems, as will be shown below.

Watson (2007: 349) argues that Kiparsky's analysis cannot account for dialects which allow CVVC syllables word-internally postlexically. She argues that if LICENSE-μ is promoted at the postlexical level then CVVC syllables cannot surface and so should appear with an epenthetic vowel or undergo vowel shortening according to Kiparsky's analysis. However, given that such syllables do not undergo vowel shortening or vowel epenthesis in VC dialects, it follows that these syllables are licensed. To this end, she proposes a mora-sharing analysis. Following Broselow et al. (1995), she argues that a mora sharing approach would account for both lexical and postlexical levels assuming that a mora is shared between the second leg of the vowel and the following consonant.

Acoustic evidence lends support to this contention. Broselow et al. (1997: 59) found statistically significant differences in length between long vowels in open syllables and long vowels closed by a coda (161 ms vs. 131.6 for one JA speaker). Also, the coda consonant following a long vowel is significantly shorter than a coda following a short vowel (67.6 ms vs. 88.4).

Although a mora sharing analysis is appealing and can account for CVVC syllables elegantly in AA, it cannot account for CVCC syllables or complex onsets. Watson's analysis fits well with dialects that do not allow CVCC syllables word-internally. However, AA does have CCC clusters word-medially that satisfy CODACON such as *kalbna* 'our dog' and it will be demonstrated below that these two consonants cannot share a mora. Also, AA has CC onset clusters at both levels, which cannot be accounted for by mora sharing. Therefore, I will adopt both analyses—mora sharing and semisyllables to account for AA syllables.

For CVCC syllables, I argue that a shared mora analysis (cf. Farwaneh 1995; McCarthy 2007b) cannot be maintained as it fails to account for cases such as /bayyan-t-l-ha/ > *bay.yan.'til.ha* 'I pointed out to her' with a stressed penult (Abu-Rakhieh 2009). Following Kiparsky (2003), a stressed epenthetic vowel means that it is inserted lexically as stress assignment is a lexical process. That is, the high short vowel is inserted lexically due to the presence of two successive semisyllables, which are banned; hence, lexical vowel epenthesis. If mora sharing was allowed between the nasal and the alveolar stop in /nt/ then the string would end up with one stray consonant, i.e. /l/, which would be analysed as a semisyllable and vowel epenthesis would not happen at the lexical level (cf. Btoosh 2006; Abu-Rakhieh 2009).(See also §4.4.4).

More evidence comes from the fact that CVVC and CVCC syllables do not pattern alike in loanwords and in native words. Although both of them occur word-internally, CVVC syllables are more frequent than CVCC syllables. CVVC syllables appear 176 times in the corpus of loanwords in all positions and AA speakers rarely invoke any phonological processes to eliminate them. In contrast, CVCC syllables are rather limited and are subject to the CODACON constraint. They appear 74 times, as in *kuntrool* and *sandwiʃ* and most of them are restricted to word-final position or in compounds. This suggests that the status of CVVC syllables is different from that of CVCC syllables; the former are less marked and so they could represent core syllables in AA. Note also that mora sharing between two consonants is marked phonetically as the sonority distance between the consonants is not wide enough to allow mora sharing (Broselow 1992: 15).

The same argument holds for CC onsets, which are already moraless according to moraic theory. Therefore, I will analyze the first consonant as a semisyllable lexically, as in k_{μ}*.taab* while at the postlexical level a semisyllable is optional so we have both *ʔiktaab* and k_{μ}*.taab*. Note that if LICENSE-μ is promoted postlexically as per Kiparsky's analysis, then vowel epenthesis in *ʔiktaab* cannot be optional in AA, which is not the case. Note that stress assignment shows that epenthesis in such complex onsets is postlexical, as will be shown in §4.4.4.

The analysis adopted here will make use of the insights of Kiparsky's semisyllable analysis and Watson's mora-sharing analysis but diverts from them as follows: In contrast to Watson, I assume that mora sharing is possible only between a vowel and a consonant and this will account for CVVC syllables only. In contrast to Kiparsky, I restrict the semisyllable analysis to complex margins only. Moreover, my analysis differs from Kiparsky's in the ranking of constraints especially LICENSE-μ. Kiparsky assumes that LICENSE-μ is ranked low at the lexical level in VC dialects but it is promoted postlexically, which invokes epenthesis. However, based on AA data, I argue that the ranking of LICENSE-μ is low at both levels and it is the ranking of other constraints that is crucial, as will be shown below.

To sum up, as has been demonstrated, Kiparsky's analysis cannot account for CVVC syllables and Watson's analysis cannot account for CVCC syllables and complex onsets in AA. Combining both analyses will better account for AA syllables.

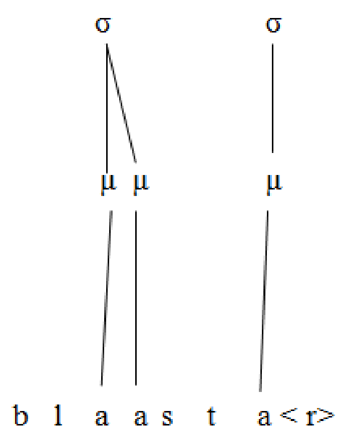
Having introduced semisyllables and mora sharing, I demonstrate this with two examples below.

(15) A tree for *blaas.tar* 'plaster' (feet are not shown)

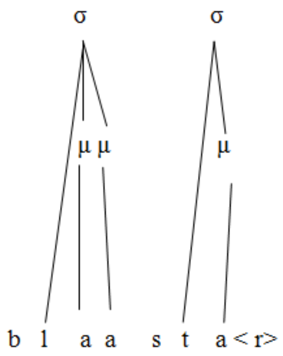
i) Domain-final consonant extrametricality

b l a a s t a < r>

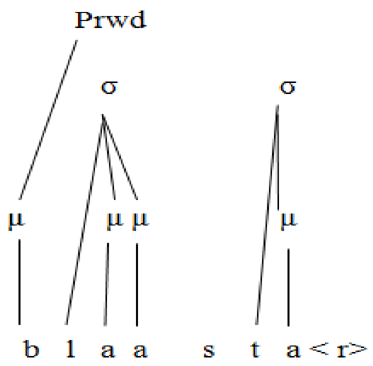
ii) Association of moraic segments to syllable node



iii) Association of onset to syllable node

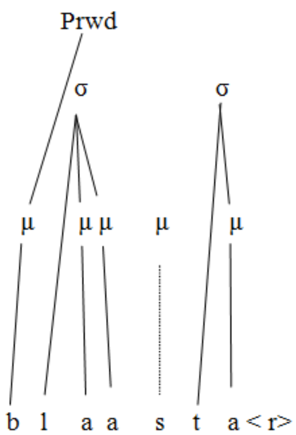


Here, the algorithm needs to account for a complex onset. As argued above, the first member of a complex onset is licensed as a semisyllable that is affiliated directly to the prosodic word, as shown below.

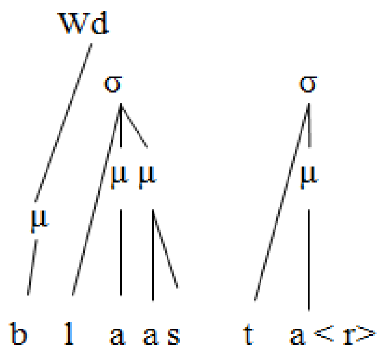


Assigning a mora through WBP as shown below will render the syllable trimoraic, which is categorically illicit in AA, so mora sharing between the second member of the vowel and the following consonant in the first syllable /blaas/ renders the syllable bimoraic.

iv) Assignment of mora through WBP

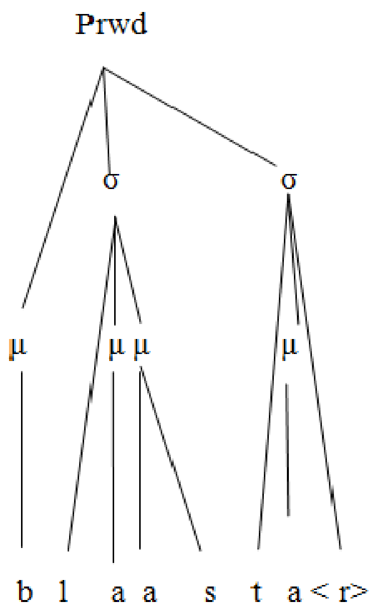


After applying mora sharing we get the representation below.



Incorporating the extrametrical consonant completes the syllabification and yields well-formed AA syllables given below.

ix) Incorporation of extrametrical consonant into preceding syllable



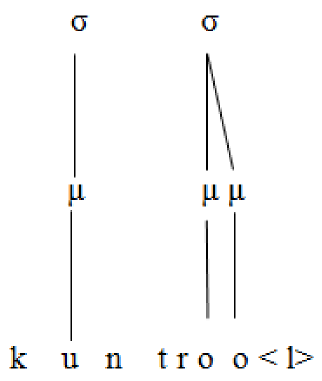
To see how the semisyllable operates in CVCC syllables, take the syllabification of *kuntrool* ‘control’ below.

(16) A tree for *kunt.rool* ‘control’ (feet are not shown)

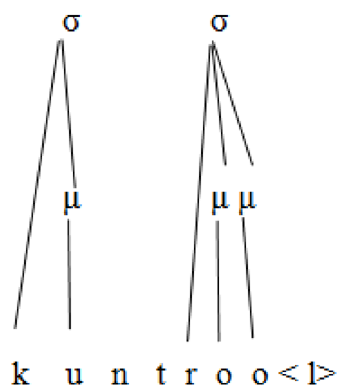
i) Domain-final consonant extrametricality

kuntroo < l>

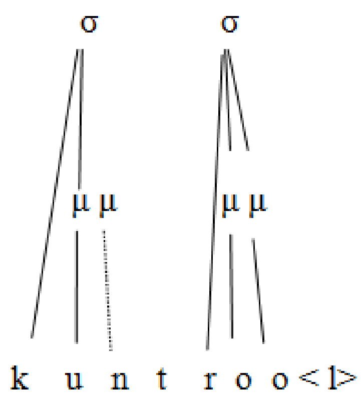
ii) Association of moraic segments to syllable node



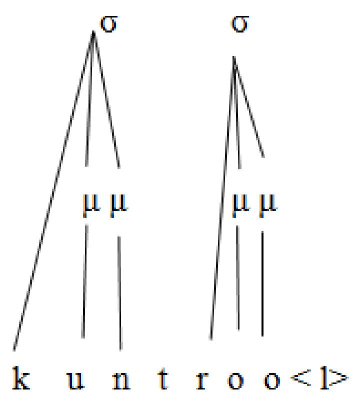
iii) Association of onset to syllable node



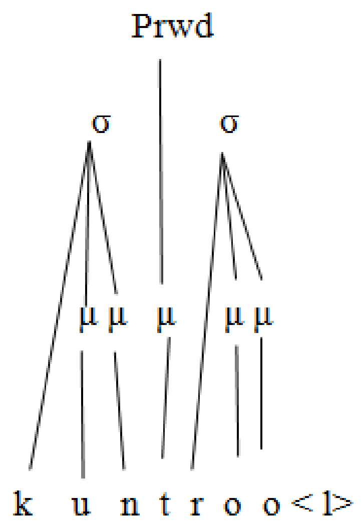
iv) Assignment of mora through WBP



v) Adjunction of WBP mora to syllable node

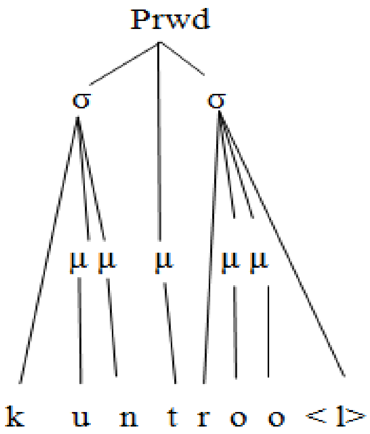


Here, the algorithm needs to account for a complex coda. Adjoining the stray consonant to either syllable will end up with a complex margin so the stray consonant is licensed as a semisyllable affiliated directly to the prosodic word as shown below.



Incorporating the extrametrical consonant completes the syllabification and yields well-formed AA syllables given below.

ix) Incorporation of extrametrical consonant into preceding syllable



To conclude, the suggested syllabification algorithm presented above is better able to account for problematic syllables in AA, thanks to Watson's mora-sharing suggestion and Kiparsky's semisyllable notion. In the following subsection, I translate these facts into OT constraints and suggest a constraint hierarchy for AA syllable structure at lexical and postlexical levels.

4.3.2 OT analysis of syllable structure

This subsection analyses syllable structure in loanwords under the framework of Stratal OT. It will be shown that the interaction of faithfulness and especially markedness constraints accounts for the well-formedness of syllables in AA. Recall that mora sharing will account for CVVC syllables and semisyllables will account for the analysis of complex margins.

4.3.2.1 Simple margins and nuclei

Examining the adaptation of all syllable types in the corpus of loanwords, we find that all syllables start with an onset and have a vocalic nucleus. The corpus shows that the minimal syllable type in AA is CV. This means that an onset and a vocalic nucleus (to the exclusion of syllabic sonorants) are obligatory in AA.

Evidence for ONSET in loanwords comes from the fact that all onsetless source syllables are augmented with a prosthetic glottal stop, the default postlexical epenthetic consonant in AA (cf. Watson 1989 for San'ni Arabic). A few examples are repeated for convenience in (17) below.

(17) acid ʔa.siid
AIDS ʔiidz
earth ʔeerθ

In OT terms this means that the markedness constraint ONSET below dominates the faithfulness constraint DEP-C.

(18) ONSET: Syllables must have onsets (Prince & Smolensky 1993/ 2004).

(19) DEP-C: Output consonants must have input correspondents (cf. McCarthy & Prince 1995).

The tableau in (20) below illustrates this ranking. (Only relevant constraints are shown).

(20) ONSET >> DEP-C

Input: action	ONSET	DEP-C
a. ☞ʔak.ʃi<n>		*
b. ak.ʃi<n>	*!	

Candidate (a) wins as it satisfies the undominated ONSET constraint in Arabic at the expense of violating DEP-C. Another option to fix this ill-formed structure is to delete the vowel in the first syllable yielding **kʃin*. However, this will render the adapted form and the source form widely dissimilar, which is avoided in loanword phonology (cf. Kenstowicz 2003, 2007). This strategy violates the faithfulness constraint MAX-IO (given in (21) below), which requires input segments to be faithfully realised in the output (McCarthy & Prince 1995). Since AA resorts to epenthesising a consonant rather than deleting the vowel, it entails that MAX-IO in (21) dominates DEP-IO in (22).

(21) MAX-IO: Input segments must have output correspondents (no deletion).

(22) DEP-IO: Output segments must have input correspondents (no epenthesis).

Further evidence for ONSET comes from hiatus resolution (see §4.4.1) where an epenthetic glide or a glottal stop is inserted to provide an onset for otherwise onsetless syllables, as in *ku.ka.ʔiin* 'cocaine' and *ma.yu.neez* 'mayonnaise'. Note here that there is no need for the constraint *HIATUS, which bans adjacent vowels as its effect is achieved by ONSET.

For the nucleus, we notice that all syllables are realised with a vocalic nucleus. Syllabic consonants are not allowed as AA requires all nuclei in AA be filled by a vowel. To this end, I adopt the constraint NUC/V presented in (23) below.

(23) NUC/V: The head of a syllable must be a vowel (Prince & Smolensky 1993/ 2004).

This constraint is undominated in AA as syllabic consonants are prohibited. Evidence for this comes from the fact that all source nasal and lateral nuclei are unpacked into a vowel and a consonant. Consider the examples below where potential syllabic consonants are realised with a vowel.

(24)	action	ʔak.ʃin
	double	da.bil
	single	sin.gil

Having established that ONSET and NUC/V are undominated in AA, I turn now to examining simplex codas. Of the 12 syllable types in the corpus, nine of them end in at least one consonant in the coda. The data show that although AA does not require a coda it does not ban it. Some examples are given below.

(25)	football	faṭ.bul
	Facebook	fees.buk
	prostate	brus.taat

In OT terms, this means that *CODA, given in (26), is low ranked in AA and is dominated by other markedness and faithfulness constraints such as MAX-IO and DEP-IO. That is, if a coda is present in the source word, it is preserved, violating *CODA, and no phonological processes are invoked to eliminate a coda.

(26) *CODA: A syllable must not have a coda (cf. Prince & Smolensky 1993/2004).

So far the ranking I have established is given in (27) below.

(27) ONSET, NUC/V, MAX-IO >> DEP-IO >> *CODA.

4.3.2.2 Analysis of complex onsets

For the analysis of complex onsets and complex codas that will be discussed below, I adopt Kiparsky's semisyllable within a Stratal OT framework. I argue that AA licenses a semisyllable at the lexical level where LICENSE-μ is ranked below DEP-V. At the postlexical level, DEP-V is demoted and is equally ranked with LICENSE-μ. Another constraint that is crucial here is CODACON, which is ranked below DEP-V at the lexical level while it is promoted at the postlexical level resulting in vowel epenthesis to break up ill-formed coda clusters, as will be shown below. It will be assumed that the surface form of adapted loanwords corresponds to the postlexical one. Therefore, I will account for syllable structure at the postlexical level unless otherwise stated.

As I argued above in §4.3.1, complex onsets are not allowed in AA and the first consonant within source complex onsets is licensed as a semisyllable that is associated directly to the prosodic word. A semisyllable violates LICENSE-μ in (28), meaning that LICENSE-μ is ranked below COMPLEX ONSET in (29). Also, the consonant cannot be left unparsed, which means that the constraint PARSE-C, given below in (30), ranks above LICENSE-μ.

(28) LICENSE-μ: A mora must be affiliated with a syllable (Kiparsky 2003).

(29) *COMPLEX ONSET: Syllables must not have more than one segment in the onset (Prince & Smolensky 1993/ 2004).

(30) PARSE-C: A consonant must be parsed into a mora or a syllable (Kiparsky 2003).

The tableau in (31) exemplifies this.

(31) *COMPLEX ONSET, PARSE-C >> LICENSE-μ

Input: flash	*COMPLEX ONSET	PARSE-C	LICENSE-μ
a. ☞ f_{μ}.laa<ʃ>			*
b. f.laa<ʃ>		*	

c. flaaʃ	*!		

Note that a complex onset also appears with an optional epenthetic vowel postlexically. Inserting a vowel violates DEP-V, so DEP-V should rank below COMPLEX ONSET. However, epenthesising the vowel renders the initial syllable onsetless so glottal stop insertion applies (violating DEP-C) to provide an onset to the onsetless syllable, which further supports the undominated status of ONSET in AA. Given that the form appears with or without an epenthetic vowel, then LICENSE-μ and DEP-V are not ranked with respect to each other as the tableau below shows.

(32) ONSET, *COMPLEX ONSET, PARSE-C >> LICENSE-μ, DEP-V, DEP-C

Input: flash	ONSET	*COMPLEX ONSET	PARSE-C	LICENSE-μ	DEP-V	DEP-C
a. ☞f$_{\mu}$.laa<ʃ>				*		
b. f.laa<ʃ>			*			
c. flaaʃ		*!				
d. iflaaʃ	*!				*	
e. ☞ʔiflaaʃ					*	*

Still another possible way to satisfy COMPLEX ONSET without violating ONSET is epenthesising a vowel after the stray consonant, as in *fi.laa<ʃ>. This option is not attested in AA due to the high ranked No[i] constraint, given below in (33), that dominates LICENSE-μ.

(33) No[i]: High short unstressed vowels in open syllables are not allowed (Kenstowicz 1995; Kager 1999).

The tableau in (34) incorporates this constraint.

(34) *COMPLEX ONSET, No[i], PARSE-C >> LICENSE-μ

Input: flash	COMPLEX ONSET	No[i]	PARSE-C	LICENSE-μ
a. ☞f$_{\mu}$.laa<ʃ>				*
b. f.laa<ʃ>			*	

c. flaaʃ	*!			
d. fi.laa<ʃ>		*		

Moreover, a form such as **fi.laaʃ* would also be ruled out on markedness constraints as it starts with a monosyllabic syllable followed by a foot (a stressed syllable). This will be demonstrated in §5.2 under gemination.

Based on the adaptation of complex onsets, the following ranking can be established

(35) ONSET, COMPLEX ONSET, No[i], PARSE-C >> LICENSE-μ, DEP-V, DEP-C

So far no ranking relationship is established between the first four constraints.

4.3.2.3 Analysis of superheavy syllables

In this subsection, I show how superheavy syllables are accounted for in AA. I will specifically show that mora sharing accounts for CVVC syllables while semisyllables account for CVCC syllables. First, I account for CVVC syllables then I move to CVCC syllables.

4.3.2.3.1 CVVC syllables

As argued above in §4.3.1, these syllables are bimoraic in AA and they are accounted for by sharing a mora between the consonant and the second leg of the vowel. This violates a constraint that bans mora sharing between a vowel and a consonant, presented in (36).

(36) *SHAREDMORA (VC) (henceforth *NSμ(VC)) (after Watson 2007)
A mora cannot be linked to a vowel and a consonant (Broselow et al. 1997: 65).

In OT terms, *NSμ(VC) is dominated by WBP, which assigns moras to coda consonants word-internally and FOOT-BINARITY, which requires feet to be bimoraic. The coda consonant will retain its mora only if the vowel is monomoraic. If the vowel is already bimoraic, mora sharing will render the foot bimoraic. Notice that mora sharing does not violate WBP (Morén 2001: 241) as the consonant here is still moraic although it does not have its independent mora. So WBP should outrank *NSμ(VC).

Recall that many loanwords have CVVC syllables both internally and word-finally. Consider the tableau of the word corner > *koor.nar* below that establishes the ranking of the three constraints in question.

(37) FTBIN, WBP >> * NSμ (VC)

Input: corner	FTBIN	WBP	*NSμ(VC)
a. μμ ☞koor.na<r>			*
b. μμμ koor.na<r>	*!		
c. μμ koor.naμ<r>		*	

The tableau shows that candidate (b) incurs a fatal violation of FTBIN as it assigns a mora to the coda consonant rendering the syllable trimoraic. To avoid this, candidate (c) does not assign a mora to the coda and is consequently ruled out as it incurs a violation of WBP. So far no ranking relationship can be established between WBP and FTBIN.

Incorporating the already established constraints above gives us more options. To satisfy FTBIN, an attempt to syllabify the stray consonant as part of a complex onset of the following syllable is ruled out by *COMPLEX ONSET. Unparsing the segment, as well as deleting it is also avoided as it falls victim to PARSE-C and MAX-C, respectively. Again, inserting a vowel after the offending segment is not possible as it violates both No[i] and DEP-V, which shows that all these constraints are ranked above *NSμ(VC). The interaction of these constraints is laid out in the tableau below.

(38) *COMPLEX ONSET, FTBIN, No[i], PARSE-C, WBP, MAX-C >> DEP-V >> *NSμ(VC)

Input: corner	*COMPLEX ONSET	FT BIN	No [i]	PARS E-C	WBP	MAX-C	DEP-V	*NS (VC)
a. μμ ☞koor.na<r>								*
b. koo.rna<r>	*!							
c. μμμ koor.na<r>		*!						
d. koo.ri.na<r>			*				*	
e. koo.na<r>						*		
f. koo.r.na<r>				*				
g. kooμμr.na<r>					*			

So far I have established the partial ranking in (39) below.

(39) *COMPLEX-ONSET, FTBIN, No[i], PARSE-C, WBP, MAX-C >> DEP-V >> *NSμ(VC)[11] >> *CODA

4.3.2.3.2 CVCC Syllables

The overwhelming majority of complex codas appear word-finally. Word-final complex codas are not problematic as they are justified by the fact that the last consonant is extrametrical (hence licensed) and is syllabified later in the derivation

[11] One might argue that there is no need for *NSμ (VC) or LICENSE-μ as FTBIN dominates WBP so this will guarantee that the coda is not assigned a mora when that results in a trimoraic foot. Although this looks possible, it cannot account for cases such as CVC.CVC.CVC *simʕillak* 'he listened to you m.'. Here, if we assume that foot binarity is enough we cannot exclude a parsing like (CVCCVC)CVC where coda consonants are rendered monomoraic to satisfy FTBIN with stress falling incorrectly on the first syllable according to AA constraints. So both constraints are still needed. Note also that it is assumed that a semisyllable does not violate WBP as the segment is still moraic.

(cf. Kenstowicz 1994). (This also applies to CVVC syllables word-finally). Recall that evidence for the extrametricality of domain final consonants comes primarily from stress facts where a CVC syllable word-finally behaves as a light syllable and stress constraints do not distinguish between heavy and superheavy syllables. Also such consonants do not count for minimality purposes, as will be shown in §5.2 (McCarthy & Prince 1990).

Let us first account for CVCC syllables word-finally. Recall that WBP requires codas to be moraic but the evidence above shows that codas in word-final position are weightless. Therefore, we need a constraint that renders consonants in domain final position moraless. I adopt Kager's (1999) *FINAL-C-μ constraint presented in (40).

(40) *FINAL-C-μ: Domain final consonants are moraless (kager 1999).

This means that WBP should be dominated by *FINAL-C-μ, as laid out in the tableau below.

(41) *FINAL-C-μ >> WBP

Input: bank	*FINAL-C-μ	WBP
a. ☞ban$_{\mu}$<k>		*
b. ban$_{\mu}$k$_{\mu}$	*!	

To account for the second member in a two-coda cluster word-internally, I assume that it is licensed as a semisyllable at the lexical level as stress assignment shows and optionally at the postlexical level if CODACON is satisfied.[12] Given that the attested form of loanwords corresponds to the surface form, the postlexical level, I refer to AA native words to establish the OT ranking at both levels.

The four relevant constraints to account for CVCC syllables at both levels are repeated below for convenience.

(42) DEP-V: Output vowels must have input correspondents (No vowel insertion)

(43) LICENSE-μ: A mora must be affiliated with a syllable.

[12] This also applies to geminate codas, even though geminates are also protected by geminate integrity.

(44) CODACON: A two-consonant coda must be well-formed.

(45) *COMPLEX CODA: Syllables must not have more than one coda segment.

AA does not allow complex onsets so I will use the cover constraint *COMPLEX, which bans both complex codas and onsets when no particular reference to onsets or codas is made (cf. Prince & Smolensky 1993/2004).

These constraints are ranked differently at each level and it is the ranking of these constraints with respect to each other at both levels that yields the optimal output, as will be explained below.

Given that CC codas optionally appear internally in AA, as in kalb-hum > *kalbhum*, ~ *kalibhum*, it follows that a semisyllable is attested at the postlexical level. Also, the alternate form with an epenthetic vowel means that DEP-V is equally ranked with LICENSE-μ. However, this cannot account for coda clusters that violate the CODACON such as dʒisr-hum > *dʒisirhum* which always surface with an epenthetic vowel. So here, it cannot be the case that LICENSE-μ is ranked above DEP-V. If LICENSE-μ was promoted postlexically, vowel epenthesis would be obligatory in AA, which cannot account for cases such as *kalbhum*. Therefore, I argue that the ranking of LICENSE-μ is not the only crucial factor. Rather it is the ranking of CODACON, DEP-V and LICENSE-μ with respect to each other that is crucial in AA. At the lexical level, DEP-V dominates both LICENSE-μ and CODACON so epenthesis is blocked and the unsyllabified consonant is licensed as a semisyllable regardless of the well-formedness of the coda. On the other hand, at the postlexical level, CODACON ranks higher than both LICENSE-μ and DEP-V, which are not ranked with respect to each other. So epenthesis is obligatory in CC codas that violate the CODACON but optional in codas that satisfy CODACON. This ranking will give rise to optional CCC clusters that do not flout CODACON while it rules out CCC clusters that contravene it and therefore invokes epenthesis.[13]

[13] The only problem with this analysis relates to hollow verbs where long vowel shortening is attested after subject suffixes, as in ʃaaf-na > *ʃufna* and ʃaaf-t > *ʃufit*, which made Kenstowicz (1986) suggest that CVVC syllables do not constitute a core syllable in PA at the lexical level. Such cases mean that neither a semisyllable nor mora sharing is allowed at the lexical level.However, I think that this shortening might not be caused by violations of syllable structure. Rather it is invoked to eliminate anti-allomorphy as it is attested only when a contrast within a morphological paradigm is compromised.

Consider the tableaux below that show the derivation of native AA words with internal CVCC syllables at the lexical and postlexical levels. (Only relevant constraints are shown).

(46) DEP-V >> LICENSE-μ, CODACON

Input: xubz.na Lexical level	DEP-V	LICENSE-μ	CODACON
a. ☞ ('xub)z_{μ}.na		*	*
b. xu.('biz).na	*		

Stress assignment (as will be explained in §5.1.4) shows that candidate (b) is suboptimal and loses out to candidate (a). The tableau shows that DEP-V outranks LICENSE-μ and CODACON at the lexical level. No ranking relationship is established between LICENSE-μ and CODACON. At the postlexical level, as demonstrated in (47) below, the optimal form appears with an epenthetic vowel that is unstressed. This means that DEP-V is demoted below CODACON. No ranking can be established between LICENSE-μ and DEP-V. Candidate (a) is already ruled out as it violates CODACON.

(47) CODACON >> DEP-V, LICENSE-μ

Input: xubz.na Postlexical level	CODACON	DEP-V	LICENSE-μ
a. 'xub.z_{μ}.na	*		*
b. ☞'xu.biz.na		*	

To further check the ranking of DEP-V and LICENSE-μ, let us consider a word with a well-formed coda cluster in AA. To this end, examine the tableaux below for /galb-na/ ‘our heart’ at both lexical and postlexical levels.

(48) DEP-V >> LICENSE-μ, CODACON

Input: galbna Lexical level	FTBIN	DEP-V	LICENSE-μ	CODA CON

a. ☞('gal)b_μ.na			*	
b. ga.('lib)na		*		
c. (galb)na	*!			

(49) CODACON >> DEP-V, LICENSE-μ

Input: galb$_\mu$.na Postlexical level	CODACON	DEP-V	LICENSE-μ
a. ☞'gal.b_μ.na			*
b. ☞'ga.lib.na		*	
c. (galb)na	*!		

Tableau (48) shows that DEP-V outranks LICENSE-μ at the lexical level so epenthesis is blocked and the stray consonant is licensed as a semisyllable. CODACON is vacuously satisfied. At the postlexical level, tableau (49) shows that both candidates (a) and (b) are optimal so DEP-V and LICENSE-μ are equally ranked. Also, (galb)na is ruled out at both levels by FTBIN. Other attempts to fix such CVCC syllables are ruled out, as laid out in the tableau below.

(50) *COMPLEX, PARSE-C, MAX-C >> DEP-V, LICENSE-μ

Input: galb$_\mu$.na Postlexical level	*COMPLEX	PARSE-C	MAX-C	DEP-V	LICENSE-μ
a. ☞gal.b_μ.na					*
b. ☞ga.lib.na				*	
c. gal.b.na		*!			
d. gal.na			*		
e. galb.na	*!				
f. gal.bna	*!				

Candidate (50c) is ruled out as it incurs a fatal violation of PARSE-C and candidate (50d) falls victim to MAX-C. The last two candidates are suboptimal as they violate *COMPLEX.

To sum up, in OT terms, DEP-V ranks over CODACON and LICENSE-μ at the lexical level while at the postlexical level CODACON dominates LICENSE-μ and DEP-V so that an epenthetic vowel splits the cluster obligatorily if the cluster violates CODACON. No crucial ranking is presumed between DEP-V and LICENSE-μ to account for free variation at the postlexical level.

Let us now take an example from loanwords. Recall that the adapted form of a loanword corresponds to the postlexical level. However, this does not mean that loanwords are not evaluated at the lexical level. Rather, they are evaluated and then the output of the lexical level is fed into the postlexical level, on which I focus. A form with a medial cluster such as ‘control’ shows how these constraints interact. It is realised as *kunt.rool* with two consonants in the coda of the first syllable. The stranded consonant /t/ is licensed as a semisyllable that is attached directly to the prosodic word. The tableau below shows the evaluation of the word ‘control’.

(51) FTBIN, PARSE-C, No[i], *COMPLEX, MAX-C >> LICENSE-μ, DEP-V

Input: control	FT BIN	PARSE-C	No [i]	*COM PLEX	MAX-C	LICENSE -μ	DEP-V
a. ☞kun.t$_{\mu}$.roo<l>						*	
b. kun.t.roo<l>		*					
c. μμμ kunt.roo<l>	*!						
d. kun.troo<l>				*			
e. kun.roo<l>					*		
f. kun.ti.roo<l>			*				*
g. ? ku.nit.roo<l>							*

The optimal output in (51a) violates LICENSE-μ to satisfy the higher ranked constraints. Candidates (b) and (c) fare worse on PARSE-C and FTBIN, respectively. Again, *COMPLEX renders candidate (d) suboptimal as it syllabifies the stray consonant as part of a complex onset. Candidate (e) is ruled out as it violates MAX-C and candidate (f) falls victim to the markedness constraint No[i]. Finally, candidate (g) is marked with a question mark as its status requires some comment. According to the established AA hierarchy, such a form is optimal as it only violates DEP-V, which is equally ranked with LICENSE-μ. In fact, such a pronunciation is attested among old people, especially illiterate ones, and is usually associated with uneducated people; hence avoided.

Before closing this discussion, we still need to introduce another constraint that rules out mora sharing between two consonants, presented in (52).

(52) NOSHAREDMORA-(CC) (henceforth *NSμ(CC)) (after Watson 2007)
A mora cannot be linked to two consonants.

Ranking this constraint above LICENSE-μ ensures that a stray consonant in CVCC is licensed as a semisyllable as sharing a mora between two consonants is worse than affiliating the stray consonant to the prosodic word. However, LICENSE-μ should outrank *NSμ(VC) so that mora sharing between a vowel and a consonant would be less costly than licensing the consonant as a semisyllable, as we have seen above.

So the following partial ranking can be established:

(53) *NSμ(CC) >> LICENSE-μ, DEP-V >> *NSμ(VC)

In the next subsection, I present the complete constraint hierarchies.

4.3.3 Section summary

This section has put forward a revised syllabification algorithm that accounts for CVVC syllables and complex margins. Also, it has presented an OT constraint hierarchy that takes the findings of the adaptation of loanwords into consideration. It has also shown that the interaction between faithfulness and especially markedness constraints determines the structure of syllables in AA. The following two constraint rankings account for AA syllables at both lexical and postlexical levels.

(54) Constraint rankings

a) Lexical level: NUC/V, *FINAL-C-μ, FTBIN, PARSE-C, COMPLEX CODA, COMPLEX ONSET, ONSET, MAX-IO, *NSμ(CC), No [i] >> WBP >> DEP-IO, >> LICENSE-μ, *NSμ(VC), CODACON >> *CODA

b) Postlexical: NUC/V, *FINAL-C-μ, FTBIN, PARSE-C, COMPLEX CODA, COMPLEX ONSET, ONSET, MAX-IO, *NSμ(CC), No [i] >> CODACON, WBP >> LICENSE-μ, DEP-IO >> *NSμ(VC) >> *CODA

Moreover, it has been shown that results point out that AA cannot be categorized as a purely VC dialect according to Kiparsky's grouping. Rather, it would be better described as an intermediate dialect type between C and VC dialects as it shares with C dialects licensing a semisyllable postlexically if CODACON is satisfied.

4.4 Syllable repair processes

This section examines some phonological processes that are invoked to repair syllable structure in loanwords. A number of phonological processes such as prosthesis, syncope, vowel shortening, vowel lengthening, deletion, epenthesis and gemination are attested in the corpus to repair syllable structure. The common denominator among all these processes is to render the output less marked in AA. The two most common processes are epenthesis and gemination. The former will be presented in this chapter while the latter will be introduced after presenting stress assignment as it is closely linked to both syllable structure and stress assignment. Lengthening and shortening are presented in Chapter Three under vowel adaptation. The other processes are not very common and will be discussed briefly in the following subsections.

The remainder of this section proceeds as follows: I briefly demonstrate how AA resolves hiatus (§4.4.1) then I proceed to deletion (§4.4.2), after that I account for syncope (§4.4.3), and finally I present an analysis of vowel epenthesis in (§4.4.4).

4.4.1 Hiatus resolution in loanwords

Hiatus refers to two or more consecutive vowels that belong to separate syllables (Casali 2011). AA does not license hiatus as this violates the undominated constraint ONSET. The most common strategy is devocalizing the high front vowel /i/ turning it into a corresponding glide as the examples below show.

(55) /i/ > /j/

cafeteria > kaf.tiir.ya
piano > byaa.nu
caviar > kav.yaar
video > viid.yu

This accounts for 15 cases. Of which nine cases relate to the diphthong /ɪə/ and three cases relate to the triphthongs /eɪə/ and /aɪə/. The other three relate to a sequence of two vowels, as in the last three examples in (55).

Deletion of a vowel to avoid hiatus is attested in three cases given below in (56).

(56) biology > bu.loodʒ.ya (~ biloodʒya)
polyester > bu.lis.tar
radiator > ru.dee.tar

The deleted vowel here can be connected with high vowel syncope in native words in the last two words. So here, two ill-formed structures are involved: a high vowel in an open syllable and hiatus. In *bulooдʒya*, the diphthong is deleted, which is more marked.

The last strategy to resolve hiatus is to insert a consonant. The glottal stop is inserted once in ‘cocaine’ > *ku.ka.ʔiin* and the glide in ‘caffeine’ > *ka.fa.yiin.* To summarize, hiatus avoidance results in a less marked output and it lends support to the high ranking of ONSET over faithfulness constraints.

4.4.2 Deletion

AA resorts to consonant deletion mainly to satisfy phonotactic constraints. It is attested in 264 tokens (see also §3.1). As it has been shown in Chapter three, deletion tends to affect less salient features and yield the least marked structure in AA.

Consider the following examples that exemplify consonant deletion in the adaptation of loanwords. Deleted consonants are in bold in the source word.

(57) English source AA adaptation

English source	AA adaptation
ax**l**e	ʔaks
contac**t**	kuntak
chimpa**n**zee	ʃambaazi
custar**d**	kastar
dis**t**ributer	disbaratoor
gra**p**ef**r**uit	karafoot
han**d**s	hanz
kun**g** fu	kunfuu
sandwich[14]	sandwiʃ
ambulance	ʔambalanṣ
carburettor	karbureetar

The examples above show that although deletion is motivated on phonological grounds, i.e. to satisfy AA phonotactics and consequently yield the least marked output, the choice of the deleted segment seems to be governed by perceptual factors. First of all, in all cases except three, deletion affects coda consonants rather than onset consonants, which are more prominent as they are licenced by perceptual cues and by prosody (Steriade 2001). Second, deletion mainly affects less salient consonants. For example, sibilants, which have very strong perceptual internal cues, rarely delete while stops are the most deleted segments. This is consistent with Steriade's (2001) P-map hypothesis and Kenstowicz's (2007) observation where the perceptibility of a consonant determines its retention or deletion. For example, results show that when nasals and obstruents are involved obstruents tend to delete which matches Steriade's (2001) perceptibility scales where nasals are more perceptible than obstruents which are more perceptible than liquids in consonant clusters.

Nonetheless, deletion is also governed by markedness. Many times deletion results in an obstruent in onset position, which is the optimal onset cross-linguistically (Clements 1990). That is, deletion affects the more sonorant segment, as in *ambalans*

[14] The deleted consonant here is /t/ and in the last two cases it is the palatal glide.

‘ambulance’ where the glide deletes leaving behind the obstruent /b/ as a simplex onset.

To sum up, consonant deletion is a process that is motivated by AA markedness phonotactic constraints that tends to affect less salient segments.

Still, deletion also affects salient segments, i.e. vowels. This relates to hiatus as discussed above and to vowel syncope in open syllables to which I turn in the following subsection.

4.4.3 Syncope

Syncope is a phonological process that affects short vowels in unstressed non-final open syllables. Cantineau (1939 cited, in Bamakhramah 2009) divides Arabic dialects into two types in terms of which unstressed short vowels in non-final open syllables are syncopated: differential and non-differential. The former deletes high vowels only as in JA and PA (Abu-Salim 1982; Farwaneh 1995, 2009) while the latter deletes both high and low vowels as in Iraqi and Syrian Arabic (Farwaneh 2009). AA belongs to the former, e.g. *fihim-u* > *fihmu* ‘they m. understood’, *kutub-u* > *kutbu* ‘his books’ cf. *katab-u* > *katabu* ‘they m. wrote’.[15] It is argued that syncope is motivated to eliminate monomoraic syllables and thus maximize bimoraicity (cf. Broselow 1992; Farwaneh 1995; among others).

However, sometimes these conditions are met yet syncope is blocked. For example, in *ʕinab-ha* > *ʕi'nabha* ‘her grapes’ and *ruxaṣ-na* > *ru'xaṣna* ‘our licenses’, syncope is opaquely blocked as the vowels are unstressed and in open non-final syllables. It could be argued that syncope is blocked due to phonotactic factors where the resulting onset cluster is not a legal onset (cf. Watson 2002 for Cairene Arabic). However, this cannot be the case for AA. Recall that there are no restrictions on complex onsets and the combination of these consonants appears in other words in AA, as in *rxaaṣ* ‘cheap m. pl.’ and *ʕnaad* ‘stubbornness’.

[15] AA also has what Broselow (1992) calls ‘promiscuous syncope’ which syncopates a vowel and compensates for its loss by vowel epenthesis to avoid syllable ill-formedness. For example, /yi-ktib-u/ ‘they write’ is realised as yi.kit.bu. Kiparsky (2003) accounts for this as follows: First, syncope applies to yik.ti.bu > yiktbu at the word level where REDUCE, a constraint against short vowels in open syllables dominates LICENSE-μ, which allows the unsyllabified segment /t/ to be realised as a semisyllable. Postlexically, epenthesis applies yielding yi.kit.bu where LICENSE-μ dominates Reduce (see Kiparsky 2003).

Following Kiparsky (2000, 2003) and adopting Stratal OT (see §4.3.1 for details), I argue that the vowel fails to syncopate as it was stressed in an earlier stratum. This gives the vowel immunity against deletion thanks to MAX-'V.[16] However, syncope in AA is blocked even though the vowel in question has not been stressed in an earlier stratum, as in *malike* ‘queen’, which is assumed to belong to SA, which suggests that AA speakers might have co-phonologies: one for AA and another for SA, albeit peripheral due to the diglossic situation in AA speech community. This issue is left for further research.

The adaptation of loanwords would shed more light on syncope in AA. It will be shown below that although the process seems to be productive, it does not apply across the board in loanwords. Syncope in loanwords is attested in seven cases only, presented in (58) below. Syncopated vowels are underlined.

(58) Syncope in loanwords

a)	cafeteria	kaftiirya
b)	cholesterol[17]	kulistrool
c)	jerry can	dʒarkan
d)	polyester	bulistar
e)	polystyrene	bulistriin
f)	radiator	rudeetar
g)	syringe	srindʒ[e]

All these cases involve the adapted high front vowel /i/, which appears in an unstressed open syllable. Surprisingly, no case has the high back vowel /u/, which appears in seven words where it would be expected to syncopate, as in *li.mu.ziin* ‘limousine’ and *nikutiin* ‘nicotine’. Also /i/ fails to syncopate in 11 cases, as in *didʒital* ‘digital’ and *ʔiti'keet* ‘etiquette’. Such examples cast doubt on the productiveness of syncope in AA. However, theses 18 cases do not mean that syncope is not a synchronic process. Rather, it seems that borrowers who are bilinguals and have access to the source word are under pressure from faithfulness to

[16] This analysis builds on the insights of earlier analyses (e.g. Brame 1974; Abu-Salim 1982) that attribute these cases to cyclic application of rules.

[17] In this example and in (e), the vowel is not /i/. It seems, however, that syncope here is invoked by spelling.

the source which requires retaining as much information of the source as possible. Together with the observations on syncope data in AA discussed above, this shows that the ban against high vowels in open syllables in AA is not absolute and is dominated by other constraints. An example of these constraints is one against consonant clusters. In an example such as *θeermustaat* 'thermostat', if syncope had applied it would have yielded a four-consonant cluster word-medially, which is illicit in AA.

Nevertheless, the adaptation process suggests that AA seems to avoid short high vowels in open syllables. There are many cases that avoid this marked structure via vowel lowering or vowel lengthening, as in *manakiir* 'manicure', where the vowel in the second syllable is lowered, and *diiluks* 'deluxe' where the short high vowel is lengthened (see §3.2.7.1). This indicates that AA avoids short high vowels in open syllables as long as other higher ranked constraints are satisfied.

4.4.4 Epenthesis

This subsection accounts for vowel epenthesis in loanwords and reviews vowel epenthesis in AA native words. Epenthesis within loanwords will shed more light on this process in AA in general. Vowel epenthesis is a phonological process whereby a vowel is inserted at a certain phonological domain for a specific reason (cf. Hall 2011). Cross-linguistically, the most common reason for vowel epenthesis is to repair illegal structures. However, it will be shown that AA uses it not only to fix ill-formed clusters but also to satisfy word minimality in native words and to optimize metrical structure in loanwords. Below, I review vowel epenthesis in native words and then I account for vowel epenthesis in loanwords.

4.4.4.1 Vowel epenthesis in native AA words

Vowel epenthesis in native AA words is not only invoked for phonotactic reasons, as it is commonly believed, but also for lexical word minimality. Two types of vowel epenthesis are attested: lexical and postlexical. Lexical epenthesis is invoked for minimality and to avoid CCCC clusters while at the postlexical level it is invoked to fix syllable structure only. If it occurs at the lexical level it is visible to stress assignment constraints while if it obtains at the postlexical level it is invisible to stress constraints (cf. Kiparsky 2003).

4.4.4.1.1 Lexical vowel epenthesis

Lexical vowel epenthesis in AA native words is invoked for minimality satisfaction in imperatives and to break up four consonant clusters. In imperatives, obligatory initial epenthesis for forms VII, VIII, and X augments syllable structure and renders the form bimoraic to satisfy the minimal word requirement as dictated by AA phonology (cf. McCarthy & Prince 1986, 1990 for SA) as the examples in (59) show.

(59) Initial epenthesis in imperatives
ʃrab > ˈʔiʃrab ‘drink ms’
drus > ˈʔidrus ‘study ms’
ktib > ˈʔiktib ‘write ms’

One might argue that epenthesis here is induced to avoid a complex onset as in the examples in (60).

(60) nkatab > ʔinˈkatab ~ nˈkatab ‘it was written ms.’
nṭarad > ʔinˈṭarad ~ nˈṭarad ‘he was sent off’

However, stress assignment shows that epenthesis occurs at the lexical level in (59) while it occurs postlexically in (60) (see §4.3.1.1). Since stress falls on the light penult in (60) escaping the expected heavy antepenult, it follows that when stress applies at the lexical level the epenthetic vowel has not been there. These forms also alternate between an onset cluster and a simple onset, as in *ʔinˈkatab ~ nˈkatab*. Therefore, following Kiparsky (2003), I argue that epenthesis to break onset clusters only is postlexical while epenthesis for minimality is lexical.

The second type of lexical epenthesis relates to CCCC clusters. These clusters arise from morpheme concatenation. They result from the amalgamation of subjective suffixes and the dative suffix *-l* with perfective verbs followed by a consonant initial pronominal object suffix, e.g. katab-t-l-ha > *katabˈtilha*. Epenthesis here is invoked at the lexical level due to the presence of two stray consonants which cannot form two semisyllables (Kiparsky 2003). Thus, they have to form a major syllable that is provided by a vocalic element at the lexical level. This is evident from the fact that the epenthetic vowel receives stress.

4.4.4.1.2 Postlexical vowel epenthesis

At the postlexical level, epenthesis is induced to repair syllable structure only. The epenthetic vowel neither receives stress nor contributes to metrical structure; it is invisible at the lexical level where stress applies (Kiparsky 2003). As has already been demonstrated in §4.1.2, vowel epenthesis is invoked postlexically to break up CC coda clusters word-finally and CCC clusters word-medially obligatorily if the coda cluster violates CODACON and optionally if the cluster satisfies CODACON. A few examples are repeated in (61) for convenience.

(61) Postlexical epenthesis

a) Obligatory epenthesis

dʒisr > dʒi.sir ‘bridge’

ʕuʃb > ʕuʃub ‘grass’

dʒisr-ha > dʒi.sir.ha ‘her bridge’

katab-t > katabit ‘I/you m. wrote’

b) Optional epenthesis

kalb > kalb ~ kalib ‘a dog’

kalb-na > kalbna ~ kalibna

ʕaks > ʕaks ~ ʕakis ‘opposite’

Moreover, optional vowel epenthesis is invoked also at the postlexical level to eliminate onset clusters. Recall that onset clusters are allowed at the lexical level where the first member is licensed as a semisyllable. Optional epenthesis occurs in forms that already satisfy minimality, as in *ntarad* in (60). Also it is optional in initial geminates, which appear with or without an epenthetic vowel, as in *ʔin.naas* ~ *nnaas* ‘people’ (Mitchell 1990).

Having reviewed vowel epenthesis in native words, I turn now to epenthesis in loanwords.

4.4.4.2 Epenthesis in loanwords[18]

Given that English is more permissive with respect to complex margins than AA, it is expected that AA will resort to a number of phonological processes to render the source forms conform to the more restrictive AA syllable structure. Findings show that this is the case and AA opts particularly for vowel epenthesis to eliminate marked syllable structures.

Vowel epenthesis in loanwords, unlike epenthesis in native words, serves two main functions: to repair ill-formed consonant clusters and to optimize metrical structure, i.e. it renders the output metrically more well-formed by creating binary feet.

Below, I present representative examples that show vowel epenthesis according to the epenthetic vowel involved.

(62) Vowel epenthesis in loanwords

a. Epenthesis of the round short vowel

dubul	'double'
fulumaastar	'flow master'
fulukloor	'folklore'
fuluskaab	'foolscap'
ʔubtikus	'optics'

b. Epenthesis of the guttural short vowel

kafayiin	'caffeine'
karafoot	'grapefruit'
salamun	'salmon'
ṭarniib	'trump'

c. Epenthesis of the default high short vowel

ʔikistra	'extra'
dʒintil	'gentle'
bankiryaas	'pancreas'
sikraab	'scrap'
drayikliin	'dry clean'

[18] An earlier version of this section was presented at the Forum for Arabic Linguistics Conference, Essex 2015.

naaytiklabb ‘night club’

As can be seen from these examples, epenthesis is invoked mainly to repair complex margins. It applies to break up onset clusters, as in *fulumaastar* ‘flow master’, *karafoot* ‘grapefruit’ and *sikraab* ‘scrap’ and to break up coda clusters word-finally, as in *ʔubtikus* and syllabic consonants, as in *dubul*. Also it is invoked to repair three and four consonant clusters, as in *fuluskaab* and *ʔikistra*, respectively (see §4.2.2 for more details on coda clusters).

Prima facie, it appears that vowel epenthesis is induced only to repair consonant clusters; however, it will be shown that epenthesis is called for to optimize the metrical structure of the adapted loanword.

4.4.4.2.1 Site of epenthetic vowel

This subsection investigates the site of the epenthetic vowel. Given that there are two places where an epenthetic vowel can land, we need to determine where AA prefers to place this epenthetic vowel. Arabic dialects are divided into two main groups in terms of the site of epenthesis: Coda (or Kiparsky’s VC dialects) and Onset dialects (or CV dialects). In onset dialects, a stray consonant appears in onset position. For example, in Cairene the stray consonant /t/ in katab-t-l-u ‘I wrote to him’ surfaces in onset position yielding *katabtilu* while in a coda dialect such as Iraqi it surfaces in coda position, as in *katabitlu* (cf. Broselow 1992; Farwaneh 1995; Kiparsky 2003; Watson 2007; among others).

Many researchers have attempted to account for the site of the epenthetic vowel. Ito (1989) relates this to directionality where coda dialects scan the phonological string from right to left while onset dialects scan it from left to right. For example, AA, as a coda dialect, would scan the string /katab-t-ha/ ‘I wrote it f.’ from right to left and group moraic vowels with the consonant to their left forming a CV syllable with a maximal CVX syllable. The stranded consonant /t/ will appear in coda position yielding *katabitha*. Likewise, Mester & Padgett (1994) adopt OT alignment constraints to account for the site of the epenthetic vowel. They translate Ito’s directionality into OT alignment constraints and introduce the constraint ALIGN-L(eft)(σ, prwd) that requires syllables to be aligned with the left edge of the prosodic word in coda dialects. In ka.ta.bit.ha, ALIGN-L is violated seven times (once by the second syllable, twice by the third syllable and four times by the last syllable) while in ka.tab.ti.ha, ALIGN-L is violated eight times (once by the second syllable, three times by the third syllable and four times by the last syllable). Accordingly, AA would rank ALIGN-L (σ, prwd) over ALIGN-R(ight) to ensure that the epenthetic vowel lands to the left of the stranded consonant.

Likewise, Broselow (1992) suggests an onset/rime parameter approach where a rime dialect such as Iraqi would syllabify a stray consonant in a rime position while an onset dialect such as Cairene would syllabify it in an onset position. Adopting Selkirk's (1981) degenerate syllable, she argues that syllables are built around vowels creating CVX maximal syllables and stray segments are assigned to degenerate syllables. Dialect specific parameters would place the consonant in a rime or an onset position.

Although these analyses can account for the majority of epenthesis cases in native and loan words in AA, they still run into some problems. For example, they cannot account for cases such as *fulumaastar*. All analyses would predict epenthesis to occur to the left of the stranded consonant /f/ as would be expected in a coda dialect; however, epenthesis occurs to the right of the stranded segment as would happen in onset dialects.

Examining the site of epenthesis in loanwords, we notice that AA inserts a vowel to the left of the stray consonant as expected in a coda dialect only 59% of cases (excluding compounds the percentage drops to 43%). If AA was a purely coda dialect, we would see epenthesis to the left of the unsyllabifiable consonant in almost all cases. However, 19% of cases have epenthesis to the right of the stranded consonant as is typical in onset dialects, as in *fulumaastar* and *ṭarniib*. If AA was a purely coda dialect we would have epenthesis word-initially yielding, e.g.**iflumaastar*.

Still, about 22 % of cases have unnecessary epenthesis, which means that the site cannot be equated with a coda or an onset pattern as there is no stranded consonant, as in *hitifun, salamun* and *vutika*. In these examples there is a two-consonant cluster and these should not be a problem as the first consonant would be syllabified as a coda and the second as an onset. Some might think that syllable contact has a role. However, this cannot be the reason as syllable contact can be called for in only one example, namely *hitfun*. All the others are well-formed with respect to syllable contact in that the coda is always more sonorous than the following onset. I argue that these examples and the previous ones can be explained in terms of metrical structure. Epenthesis here renders the output less marked in that it constructs bimoraic feet.

Primary evidence comes from the adaptation of two-consonant complex onsets. Of all forms with two-consonant onset clusters in the corpus, only six loanwords are realised with an epenthetic vowel to the right of the stranded consonant whereas the overwhelming majority of complex onsets are imported into AA. As has been argued in §4.3.1, AA licenses the first member of the cluster as a semisyllable at the lexical level that is optionally realised with an epenthetic vowel that is preceded by a glottal stop phonetically at the postlexical level (cf. Kiparsky 2003).

Moreover, if epenthesis was invoked to repair the cluster, it would land to the left of the stray consonant as AA is a coda dialect. So why does AA not incorporate these onset clusters? This suggests that another factor other than the onset cluster is behind epenthesis. I argue here that epenthesis is invoked to optimize the metrical structure of the output. Epenthesis to the right of the stranded consonant results in constructing a bimoraic foot at the left edge of the word. To illustrate, take the word *fulumaastar*. The output is made up of two bimoraic feet with main stress on the rightmost foot according to AA constraints (see §5.1 on stress). If epenthesis was to the left of the stray consonant, a more marked output would surface, as in **ʔiflumaastar*. Such a form is more marked than *fulumaastar* in that the former has an unfooted monomoraic syllable, among other things. That is, epenthesis to the right of the stray consonant renders the output more optimal. This is similar to gemination cases where pretonic light syllables are augmented through gemination to render the syllable bimoraic, as in *bal.loon* 'balloon' (see also §5.2 on gemination).

Compare this with loanwords such as *treella* 'trailer' and *triks* 'tricks' where epenthesis into the cluster will not yield bimoraic feet. So it could be argued that foot binarity is behind this unusual epenthesis. More evidence for this comes from the fact that all English complex onsets which did not undergo epenthesis appear in a bimoraic foot.[19]

[19] Sometimes postlexical vowel shortening applies if the long vowel is unstressed.

As the examples of epenthesis in loanwords show, the site of epenthesis is not uniform. It occurs to the left of the stranded segment as well as to the right and sometimes it is invoked unnecessarily as there is no stray consonant. Here neither Ito's directionality nor Broselow's rime/onset parameters are able to account for this erratic epenthesis.[20] Therefore, I argue that markedness is behind epenthesis in that the least marked output surfaces.

Note that the results here do not show a great role for perception in determining the site of the epenthetic vowel.[21] Hall (2011) points out that perceptual factors do affect epenthesis in loanwords. Citing Fleischhacker (2001), she reports that cross-linguistically the epenthetic vowel is inserted in the place that leads to the minimal perceptual differences between input and output where epenthesis is expected to occur between a sibilant and a sonorant but before a sibilant and a stop. Findings here show that both types have epenthesis in the middle of the cluster. This means that perceptual factors cannot account for this type of epenthesis.

4.4.4.2.2 The quality of the epenthetic vowel

Cross-linguistically it is assumed that the epenthetic vowel is basically a default vowel in a certain language that is inserted context-independently, which is followed by vowel harmony and consonantal assimilation (see Uffmann 2005: 1080). Findings here show that this is not the case. It is observed that the quality tends to correlate with the reason for epenthesis and that harmony/assimilation is the dominant factor behind the quality of the epenthetic vowel. As a first option, vowel harmony applies; otherwise consonant to vowel assimilation applies; otherwise a default vowel insertion applies.

AA has three short vowels /i, u, a/ and all of them are attested as epenthetic vowels in native and in loan words (see §3.2.7.4 for more details on vowel harmony). Recall from that section that AA has rounding harmony obligatorily at the foot level and

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[20] Moreover, previous analyses cannot account for epenthesis word-initially, as in /drus/ > *ʔidrus* 'study m.'. In both onset and coda dialects, epenthesis appears to the left of the stray consonant. However, according to Ito's left-right directionality in onset dialects, /d/ would surface in onset position yielding **dirus*. To this end, Broselow suggests that epenthesis does not occur within morphemes. This means other constraints are involved, as pointed out above.

[21] The only possible exception might be *ʔikistra* 'extra'.

optionally at the word level in the vicinity of round vowels. Also, a guttural vowel is inserted after primary gutturals otherwise the default high front vowel applies.

Likewise, epenthetic vowels in loanwords derive their quality from these three sources: vowel harmony where a copy vowel is inserted, consonant to vowel assimilation where the vowel takes its features from a preceding consonant and a default vowel that is used as a last resort.

The driving factor that determines the quality of the epenthetic vowel is harmony. That is, AA inserts a copy vowel especially within the same foot. This strategy accounts for 40% of cases. It can be seen that this strategy especially applies in cases where epenthesis is used to improve foot structure, as in *fulumaastar* and *salamun*. The first two syllables make up one foot with the same vowel quality in both syllables. This is followed by consonant to vowel assimilation (7%) where an emphatic sound spreads its guttural feature resulting in the low vowel /a/, as in *ṭarniib* and *disbaratoor*. This occurs when harmony is not pressing as the vowels are not found in the same foot. Given that there are only two cases and there is no conflict between vowel harmony and consonant to vowel assimilation, it is safer not to draw conclusions from these limited cases and leave this to future research. Note that this type of assimilation is not attested in AA cf. *baṭin*, most probably to avoid anti-allomorphy.

Finally, as a last resort, default vowel insertion applies in 53% of cases. Note that not all cases here can be clearly attributed to default insertion as the high front vowel is originally found within the source word. That is, one third of these cases have a high front vowel that could trigger vowel harmony, as in *biksil*.

To summarise, the quality of the epenthetic vowel seems to be strongly related to markedness. Vowel harmony and even consonantal assimilation result in less marked outputs that are easier to produce and process (Uffmann 2005: 1107). It has been observed that vowel harmony is more closely connected with epenthesis that is invoked to optimize metrical structure while a default vowel tends to break up consonant clusters. This could also relate to markedness in that the default epenthetic vowel in AA is the shortest and the least sonorant vowel in AA vowel inventory. That is, insertion of this vowel to break a cluster tends to have the least perceptual effect on the output. In essence, it will be shown below that vowels inserted to break up CCC and CCCC clusters are acoustically different from other vowels, which makes them look like intrusive/excrescent vowels rather than epenthetic vowels (see Hall 2006).

To conclude, vowel harmony is the first strategy that AA opts for, otherwise consonantal assimilation and as a last resort it uses the least marked AA vowel as a default insertion. For arguments in support of positing [i] as the default epenthetic vowel in AA, see §3.2.7.4.

4.4.4.2.3 Epenthetic versus lexical vowels

The three epenthetic vowels in AA are also lexical vowels; however, they do not behave alike in native phonology. The opacity of epenthetic vowels to metrical structure in many languages suggests that these vowels may have different acoustic qualities that make them distinctive from their lexical counterparts (cf. Hall 2006, 2011). If this turns out to be true then much of the controversy regarding the opacity of epenthetic vowels would be settled down (cf. Hall 2006). For example, Gouskova & Hall (2009) found that epenthetic vowels in Lebanese Arabic are shorter and have lower F2 for some speakers. Also many other studies on English show that the epenthetic schwa is different from the lexical one. Davidson & Stone (2003) argue that epenthetic schwa is not an articulatory gesture; rather it is a transitional sound that results from an overlap between articulatory gestures of adjacent consonants.

It has been found that none of the epenthetic vowels in the corpus of loanwords receive main stress.[22] However, no conclusions can be drawn from this fact as the epenthetic vowel does not stand in a position where it should be stressed according to AA stress constraints. For example, in *bankirˈyass*, the epenthetic vowel in the penult cannot take stress whether it is epenthetic or lexical as stress falls on the final heavy syllable according to AA constraints (see §5.1). Nonetheless, epenthetic vowels in loanwords contribute to metrical structure, as in *fulumaastar* where the first two syllables make up a foot, which could carry secondary stress. In this subsection, I compare lexical vowels and epenthetic vowels to find out whether they share the same acoustic characteristics in AA. Note that this subsection is not intended to conduct a thorough investigation of these acoustic characteristics; rather it will only present a preliminary study to invoke more studies on this neglected area.

[22] Except for two cases, namely *ʔiˈkistra* ‘extra’ and *ʃalˈlistun* ‘charleston’.

To compare the acoustic characteristics of epenthetic and lexical vowels in both native and loan words, I conducted a preliminary study in which I asked three female informants to pronounce the following 18 words in (63) that contain the target vowels in a frame sentence. To elicit these words, the general methodology adopted in the study was followed (see §2.6.3).

(63) Lexical vs. epenthetic vowel comparison

1. ʔikistra, ʔiksirha, kasirha
2. hitifun, bihtif, hatif
3. dabil, gibil, ʔibil
4. biksil, biksir, kasir
5. sikraab, siknaadʒ
6. bankiryaas, tbankilhaaʃ
7. sibree, sibnaa

All these examples relate to the short high front vowel /i/. The first word in each set is a loanword that has an epenthetic vowel; the second is a native word with a lexical vowel while the third is a native word with an epenthetic vowel. Note that in the last three sets there is no native word with an epenthetic vowel as I could not find a native word with an epenthetic vowel in the same environment.

Following the same procedures to measure stress in loanwords (see §5.1.3.2), these words were analysed using PRAAT. Table 4.3 presents the mean readings of duration, F1 and F2 of lexical and epenthetic vowels.

Table 4.3 Mean readings and standard deviations (SD) of lexical and epenthetic vowels[23]

	Lexical native	SD	Epenthetic native	SD	Epenthetic loan	SD
Duration	.072	8.01	.066	8.37	.070	6.15
F1	472	34.90	460	31.15	442	44.80
F2	2180	224.40	2090	238.40	2100	198.05

[23] Also, these vowels can be different from a psycholinguistic/perceptual perspective; however, this will not be pursued here.

One-way ANOVA was conducted to find out whether differences between lexical and epenthetic vowels are statistically significant. ANOVA reveals that there are no statistically significant differences between the three groups at the $p<.01$ level in regard to duration [$F(2, 48) = 1.805$, $p = 0.175$], or F1 [$F(2, 48) = 3.115$, $p = 0.053$] or F2 [$F(2, 48) = .913$, $p = 0.408$].[24] This suggests that the opacity of epenthetic vowels in the native phonology is not reflected in their acoustic characteristics. These findings contradict Gouskova & Hall's (2009) findings for Lebanese Arabic. However, a larger scale study would give more reliable results.

Still, the researcher noticed that some vowels were impressionistically different from other epenthetic and lexical vowels as they posed considerable difficulty to perceive. These relate mainly to words that have four-consonant clusters in English compounds such as 'hand break', 'night club' and 'dry clean'. All these words are realised with an excrescent vowel in the middle of the compound in AA.

The same measurements were taken (following the procedures above) for the same three participants. Results are presented in Table 4.4.

Table 4.4 Mean readings of excrescent vowels

	drayikliin 'dry clean'	naytiklabb 'nightclub'	handibreek 'hand brake'	Average
Duration	.011	.033	.031	.025
F1	684	352	406	480
F2	2205	2252	2055	2171

Comparing the vowels in Table 4.4 with those in Table 4.3, it can be clearly seen that there are huge differences between both groups with respect to duration. To find out if there are statistically significant differences between these excrescent vowels and epenthetic and lexical vowels given in Table 4.3, one-way ANOVA was conducted. Results show that there are statistically significant differences between both groups at the $p<.01$ level in regard to duration [$F(1, 58) = 239.90$, $p = 0.000$],[25] but not in terms

[24] All the words in the sample have very close durations except for *sikraab* (25 ms) and *ʔikistra* (38 ms), which were excluded for statistical reasons.

[25] Note that the mean for excrescent vowels is 25 ms and SD is 11.13 while for other vowels it is 70 ms and SD is 7.48.

of F1 [F (1, 58) = .813, p = 0.371] or F2 [F (1, 58) = .262, p = 0.610]. This confirms that these vowels are excrescent vowels that result from the phonetic transition between consonants, which makes them different from other epenthetic vowels (Hall 2011: 1584). A large scale study is highly recommended to shed more light on these vowels.

To sum up, this subsection has shown that vowel epenthesis in loanwords not only repairs consonant clusters, but also renders the output less marked metrically. Findings regarding the site of the epenthetic vowel point to the same conclusion such that the vowel is inserted in the place that results in the least marked output. Also, the quality of the epenthetic vowel contributes to yielding a less marked structure. Finally, cases where epenthesis does not look to be necessary can be taken as cases of TETU (see §2.7.3). Recall that epenthesis in loanwords is invoked to repair clusters that are attested in native AA words. However, the forms with epenthetic vowels are less marked than those without epenthesis. That is, even though such cases would be accepted in AA, epenthesis applies yielding less marked outputs.

4.5 Conclusion

This chapter has accounted for the adaptation of syllable structure in loanwords. It has established onsets and codas in AA and shown that complex margins are not basic in AA. It has argued that SSP cannot account for all AA coda clusters and therefore has suggested a new constraint, i.e. CODACON that better accounts for AA codas, which can apply to other Arabic dialects.

It has shown that AA accommodates the majority of complex onsets and superheavy syllables that do not contravene CODACON. However, it has been shown that the maximum syllable in AA is still bimoraic and superheavy syllables are accounted for by resorting to semisyllables to license CVCC syllables and mora sharing to account for CVVC syllables. A new syllabification algorithm that takes these facts into consideration has been suggested. This algorithm, which is couched within Stratal OT, is believed to better account for AA syllables and could apply to other Levantine dialects.

Furthermore, an OT constraint ranking has been suggested to account for syllable structure and syllabification in AA. This ranking is different from earlier analyses for other dialects (e.g. Kiparsky 2003) in that it introduces a new constraint (CODACON) that is ranked differently at the lexical and postlexical levels in AA. This constraint should be taken into consideration in accounting for other Levantine dialects.

Also, this chapter has shown that AA resorts to a number of phonological processes chief among which are deletion and epenthesis to render the syllable less marked. It has been shown that epenthesis is not invoked to repair ill-formed clusters only; rather it results in a less marked output. Findings from epenthesis show that AA is not a purely VC dialect as it allows semisyllables postlexically. Thus, it would be better categorized as an intermediate dialect between C and VC dialects. Moreover, it has been shown that the quality of the epenthetic vowel is governed by vowel harmony as a first option and a default vowel insertion as a last resort. Preliminary results of the acoustics of the vowels that AA inserts to repair ill-formed structures suggest that AA makes use of two types of vowels –epenthetic and excrescent, whose choice tends to correlate with the motivation behind epenthesis. This awaits further studies at a larger scale.

To conclude, findings point out that the adaptation processes tend to yield the least marked syllable structure in general. In the next chapter, I further explore other suprasegmental aspects of AA and account for stress assignment and gemination in loanwords.

Chapter five

Prosodic adaptation: Stress assignment and gemination

Having accounted for syllable structure and weight in the previous chapter, I turn now to examining stress assignment and gemination adopting moraic analysis within an OT framework. This chapter is particularly important as it is the first study of its kind. No previous study on JA has ever tackled stress assignment in loanwords. Furthermore, loanword prosody has been neglected until recently, and the majority of studies that investigate loanword prosody focus on mapping source prosody onto tone or pitch accent languages (Owino 2003; Kang 2010; Davis, Tsujimura & Tu 2012; Tu 2013). Therefore, this chapter will contribute to the few studies that have tackled stress adaptation in a stress-based language such as Arabic.

It will be shown that source stress is ignored and stress is assigned to the adapted form according to AA stress constraints. It will be demonstrated that stress is determined by two factors: weight and position. Stress falls on the rightmost heavy syllable within a three syllable window. If no heavy syllable is found within the stress window, stress falls on the antepenult. This is corroborated by stress shift results that show that stress shift is almost always attested toward a heavy syllable at the right edge.

Stress position will be verified acoustically and it will be shown that stress mainly correlates with F0 and intensity while there is no solid evidence for duration as a phonetic correlate of stress in AA.

This chapter will propose a constraint hierarchy that accounts for stress assignment in AA native and loan words. This can also apply to other Levantine dialects as they share the same basic stress constraints. The suggested hierarchy introduces two new constraints, namely ALIGN-L and WINDOW. The former ensures that a prosodic word is left-aligned with a foot and the latter ensures that stress is assigned within the three syllable window. Also, the new hierarchy can account for stressing heavy ultimate syllables without revoking final syllable extrametricality, as will be demonstrated in §5.1.4.

In the second part of this chapter, it will be revealed that gemination within loanwords is caused by purely phonological reasons where the influence of orthography is minimal, if any. Gemination is mainly invoked to render the output less marked: it is induced for minimality requirements and for markedness factors. As will be demonstrated in §5.2.2.2, the interaction of five markedness constraints, namely FTBIN, SWP, ALIGN-L, ONSET and NONFIN yields the least marked output.

This chapter is structured as follows: The first section accounts for stress adaptation while the second accounts for gemination in loanwords. Section one is organized as follows: §5.1.1 reviews stress assignment in native AA words. This is followed by a thorough discussion of stress assignment in loanwords in §5.1.2. §5.1.3 provides acoustic evidence for stress position in loanwords and §5.1.4 presents a theoretical analysis of stress assignment in both native and loan words. Section two proceeds as follows: §5.2.1 provides an overview of gemination in native words then §5.2.2 proceeds to an analysis of gemination in loanwords within an OT framework. The chapter concludes with §5.3.

5.1 Stress adaptation in loanwords[1]

This section accounts for stress adaptation in loanwords. It also reviews stress assignment in native words as this dialect has not been described before in the literature. It will provide acoustic evidence in support of stress position in polysyllabic words and it will propose a new OT constraint hierarchy that accounts for both native and loan words, which could apply to other Levantine dialects.

[1] An earlier version of this section was presented at the EPIP3 Conference in Murcia, Spain in 2013.

When a word is borrowed into another language, it usually adapts not only the segments of the source language but also the prosodic features to fit into the recipient language. Stress adaptation can take a number of forms. First, source stress might be preserved in L1 at the expense of the segmental makeup of the target word by modifying the SL metrical structure to meet the constraints of L1 phonological system (Kang 2010), as in Swahili loanwords in Dholuo (Owino 2003) and Spanish loanwords in the basilect of Huave (cf. Davidson & Noyer 1997; Broselow 2009). Second, source stress might be completely ignored and stress assignment follows the native constraints, as in Japanese loans in Thai and Taiwanese (Kang 2010), and loans in South Kyungsang Korean (cf. Kubozono 2006; Lee 2009). Sometimes this happens without affecting other segments in the source language (Kang 2010).

The choice between these two options is determined by contractiveness and perceptual factors, argues Kang (2010). If stress in L1 is contrastive, it would be preserved in the adapted form. However, if not, stress tends to be shifted to an acceptable place in accordance with the phonological properties of L1, as in Finnish borrowings of American English words (Fenyvesi & Zsigri 2006). Furthermore, if stress pattern is 'surface-observable', it is more likely that L1 native speakers would be unable to perceive stress place in the SL, leading to stress-deafness (Peperkamp & Dupoux 2003). Peperkamp & Dupoux (2003) argue that the stress parameter would be set during L1 acquisition and because the stress patterns are regular, children lose sensitivity to stress and would not encode it into their phonological representation. Stress in AA, unlike English, is 'surface-observable' as it is predictable (but not fixed). Therefore, AA borrowers should not seem to pay attention to source stress in the adaptation process. This is corroborated by many earlier observations regarding the inability of Arab learners in general and JA in particular to perceive stress not only in English but even in native words (cf. Peperkamp & Dupoux 2002 for Arab speakers in general; Al-Jarrah 2002; Zuraiq 2005, for JA speakers; Altmann 2006 for Arabs in general). It follows that AA borrowers would not pay attention to stress position in SL and consequently apply native stress constraints to the adapted segmental structure (cf. Kang 2010). However, this does not mean that a stressed syllable is not salient at all; rather it could be perceived as longer than unstressed syllables.

In an attempt to build up a taxonomy of loanword prosody, Davis et al. (2012) adopt a number of factors to categorize languages in terms of the factors that account for prosodic adaptation. The first factor relates to SL features. Borrowing languages either preserve or neglect source prosodic features when they assign prosody to the borrowed forms. Second, languages differ in terms of applying constraints that are used for loanwords only or for both loan and native words. The last factor explores the features that are in play in adapting loanwords. Some languages opt for segmental features in assigning prosody to loanwords, while others take into account prosodic features including syllable structure (ibid). For instance, Modern Hebrew takes features of the SL into account in that it preserves source stress while it does not use constraints that are specific to loanwords only. Instead, it uses the same constraints that account for native words. Also it takes prosodic features such as syllable type into consideration, but not segmental features when assigning stress to loanwords (ibid: 18). On the other hand, Japanese does not attempt to preserve stress position in adapting English loanwords. It, however, opts for constraints that are used for both loans and native words and it uses prosodic features, just like Modern Hebrew in assigning prosody (ibid: 26). AA will be placed into this taxonomy below.

The remainder of this section is organized as follows: I review stress assignment in native words in §5.1.1. Then I proceed to stress assignment in loanwords in §5.1.2. This will be followed by an examination of source stress shift and an analysis of the behaviour of stressed vowels in the adaptation process in §5.1.2.3 and §5.1.2.4 respectively. In §5.1.3, I report on the results of an acoustic comparison using PRAAT between stressed syllables and unstressed syllables with respect to the three phonetic correlates of stress in AA and in §5.1.4, I present a theoretical analysis of stress assignment within OT. §5.1.5 concludes the section.

5.1.1 Stress assignment in native AA words

Stress in AA falls within a three-syllable window and correlates with syllable weight and position. That is, it falls on one of the last three syllables of the word and never exceeds the antepenult. It correlates with weight in that a heavy syllable attracts stress and with position in that it is right-oriented and does not go beyond the antepenult. When there is no heavy syllable in the word, the first syllable is stressed with an antepenultimate limit (cf. Brame 1974; Abu-Salim 1982; Al-Sughaer 1990; Abu-

Abbas 2003; Watson 2011; among others). Recall that syllable weight is determined by its vowel length and coda. A short vowel is monomoraic, a long vowel is bimoraic and a diphthong is also bimoraic. Codas are moraic word-internally and non-moraic word-finally while geminates are underlyingly moraic (see §2.7.1). The following illustrative examples show stress assignment in AA according to the number of syllables.

(1) Stress assignment in native AA words according to number of syllables

A. Monosyllabic words

ˈnaas	‘people’
ˈbarr	‘over land’

B. Disyllabic words

baˈnaat	‘girls’
ˈsama	‘sky’
ˈmasdʒid	‘mosque’
ˈkursi	‘chair’
gaarˈraat	‘continents’

C. Trisyllabic words

ˈmadras[e]	‘school’
sayˈyaara	‘car’
ˈʃadʒara	‘tree’
baraˈwiiz	‘frames’
darasˈnaa[2]	‘we studied it m.’
midʒtamˈʕiin	‘gathered m. pl.’

D. Quadrisyllabic and more

mistaʕdʒiˈliin	‘they m. are in a hurry’
mazaaˈriʕhum	‘their m. farms’
mafruˈʃaathum	‘their m. furniture’
mustaʕˈmarati	‘my colony’
muħˈtaram[e]	‘respected f.’

[2] Phonologically this word ends with a superheavy syllable, cf. -naah (McCarthy 1979).

In Group A, stress falls on the only syllable in the word. Note that all these words are bimoraic, which satisfies the prosodic word minimality condition in Arabic in general, as will be explained in §5.1.4.3. In group B, the final syllable receives stress iff it is superheavy, as in *ba'naat*, otherwise the initial syllable is stressed regardless of its weight, as in *'masdʒid* (cf. Watson 2011). As can be seen from these examples, weight is not decisive on its own. Both position and weight interact to produce the correct stress place. A heavy initial syllable fails to attract stress if a superheavy ultimate syllable is available, as in *gaar'raat*.

Likewise, in trisyllabic words a superheavy ultimate syllable receives stress, as in *bara'wiiz*. Otherwise, stress falls on a heavy penult, as in *say'yaara*; otherwise the antepenult, be it heavy or light, receives stress, as in *'madras*[*e*]. Words consisting of more than three syllables follow the same principles. A superheavy ultimate syllable is stressed, as in *mistaʕdʒi'liin*, otherwise stress falls on a heavy penult, as in *mafru'ʃaathum*; otherwise stress will be placed on the antepenult, as in *mustaʕ'marati* (cf. Watson 2011).

Abu-Salim (1982), Al-Mohanna (2004) and Watson (2011) contend that words consisting of four light syllables are stressed on the pre-antepenult in PA, as in 'ʃadʒaratun (MSA) 'a tree'. In fact, such words belong to Modern Standard Arabic and they could represent a case of code mixing because such forms do not surface phonetically in AA or in JA (cf. Al-Sughayer 1990). They always undergo syncope and surface with antepenultimate or penultimate stress. Loanwords will provide us with such words, which will enhance our understanding of AA stress system.

To sum up, the examples above show that stress falls on a superheavy ultimate syllable, otherwise on a heavy penult, otherwise it falls on the antepenult. However, consider the following examples that show that stress falls opaquely on a light penult or escapes a heavy penult.

(2) Opaque stress assignment

a.	ka'tabit	'I/you m. wrote'
	ʔa'kalit	'I/you m. ate'
b.	'kalibna (cf. ba'ladna)	'our dog'
	'ħibirna	'our ink'
	'fihimna	'our understanding'

In (2a), stress opaquely falls on a light penult, as in *ka'tabit* and in (2b) on a light antepenult skipping a heavy penult, as in *'kalibna*. This is due to the cyclic application of stress (Brame 1974; Abu-Salim 1982; Watson 2011; among others), which has been translated into Stratal OT, as pointed out in §2.7.2. Opaque stress assignment, which arises from morpheme concatenation, will not be pursued here as loanwords are thought to be borrowed as unanalysable simplex forms in AA although they might be morphologically complex in the source word (cf. Haspelmath & Tadmor 2009).

To summarise, this subsection has reviewed stress assignment in native AA words. It has been shown that stress falls on the rightmost heavy syllable within a three-syllable window. However, it has been noticed that AA native words do not provide us with enough data to test cases with four light syllables so loanwords will be of paramount importance to provide us with external evidence to further explore the stress system in AA.

5.1.2 Stress assignment in loanwords

In this section, I account for stress assignment in loanwords. It will be shown that source stress is ignored and loanwords are assigned stress according to AA constraints. It will be shown that there is a striking tendency for stress to fall as close as possible to the right edge such that it never exceeds the antepenult respecting the three-syllable window as in native words. Excluding monosyllabic words (78 forms), stress falls on the ultimate syllable in 133 cases (40.4%) and on the penult in 184 cases (56%) while it falls on the antepenult in 12 cases (3.6%). These findings show that AA, like other Jordanian dialects, is right-oriented (cf. Abu-Abbas 2003; Abu-Rakhieh 2009; among others). In addition, there is evidence that the final foot in AA is visible to stress assignment constraints as stress falls on a final foot many times, as in *fii'lee* ‘fillet’ and *kara'tee* ‘karate’. Moreover, findings indicate that stress strongly correlates with syllable weight. Light syllables are stressed only if a heavy syllable is not found within the three syllable window or if the word lacks a heavy syllable. In the remainder of this section, I present the results of stress assignment in terms of position in §5.1.2.1 and then in terms of weight in §5.1.2.2 and conclude with a discussion of stress shift in §5.1.2.3.

5.1.2.1 Stress in terms of position

This subsection shows the distribution of stress in the adapted words in terms of position. Table 5.1 shows that the overwhelming majority of words receive stress either on the ultimate syllable or on the penult and rarely on the antepenult.

Table 5.1 Distribution of stressed syllables in terms of position

		Stress position		
No of syllables	Total no of words	Ultimate syllable	Penult	Antepenult
Disyllabic words	196	69	127	NA
Trisyllabic	115	59	44	12
Quadrisyllabic	18	5	13	0
	329	133 (40.4%)	184 (56%)	12 (3.6%)

Table 5.1 shows that 40% of words receive stress on the ultimate syllable and 56% take stress on the penult (excluding monosyllabic words). This indicates that AA prefers stress to be aligned with the right edge, as will be demonstrated in this section. Antepenultimate stress is attested only in 3.6% of cases. Below, I discuss these findings in more detail.

5.1.2.1.1 Stress in monosyllabic words[3]

There are 78 monosyllabic words where stress is assigned by default to the only syllable available. This is in conformity with the 'culminativity principle' where every lexical word must have one main stress (Hayes 2009).

All source words here are also monosyllabic except for three, namely 'axle' > *ʔaks*, 'organ' > *ʔoorg*, and 'solid' > *ṣuld*. Note that when a source word does not comply with the bimoraicity principle in AA, which requires prosodic words to be minimally

[3] In the discussion of stress assignment and number of syllables reference is made to the adapted loanword, not to the source word. That is, a disyllabic source word that is realised as trisyllabic in AA will be referred to as trisyllabic. So 'between' > *batwan*[*e*] is described as a trisyllabic word.

bimoraic, as will be explained in §5.1.4.3, consonant gemination, but not vowel lengthening, is mainly invoked to render the form bimoraic (See §5.2.2 on gemination). However, vowel lengthening is invoked for other purposes, as will be shown. This indicates that AA prefers to geminate a consonant rather than lengthen a vowel to satisfy minimality. This suggests that lengthening a vowel has more serious effects than gemination on the output. This is expected as it seems that not all gemination cases in AA are phonemic. A future study that shows all cases of phonemic and non-phonemic cases of gemination in native words is highly recommended.

5.1.2.1.2 Stress in disyllabic words

There are 196 disyllabic words in the corpus (about 48%). Stress falls on the ultimate syllable in 69 cases (35%) and on the penult in 127 cases (65% of cases). The final syllable receives stress iff it is superheavy, i.e. CVVC or CVCC, as in *ʔooˈzoon* ‘ozone’ or ends in a long vowel, as in *tatˈtuu*; otherwise the initial syllable is stressed, as in *ˈnooga* ‘nougat’ and *ˈbuliʃ* ‘polish’.

For the 69 cases where the ultimate syllable is stressed, the source ultimate syllable is usually superheavy or ends in a long vowel. If not, it is augmented in the adaptation process through vowel lengthening or consonant gemination, as in *ʔaˈsiid* ‘acid’, *ʔalˈbuum* ‘album’ and *skaaˈlubb* ‘scallop’.

For initial stress in disyllabic words, the penult is heavy in 106 cases (84%) while it is light in 21 cases (16%). In the latter case, the first syllable makes up the first mora of a trochee that consists of two-light syllables as shown in (3).

(3) Disyllabic words with initial stress

ˈʃanil	chenille
ˈflaʃar	flasher
ˈhamar	hummer
ˈdʒili	jelly
ˈmadʒik	magic
ˈmuris	morris
ˈbikam	pickup

In the other 106 cases where the penult is stressed, the source penult is usually heavy; however, it is not heavy in the source word in 11 cases where it is augmented via gemination or vowel lengthening as the table in (4) shows.[4] Lengthening these syllables, which may have been invoked due to the original spelling, is consistent with markedness principles where a stressed syllable tends to be heavy.

(4) Disyllabic words with source light penult

ˈliigu	lego
ˈleesta	list
ˈluubi	lobby
ˈraabiʃ	rubbish
ˈswiitar	sweater
ˈtwiitar	twitter
ˈfallal	full

Of particular importance here are cases where an adapted form ends in a CVV syllable, which receives stress in AA. This occurs in five cases such as *ʔukˈkee* ‘okay’ and *fiiˈlee* ‘fillet’. This lends support to the contention that not all final feet are extrametrical in AA, as will be explained in §5.1.4. Further evidence to this contention comes from the fact that stress falls on a syllable that ends in a diphthong in the source in two cases, namely cowboy > *kaaˈboy* and convoy > *kamˈboy*.

5.1.2.1.3 Stress in trisyllabic words

There are 115 trisyllabic words in the corpus of loan words. Stress falls on the ultimate syllable or on the penult in 103 cases. The ultimate syllable receives stress if it is superheavy or ends in a long vowel, otherwise the penult is stressed if it is heavy, otherwise the antepenult is stressed whether heavy or light. When more than one heavy syllable is present, the rightmost syllable receives stress, as in *niktaˈriin* ‘nectarine’ and *teermuˈstaat* ‘thermostat’. This indicates that AA requires the main foot to be aligned with the right edge, as will be demonstrated in §5.1.4.

[4] In ‘jumbo’ > ˈ*dʒaambu*, an already heavy syllable is rendered heavier by vowel lengthening and in ˈ*bubbo* ‘baby’, gemination is used to keep the initial syllable heavy. Moreover, two monosyllabic source words are realised as disyllabic for morphological factors, namely ‘block’ > *ˈblukke* and ‘chat’ > *ˈʃayyat*, where the penult is also heavy, as will be demonstrated below.

The ultimate syllable is stressed in 59 cases (51%). In all these cases, the ultimate syllable is superheavy or ends in a long vowel in AA, as in *niku'tiin* ‘nicotine’ and *niska'fee* ‘Nescafe’. However, in 20 cases the source ultimate syllable is neither superheavy nor ends in a long vowel; nevertheless, it is rendered superheavy via gemination (eight cases) or via vowel lengthening (12 cases); hence stressed as in (5).

(5) Augmenting stressed syllables in trisyllabic words

Augmenting via gemination		Augmenting via vowel lengthening	
dabil kikk	double kick	ʔasbiriin	aspirin
ʔintarnitt	internet	siarmiik	ceramic
ʔintarkamm	intercom	ʔansuliin	insulin
sivin ʔabb	seven up	karatee	karate

In the first column, the borrowed words are stressed on the ultimate syllable as it is superheavy following gemination. It seems that AA treats these words as compounds (except for one case, i.e. ‘scallop’) and so every member of the compound needs to satisfy minimality on its own; hence gemination. In the second column, lengthening seems to be motivated by spelling because written vowels in Arabic are realised as long vowels and the Arabic spelling of these words has a long vowel. Also, this might relate to frequency effects. Note that the most common CV template among trisyllabic words is CVCVCVVC where two bimoraic feet are constructed. That is, lengthening could be motivated to render the output less marked in AA.

The penult is stressed in 44 cases, where it is always heavy in L1. It is already heavy in 30 cases. In the other cases where it is light in the SL, it is rendered heavy via gemination in four cases (*bar'tiyye* ‘party’, *run'deella* ‘roundel’, *sbaa'gitti* ‘spaghetti’ and *vaa'neella* ‘vanilla’) or via vowel lengthening in 11 cases, as in *bin'taagun* ‘pentagon’ and *ʔur'kiida* ‘orchid’. It relates to epenthetic vowels in two cases, namely *ʃal'listun* ‘charleston’ and *ʔi'kistra* ‘extra’. Note that morphology is at play here where the feminine marker invokes either gemination or lengthening in five cases, namely *bar'tiyye* ‘party’, *bat'roone* ‘patron’, *dʒur'zaaye* ‘jersey’, *ʔur'kiida* ‘orchid’ and *run'deella* ‘roundel’.

The antepenult is stressed in 12 cases. It is heavy in five cases (*'batwan*[*e*] ‘between’, *'fabrak*[*e*] ‘fabricate’ *'kundiʃin* ‘condition’, *'ʔaskimu* ‘eskimo’, and *'ʔubtikus* ‘optics’) The metrical structure of these words seems marked as it leaves two syllables unparsed word-finally. However, it is noticed that the first two words are morphologically conditioned as they need to follow AA verb templates whereas the last one has an epenthetic vowel. Also, the antepenult is light in seven cases, as in *'didʒital* ‘digital’, *'ʔasitun* ‘acetone’, *'mitalik* ‘metallic’, and *'salamun* ‘salmon’. Here the first two syllables form a bimoraic trochee leaving behind an unparsed light syllable word-finally.

5.1.2.1.4 Stress in quadrisyllabic words

Of the 18 quadrisyllabic words, 13 (81%) are stressed on the penult and five receive stress on the ultimate syllable that is superheavy, as in *adrena'liin* ‘adrenaline’ and *carbuhay'draat* ‘carbohydrate’. The antepenult is never stressed here. The penult is always heavy in L1. It is already heavy in eight cases in the SL, as in *ambi'faayar* ~ *ambi'fayar* ‘amplifier’ or light but lengthened and stressed in the source in three cases, as in *karbu'reetar* ‘carburetor’. The only two cases where the penult is neither stressed nor heavy in the source are *tiknu'loodʒya* ‘technology’ and *munu'buli* ‘monopoly’.

Findings relating to quadrisyllabic words suggest that markedness plays a major role in the adaptation process such that the least marked structure surfaces. That is, in a four-syllable word, every two syllables form a binary foot.

There are no five-syllabic words and the only source form that is pentasyllabic in the source, i.e. ‘matriculation’ undergoes clipping yielding *'matrik*.

A final note is in order. One might argue that the low percentage of stress on the antepenult does not reflect a preference on the part of AA to avoid stress on the antepenult, but rather relates to the fact that the number of words having three syllables or more is less than disyllabic and monosyllabic words. However, taking trisyllabic and quadrisyllabic words on their own, we notice that the percentage is still high: 45% of trisyllabic and quadrisyllabic words have stress on the ultimate syllable and another 45% have stress on the penult whereas only 10% have stress on the antepenult. This lends support to the tendency of stress in AA to fall at the right edge.

To further check this, I checked the most frequent 500 polysyllabic words[5] in AA and found that stress is mainly right-oriented. It falls on the ultimate syllable in 30% of cases and on the penult in 66% of cases, while it falls on the antepenult only in 4% of cases. This could mean that frequency effects might manifest themselves in the adaptation process. It is well known that frequency can affect phonological patterning as Frisch (2011) observes that "speakers have statistical knowledge of language sound structure at a variety of levels" (ibid: 2144). The tendency for stress to fall at the right edge especially on the penult is consistent with Altmann's (2006) finding that Arab speakers tend to stress the penult. Taken together, these findings suggest that the unmarked stress position in AA could be the penult (more evidence for this is presented in §5.2.2.2.

5.1.2.2 Adapted stressed syllables in terms of weight

In this subsection, I focus on the type of stressed syllables in L1 in terms of weight. It is expected that stressed syllables are usually heavy or superheavy, while light syllables are stressed under duress. Results show that stress falls on a heavy syllable (or a superheavy syllable) in 380/407 (93.6%) cases. These findings are consistent with markedness principles where stressed syllables tend to be heavy. The majority of these heavy syllables are also heavy in the source (299/380). However, when the adapted stressed syllable is not heavy in the source, vowel lengthening or gemination is invoked to augment the syllable in AA. The table below gives the number of cases where a light syllable that is stressed in L1 is augmented via gemination or vowel lengthening.

(6) Augmenting light syllables

	Via gemination	Via lengthening
Monosyllabic words	16	0
Disyllabic words	7	27
Trisyllabic words	10	18
Quadrisyllabic words	1	2
Total	33	47

[5] The list of the most frequent words was adapted from the Routledge *Frequency Dictionary of Arabic* (Buckwalter & Parkinson 2014). Words that are not used in AA were replaced by AA equivalents.

Gemination in monosyllabic words is invoked to satisfy minimality. However, in polysyllabic words where minimality is not in question, gemination is induced to render a stressed syllable heavy, or sometimes heavier, in accordance with the STRESS-TO-WEIGHT Principle, which demands that stressed syllables are heavy, as in *sbaa'gitti* ‘spaghetti’. Similarly, vowel lengthening optimizes metrical structure by rendering the syllable heavier. Vowel lengthening occurs 65 times in the corpus, of which 59 cases are attributed to stress where stress falls on the lengthened vowel, as in *'raabiʃ* 'rubbish’ and *tran'ziit* ‘'transit’.[6] This tendency is also attested in AA native words, which suggests that the adaptation process is geared towards unmarkedness. Of the 500 most common polysyllabic native words in AA, stress falls on a heavy syllable 85% of the time.

Stress falls on a light syllable in only 27 cases. In these 27 cases, the source syllable is also light in 19 cases. This is not unusual as borrowers try to be faithful to source as much as possible and the metrical structure of the source words does not violate AA constraints as 14/19 words are disyllabic and both syllables form a perfect trochee, as in *'tinar* ‘thinner’ and *'dʒili* ‘jelly’.[7] What is unusual is the fact that a heavy syllable is rendered light and stressed in the adaptation process. This occurs in eight cases, as in *'galan* ‘gallon’, *'ʃawar* ‘shower’ *'ʔasitun* ‘acetone’ and *'salamun* ‘salmon’. Most of these cases are recent borrowings and all of them (except for *'ʔasitun* ‘acetone’ and *'salamun* ‘salmon’) have two syllables that make up a bimoraic trochee.

One final note about lengthening here is in order. It seems that source spelling and frequency seem to be relevant here. It could be that AA native speakers mispronounce the vowels in the final syllables as long vowels thinking that a vowel that is represented orthographically is long, as is the case in Arabic orthography where short vowels do not appear in the orthography. Frequency can account for lengthening here as lengthening renders the output fit the most frequent templates in the adaptation process, as already pointed out in §5.1.2.1.3. For example, words such as ‘insulin’ and ‘transit’ are realised with a long vowel in the ultimate syllable that consequently attracts stress. A further study that investigates the most frequent CV templates in

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[6] Recall that lengthening is also attested for foot-binarity, as in *dʒaakuuzi* (see §3.2.7.1).

[7] The other five cases relate to recent borrowings that are trisyllabic where the antepenult is stressed and the initial and the penultimate syllables form a trochee with an extrametrical ultimate light syllable.

native words would shed more light on this issue and the role of frequency in governing phonological patterns.

5.1.2.3 Stress shift

This subsection examines source stress shift in L1. It will be shown that shift is accounted for in terms of markedness. Almost all cases of shift are called for to render a form less marked such that stress shifts from a light syllable to a heavy one or it shifts rightward to another heavy syllable that is closer to the right edge.

Source stress is shifted in 32.4% of cases (132/407). Excluding monosyllabic words where no shift is possible, the percentage goes up as high as 40%. This means that stress position is retained at least 60% of the time. Prima facie, this might suggest that AA attempts to map source stress faithfully in the adaptation process; however, it will be shown that this is not the case. Table 5.2 below gives more information about the distribution of stress shift in the corpus.

Table 5.2 Stress shift in loanwords

	Penult >ult	Ult > penult	Antepenult > ult	Antepenult > penult	Penult > antepenult	Preantepenult > penult	Total	No shift
Disyllabic words	42	4					46 (23.5%)	150
Trisyllabic words	5	2	48	17	2		74 (64%)	41
Quadrisyllabic words	1		3	3		5	12 (66.7%)	6
Total	48	6	51	20	2	5	132 (40%)	197 (60%

Stress shift occurs more in words consisting of more than two syllables. The more syllables there are in the SL word, the more likely stress will shift. As can be seen, stress shifts in 64% of trisyllabic words and in 66.7% of quadrisyllabic words. Therefore, there is no concluding evidence that a MATCH-STRESS constraint that requires source stress to be preserved in loanwords is active in the adaptation process.

Rather, it seems that the position of stress in cases that show stress preservation is compatible with native AA constraints where no stress shift is necessary.

These results are in harmony with Peperkamp & Dupoux's (2002) contention that borrowers in surface-observable stress languages lose the ability to perceive stress. Therefore, borrowers seem to ignore source stress and stress is later assigned over the segmental string that has been mapped onto an acceptable AA form. Moreover, the linguistic context of borrowing is compatible with these findings. Recall that bilingualism in AA can be described as adult bilingualism that is mainly restricted to reading and writing (see §2.3.1). Under this type of bilingualism, adapters are not supposed to have access to syllable structure and stress. This is also consistent with Tu's (2013) observation that in stress languages, unlike tone languages, it is difficult to retain source stress due to more restrictions on stress position in stress languages.

Following is a detailed analysis of stress shift according to number of syllables. Note that in accounting for stress shift, number of syllables refers to the number in the adapted form while syllable weight refers to the source according to AA weight criteria unless otherwise stated. For example, in 'cry.stal' /ˈkrɪ.st(ə)l/ > kris'taal, I consider stress shift from a light penult to a light ultimate syllable although the ultimate syllable is lengthened in AA. The penult has a short vowel with no coda in the source so it is treated as a light syllable in AA.

5.1.2.3.1 Stress shift in disyllabic words

Here shift occurs mainly from the penult to the ultimate syllable. Shift to ultimate syllable occurs 42 times while shift from ultimate syllable to penult is rare and occurs only in four cases, namely *'braavu* 'bravo', *'kasit* 'cassette', *'ʃanil* 'chenille' and *'ʃaampu* 'shampoo'. Shift from penult to ultimate syllable can be classified according to syllable weight as shown in Table 5.3 below.

Table 5.3 Stress shift in disyllabic words

a. Heavy penult to heavy ult	b. Light penult to heavy ult	c. Light penult to light ult	d. Heavy penult to light ult
convoy > kam'boy keyboard > kii'boord mobile > moo'baayl ozone > ʔoo'zoon sonar > soo'naar zigzag > zig'zaag	collage > kul'laadʒ essence > ʔa'ṣanṣ prostate > brus'taat snubbers > ṣnoo'barṣ cut-out > ka'taawt	crystal > kris'taal Dettol > dii'tool	acid > ʔa'siid packet > baa'keet album > ʔal'buum panel > baa'neel service > sar'viis transit > tran'ziit

Shift in (a) is well-motivated phonetically and phonologically as the source ultimate syllable is superheavy and hence attracts stress. In (b), it is still unmarked as AA is weight sensitive and here stress is shifted from a light syllable to a superheavy one. In (c) and (d), stress shift does not appear to be well-motivated. However, orthography here seems to have a major role. The realisation of these words in AA is consistent with AA orthographic rules where the ultimate syllable in these words is rendered heavy. Moreover, it might be the case that these words came into AA through French via other dialects that have had intense contact with French such as Cairene and Syrian dialects. Note that these words are also attested in those dialects and realised as such.

5.1.2.3.2 Stress shift in trisyllabic words

Shift in trisyllabic words occurs 74 times. The most common type of shift is from the antepenult to the ultimate syllable, which accounts for about 65% of cases. This is followed by shift from the antepenult to the penult in 23% of cases. Shift is also attested from the penult to the ultimate syllable in 7% of cases. Thus, shift here is rightward, which gives evidence to the contention that AA is right-oriented. However, shift into the other direction is rare with four cases only, namely ‘between’ > '*batwan*[*e*], ‘chimpanzee’ > *ʃam'baazi*, ‘condition’ > '*kundiʃin* and ‘metallic’ > '*mitalik*. In ‘between’, stress is shifted as a result of morphological templates while in ‘condition’ and ‘metallic’ stress is shifted from a light penult, which is in line with AA stress constraints.

Table 5.4 Stress shift in trisyllabic words

A. Antepenult to ult	B. Antepenult to penult	C. Penult to antepenult	D. Penult to ult	E. Ult to penult/ antepenult
aspirin > ʔasbi'riin	penalty > ba'lanti	condition > 'kundiʃin	ceramic > sara'miiik	chimpanzee > ʃam'baazi
manifold > mana'vult	bulldozer > bil'doozar		karate > kara'tee	between > 'batwan[e]
nicotine > niku'tiin	hamburger > ham'burgar	metallic > 'mitalik	professor > brufu'soor	
satellite > sata'laayt	extra > ʔi'kistra		polystyrene > bulist'riin	
pancreas > bankir'yaas	roundel > run'deella			

In column (a), shift is attested into a heavy syllable in 30/39 cases. This is unmarked in that it is consistent with SWP. In five cases, stress is shifted from a light antepenult, which is completely unmarked, as in *niku'tiin* ‘nicotine’ where two feet are erected and the rightmost foot functions as the main foot. These cases show clearly that AA requires the rightmost foot to be the head foot when more than one foot is present.

In column (b), stress shift is also unmarked as it shifts rightward to a heavy penult, whether in the source or in the adapted form. It can be seen that stress shift here is strongly correlated with syllable weight; almost all cases show a stress shift either to source heavy syllables such as ‘penalty’ and ‘bulldozer’ or to a light syllable that is rendered heavy in the adaptation process, as in *run'deella*.

Also, morphology is behind stress shift in four cases. For example, ‘roundel’ > *run'deella* is realised with the feminine marker *–a*. Amplifying this results in a heavy syllable followed by two light syllables, which seems to be marked in AA. Gemination and vowel lengthening render the penult heavy and consequently stressed.

5.1.2.3.3 Stress shift in quadrisyllabic words

Stress shift here occurs in 12/18 cases and it either shifts to the ultimate syllable or to the penult. It shifts to the ultimate syllable in four cases and to the penult in the rest of cases as shown in Table 5.5 below. As before, the stressed syllable is always heavy either in the source or in the adapted from.[8] If not heavy in the source, the ultimate syllable or the penult is rendered heavy in the adaptation process in order to be able to accommodate stress. Moreover, if the source syllable to which stress is shifted is heavy, it is found to the right of the source stressed syllable. That is, stress shifts rightward to a better stress carrier as dictated by AA constraints.

Table 5.5 Stress shift in quadrisyllabic words

Shift to ultimate syllable	Shift to penult
adrenaline > ʔadrina'liin	amplifier > ʔami'faayar
carbohydrate > karbuhayd'raat	monopoly > munu'buli

Moreover, note that the stressed syllable is usually preceded by a binary foot (always two syllables). This shows that foot binarity, whether under a moraic or syllabic level, is very crucial in AA. Note further that some forms are not bimoraic but bisyllabic, e.g. ‘technology’ > *tik.nu.ˈloodʒya*. Whether AA allows binarity at a syllabic level is still unknown. It could be the case that foot binarity is restricted to a moraic level in AA and the vowel and the consonant share a mora. Further investigation is highly recommended.

One case is of crucial importance to understanding AA stress constraints. This relates to the word ‘monopoly’ > *munu'buli*, where stress shifts to a light syllable, which is the only case among four-syllable words. This form, which is stressed on the antepenult in English, should not pose a problem to AA speakers as the antepenult is stressed in many cases in AA native words. However, the source form would still be marked in AA in that it leaves an unparsed syllable at both the left and the right edges.

[8] Except for *munu'buli*

Assuming that ALIGN-L, which requires the left edge to be aligned with a foot as will be demonstrated in §5.1.4, is highly ranked in AA, a stress shift to the penult would render the form optimal. The first two light syllables make up a bimoraic trochee and the last two would erect another bimoraic trochee. This also shows that final feet cannot always be extrametrical in AA.[9]

5.1.2.4 What happens to source stressed vowels[10]

In this subsection, I examine SL stressed vowels in the adaptation process. Earlier, it has been shown that stressed vowels in L1 are lengthened or even sometimes shortened to render the output less marked. It will be shown here that although stressed syllables in the SL are not immune to shortening or lengthening, they are often realised as is. This is not surprising as the majority of English loanwords have stress positions that are not in conflict with AA markedness constraints.

First of all, about 69% of stressed SL vowels are realised intact in terms of weight. However, although realised as they are in the SL, not all of them maintain the source stress. About 53% of all words preserve the source stress without affecting the weight of the source vowel. However, 16% of the total words (about 66/407 words) have stress shift although the stressed syllable has not undergone any modification in terms of weight, as in *ʔoo'zoon* ‘ozone’. The shift here is almost always rightward into a heavy syllable, as in *kam'boy* ‘convoy’, *kris'taal* ‘crystal’ and *limu'ziin* ‘limousine’. This suggests that what AA borrowers pay attention to in assigning stress in loanwords is length —not source stress.

Lengthening the SL stressed vowels occurs in about 5% of all loanwords. In all these cases, the vowel is lengthened to render L1 stressed vowel heavy, as in *'liigu* ‘lego’ and *'diisku* ‘disco’ (see §3.2.7.1).

On the other hand, shortening of source stressed long vowels may occur contrary to markedness principles. Shortening SL stressed long vowels is attested in 99 loanwords. About one third of these words (37 words) maintain the SL stress, as in

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[9] Further evidence to penultimate stress in this word comes from the fact that the stressed syllable in this form appears with gemination by one informant and sometimes lengthened by some AA speakers.

[10] Monosyllabic words are included here as they are affected by these processes.

'ʔasitun ‘acetone’, *band* ‘band’, *kiks* ‘cakes’, *dʒinz* ‘jeans’ and *rindʒ* ‘range’. Therefore, shortening these vowels looks unusual. However, a closer inspection of these words shows that this is not the case. Shortening these vowels is unmarked. For example, in a word such as ‘jeans’ not shortening the stressed vowel yields a marked structure as it will render the foot trimoraic violating FOOT-BINARITY. Also in (*'ʔasi)tun* ‘acetone’, shortening allows parsing the first and the second syllables leaving only a final ultimate syllable. That is, shortening these stressed vowels optimizes the metrical structure of these forms making the syllable maximally bimoraic.

Shortening of a source stressed vowel coupled with stress shift also occurs in another 62 cases, such as *bakim'bawdar* ‘baking powder’, and *fulis'kaab* ‘foolscap’. The majority of shortening cases here occur for syllable bimoraicity, as in *fulis'kaab*, and in almost all cases stress shifts rightward to a heavy syllable. Also, shortening unstressed vowels following stress shift in the adaptation process is expected as stressed syllables gain more salience by shortening adjacent vowels. This could be related to markedness: stressed syllables are more prominent than unstressed syllables.

Finally, SL stressed vowels are deleted in two cases only, namely *'matrik* ‘matriculation’, which undergoes clipping and *bulistriin* ‘polystyrene’, which undergoes syncope (see §4.4.2 and §4.4.3).

5.1.2.5 Interim summary

Stress assignment in loanwords has shown that stress is closely related to weight and position. Results show that source stress is ignored and stress in loanwords applies to the adapted form although source stressed syllables are realised unchanged 69% of the time, which is attributed to the fact that they do not violate AA markedness constraints.

Stress in loanwords follows the same native constraints where stress does not retract beyond the antepenult and falls on the rightmost heavy syllable. It has been shown that stress falls at the right edge as much as possible as it falls on the penult or on the ultimate syllable in 97% of cases. Also, results show that weight is very crucial; 94%

of stressed syllables are heavy. More evidence for these two observations comes from stress shift; stress shifts almost always rightward to a heavy syllable.

Most interestingly, findings show that final feet cannot always be extrametrical even if they are not morphologically complex as long vowels in open syllables are stressed, as in *tat'tuu*. Also, unexpectedly, a light penult is stressed, as in *munu'buli*, as will be accounted for in §5.1.4 below. To further verify stress position especially in such cases, an acoustic analysis was conducted, which is the focus of the next section.

5.1.3 Acoustic analysis

This section reports on two acoustic experiments that attempt to establish what AA uses to cue lexical stress. In the first experiment, stressed vowels and unstressed vowels are compared in terms of F0 and intensity in 41 loanwords. In the second, vowels in almost identical stressed and unstressed syllables are compared with respect to F0, intensity and duration. It will be shown that AA cues stress mainly through F0 and intensity while there is no concluding evidence that duration is consistently used to cue stress.

5.1.3.1 Stress acoustic correlates

Although there is no consensus in the literature concerning whether stress has phonetic correlates and therefore can be measured or not, I am of the view that acoustic analysis can enhance our impressionistic judgements regarding stress position. Some researchers, e.g. Hayes (1995: 5), argue that stress is a cognitive entity that does not have a single clear physical correlate. In contrast, many other researchers maintain that stress usually has three acoustic/phonetic correlates, namely pitch, intensity and duration (cf. Laver 1994; Gordon 2011a; among others).[11] Pitch (measured in Hertz (Hz)) corresponds to the fundamental frequency which refers to “the number of complete repetitions (cycles) of variations in air pressure occurring in a second” (Ladefoged 1996: 114). Intensity (measured in decibels (dB)) is ‘the acoustic basis of what we perceive as loudness and it is the result of the energy of the displacement of air’ (Ball & Rahilly 1999: 160). Finally, duration (measured in

[11] Some researchers add spectral tilt and vowel quality as correlates of stress (cf. Sluijter & van Heuven 1996).

milliseconds (ms)) corresponds to phonological length and refers to the amount of time a sound takes to produce (ibid: 107).

Earlier acoustic studies on Arabic dialects are not abundant. Among the few studies that tackled Arabic dialects (no study has investigated the dialect in this study) are Al-Ani (1992), de Jong & Zawaydeh (1999), Zuraiq (2005) and Al-Absi (2011). With the exception of Al-Absi, they all found that stressed syllables are significantly different from unstressed ones in one or more ways. Al-Ani (1992) found that stressed syllables have greater values than unstressed ones for all three correlates. de Jong & Zawaydeh (1999) found that JA uses both duration and F0 to cue stress; stressed vowels are longer and have higher F0 (215 vs. 200 Hz). Zuraiq (2005) came to similar conclusions and found that stressed syllables have longer duration, higher F0 and higher amplitude than unstressed syllables in JA. He also found that JA speakers do not reduce vowels in unstressed syllables. In contrast, Al-Absi did not find significant differences between stressed and unstressed syllables in terms of the three correlates. It seems that his results do not apply to any Arabic dialect, as he bases his results on recitations of the Holy Quran by three Quran readers. It could be the case that these findings apply to the Quran only, where extra attention is paid to articulating every phoneme and syllable.

5.1.3.2 Experiment one

In this experiment, 41 loanwords as produced by nine AA native speakers were selected (see §2.6.3 for details on participants) and their vowels were measured with respect to F0, intensity and duration using PRAAT software version 1.4.9 (Boersma & Weenink 2015). Also, F2 readings were obtained for one female subject only as a pilot study to see if AA opts for vowel reduction or vowel quality to enhance stress place. The participants pronounced every word three times and the middle repetition was selected.

Each vowel was measured for the three correlates. Duration was measured in ms and was taken for the whole vowel from the start of voicing striations to end. The researcher identified the whole vowel and measured the duration manually. The same selection was used to get intensity (in dB) and pitch (in Hz). Intensity/amplitude was measured for the whole vowel and the average was taken. The same was done for F0.[12]

Measuring duration was not always clear-cut and straightforward so extra attention was paid to identifying the vowels as this will affect other readings. Vowels flanked by obstruents were easy to identify as they have clear formants on spectrograms where acoustic energy is displayed and the dark bands that correspond to vowels and the striations that refer to voicing are distinct. The researcher double checked vowel boundaries by listening to the sound in question. However, when vowels are flanked by sonorants, measuring duration was not easy; therefore, for this and other reasons, as will be pointed out below, duration will not be tested in the first experiment. In the second experiment, many variables will be controlled for and it will be much easier to identify vowels, as will be shown below. In the first experiment, duration is measured only for reference and will not be taken into consideration in statistical analysis.

5.1.3.2.1 PRAAT sample selection

Given that there are a big number of loanwords, a representative sample was selected randomly. To do so, I put all loanwords (excluding monosyllabic words) in alphabetical order according to their number of syllables to ensure that all words had equal chance to be represented and then I selected every tenth word in the list starting from number one.[13]

Of the 196 disyllabic words, 20 words were selected in addition to five more problematic words given below. These problematic words were selected as they are crucial to test whether a long vowel in an open final syllable is stressed, as it is impressionistically assumed. Stressing these syllables means that final foot extrametricality needs to be reconsidered, as will be demonstrated in §5.1.4.

(7) Disyllabic words with final stressed long vowels in open syllables

boo'keeh	'bouquet'
ʃam'waa	'chamois'

[12] Note that when F0 could not be identified as when the vowel was realised as voiceless, the researcher took the lowest pitch level of that speaker. Also, the researcher excluded the very few outliers when a participant produced a very high level of pitch and took the highest normal pitch level of that speaker.

[13] The sample appears in the appendix. The 41 words are followed by the letter S.

fii'lee 'fillet'

kung'fuu 'kong fu'

tat'tuu 'tattoo'

Of the 115 trisyllabic words, 12 words in addition to one more word that ends in a long vowel, namely *niska'fee* 'Nescafe' were selected. Of the 18 four-syllabic words, two words in addition to a problematic word, namely *munu'buli* 'monopoly' were selected. The total number of loanwords to be analysed using PRAAT is 41.

5.1.3.2.2 Measurement results

Upon measuring all vowels, measurements of duration, intensity and F0 were tabulated using Excel and then were fed into SPSS (except for duration) where ANOVA and t-tests were run. Table 5.6 below gives some illustrative examples that summarise the results.

Table 5.6 Stressed vs. unstressed vowels in terms of duration, intensity and F0

	Vowel	Mean duration	Mean intensity	Mean F0
cheetah> 'ʃiita	ii	114	73	197
	a	81	73	176
gallon > 'galan	a	73	75	177
	a	68	75	175
defrost > dii'frust	ii	80	75	192
	u	69	76	197
fillet > fii'lee	ii	68	71	177
	ee	148	75	185
flowmaster > fulu'maastar	u	44	71	175
	u	48	71	160
	aa	101	73	179
	a	59	74	182
chamois > ʃam'waa	a	74	72	178
	aa	133	75	187
heater > 'hiitar	ii	108	74	191
	a	77	74	184
karate > kara'tee	a	58	74	185
	a	66	73	175
	ee	161	76	185
magic > 'madʒik	a	67	74	183
	i	58	72.5	181
monopoly > munu'buli	u	49	75	187
	u	55	73	183.5
	u	57	75	195
	i	63	74	196
nescafe > niska'fee	i	52	71	188
	a	60	70	184.5
	ee	156	73	189
pixel > 'biksil	i	54	76	219
	i	65	73.5	199
shower > 'ʃawar	a	75	78	222

	a	63	77	200
tattoo > tat'tuu	a	68	74	202
	uu	178	75	202
toffee > 'toof[e]	oo	118	75	195
	e	61	72	197
sandwich > 'sandwiʃ	a	80	74	197
	i	57	73	189
satellite > sata'laayt	a	44	71	188
	a	54	73	176
	aa	100	75	185
cornflakes > koornif'liks	oo	105	75	195
	i	35	72	183
	i	54	73	191

Table 5.6 shows that stressed vowels tend to have higher readings with respect to F0 and intensity and to a lesser extent with respect to duration. Results indicate that F0 in the stressed syllables tends to be higher, as in *'hiitar*, *'biksil* and *'ʃawar* where F0 is 191, 219 and 222 Hz, respectively compared with 184, 199, and 200 Hz, respectively for the second unstressed vowels. However, this is not always the case. Sometimes, the difference in F0 does not seem to be enough to cue stress, as in *'galan* where the difference is only two Hz. Still, sometimes the unstressed vowel has higher F0 than the stressed vowel, as in *'toof*[*e*] where F0 of the second unstressed vowel is two Hz higher than that of the first stressed vowel. This might be related to other factors than stress, as will be explained below.

For intensity, the picture is almost the same. Stressed vowels tend to be 2 dB on average higher than unstressed vowels. This is clear, as in *'biksil* where the intensity of the stressed vowel is 76 dB while the intensity of the unstressed vowel is 73.5 and in *'toof*[*e*] where the difference is three dB. However, the difference is sometimes less than two, as in *'madʒik* with a 1.5 dB difference. Moreover, sometimes stressed and unstressed vowels have equal values for intensity, as in *'galan*, *'ʃiita* and *'hiitar*. Still, sometimes the unstressed vowel is higher in intensity, as in *fulu'maastar* where the last unstressed vowel is one dB higher than the vowel in the stressed penult.

Results with respect to duration give mixed evidence. Although stressed vowels tend to be longer, a strong correlation is difficult to establish as these vowels are not found in identical environments, which will be investigated in the second experiment. Sometimes, stressed vowels are longer; other times unstressed vowels are longer. For example, the stressed short low vowel in *'galan* and *'ʃawar* is more than five ms longer than the unstressed short low vowel. On the other hand, the unstressed vowel in the second syllable in *'biksil* is nine ms longer than the stressed vowel.[14] Similar results are obtained in *fulu'maastar* and *kara'tee* where the first vowel, which is supposed to have secondary stress as it is the head of a moraic trochee is longer than the second unstressed vowel.

To summarise, although stressed vowels tend to have higher values in terms of F0 and intensity and to a lesser extent in terms of duration, sometimes unstressed vowels have higher values. That being the case, we need to find statistical evidence to support these results and we need to control for other variables as these values can be much affected by the phonetic environment, as will be explained below.

Returning to Table 5.6, results show that some vowels tend to have secondary stress, as in *dii'frust, fulu'maastar* and *kaara'tee* where the first vowel in each word seems to have a secondary stress as they have similar pitch and intensity readings to stressed vowels and higher readings than unstressed vowels. For example, in *fulu'maastar* the high short vowel in the first syllable has F0 at 175 Hz while the second unstressed one has F0 at 160 Hz.

Results also provide evidence for my earlier observation that final long vowels in open syllables are stressed. Consider the words *fii'lee, ʃam'waa* and *ta'ttuu* that show that the final vowels have higher intensity and F0 than the unstressed vowels. The final vowel in *fii'lee* is eight Hz and four dB higher than the first vowel. The same applies to *ʃam'waa* where F0 is 187 Hz for /aa/ and 178 Hz for /a/ in the first syllable and intensity is 75 dB compared with 72 dB for the unstressed vowel.

Moreover, results confirm that the light penult in *munu'buli* is stressed. The penult has F0 at 195 Hz and intensity at 75 dB, which are higher than readings in unstressed syllables, as shown in Table 5.6 above. Similarly, results show that some words are treated as compounds where each word has its own stress, as in *koornif'liks* where the first and the last vowels have comparable readings to stressed ones.

Finally, results do not show any evidence for the use of F2 as a correlate of stress in AA. Vowels in stressed and unstressed syllables have comparable readings, as shown

[14] One might suggest that this relates to the fact that it is word final; however, other cases with similar environments suggest that this is not the case. Therefore, these external variables will be controlled for in the second experiment below.

in Table 5.7 below.[15] Moreover, F2 of unstressed vowels is sometimes higher than that of stressed ones.

Table 5.7 F2 readings of stressed and unstressed vowels (other readings are shown for reference)

Loanword	Vowel	Duration	Intensity	F0	F2
pixel > 'biksil	i	55	78	234	1775
	i	56	76	213	1986
racquet > 'rikit	i	65	80	239	1813
	i	72	76	205	1870
dumdum > 'dumdum	u	58	75	220	1515
	u	60	74	213	1467

To conclude, results of the first experiment suggest that the primary and clearest correlate of stress place in AA loanwords is higher pitch, which is enhanced by higher intensity. Mixed evidence is obtained for duration, which is further examined in §5.1.3.3.

To test whether these differences in F0 and intensity between stressed and unstressed vowels are statistically significant, a one-way ANOVA and two-tailed t-tests were conducted. Below, I report on the results according to F0 and intensity.

5.1.3.2.3 Statistical analysis of F0

The one-way ANOVA shows that there are statistically significant differences between stressed vowels and unstressed ones in terms of F0 at a 0.01 level [F= (1, 940) = 14.499, P = .000)]. Stressed vowels have higher F0 than unstressed ones with a mean difference of 8.72 Hz. Stressed vowels have an F0 at 182.21 Hz on average while unstressed ones have a lower F0 at 173.48 Hz. This difference is sufficient to cue stress in AA.

A two-tailed t-test was performed to further compare the means of the two groups. Results show that there are statistically significant differences between the two groups

[15] Recall that these results refer to one participant only.

($t(470) = 10.053$, $p<.000$). Also the correlation between F0 and stress is very strong at .858.

To sum up, the results show that AA speakers use F0 to cue stress in AA. These results are consistent with earlier results by Zuraiq (2005) and de Jong & Zawaydeh (1999), who reported similar results for F0.

5.1.3.2.4 Statistical analysis of intensity

Results show that there are statistically significant differences between stressed vowels and unstressed ones with respect to intensity at a 0.01 level [$F= (1, 940) = 31.59$, $P = .000$)]. Stressed vowels have intensity at 74.73 dB compared with 73.04 dB for unstressed vowels with a mean difference of 1.69 dB. Although this difference does not appear considerable, it is statistically significant. (Note that the standard deviation for stressed vowels is 4.91099 and for unstressed ones, 4.29987). A two-tailed t-test was performed to further compare the means of the two groups. Results show that there are statistically significant differences between the two groups ($t(470) = 7.043$, $p <.000$). Note also that the correlation between stressed and unstressed vowels with respect to intensity is not very strong, which is at .366. This is expected from the examples above, where intensity of unstressed vowels is sometimes higher than that of stressed ones. In general, AA speakers do use intensity as a correlate of lexical stress, although it is not as strong as F0.

The results above need to be interpreted with caution as the phonetic environment of stressed and unstressed vowels vary and could not be controlled for with greater certainty. Therefore, I attempt to control for external variables in the second experiment by selecting vowels in identical syllables as much as possible, which is the topic of the next section.

5.1.3.3 Further analysis of stress correlates

It is agreed that the three stress correlates–duration, intensity and F0–can be influenced by other variables. For example, it has been reported by Hanson (2009) that F0 is significantly higher after voiceless obstruents than voiced ones. Also, F0 of high vowels is higher than that of low vowels and short vowels have higher intrinsic pitch than long vowels, which is usually attributed to enhancing short vowel perception (cf. Ohala & Eukel 1987; Thongkum, Teeranon & Intajamornrak 2007).

Similarly, vowel duration can be affected by the phonetic environment. For example, vowels are shorter before voiceless obstruents than before voiced obstruents. On this view, measurements can be affected by external factors as the phonetic environment of stressed and unstressed vowels is rather different.

To control for such variables, eight pairs of words with vowels in identical or near identical phonetic environments were selected. Here duration will be taken into consideration. Note that these are not minimal pairs so the results have to be interpreted with caution. Note further that syllables in initial position preceding stressed syllables could have secondary stress. Therefore, differences between stressed and unstressed vowels are not expected to be very high. Table 5.8 below presents the eight pairs, along with their vowel measurements. All these words were taken from the 407 loanword corpus so all of them had been already recorded by all participants. The same procedures that were followed earlier to make the acoustic measurements were used here.

Table 5.8 Mean values of stressed and unstressed vowels in terms of duration, intensity and F0

Pair	Vowel	Mean duration	Mean intensity	Mean F0
'askimu	a	48.41	71.83	182.16
vs. as'kiimu	a	54.58	69.33	173.5
'ʔasitun	a	58.75	72.42	184.92
vs. ʔa'siid	a	46.75	68.58	158.25
'kastar	a	66.00	74.25	183.75
vs. kas'keet	a	53.67	69.50	170.45
'madjik	a	65.50	73.67	179.17
vs. ma'daam	a	64.33	73.83	177.33
'kuntak	u	64.00	72.75	186.88
vs. kun'trool	u	56.00	73.33	181.42
'kungris	u	67.08	75.25	194.50
vs. kung'fuu	u	65.83	75.17	191.00
'muris	u	58.50	75.75	179.33
vs. mu'keet	u	59.25	69.83	160.17
'biksil	i	52.92	76.17	210.00
vs. bik'kiini	i	49.92	71.83	172.00

Table 5.8 shows that F0 of vowels in stressed syllables is always higher than that of unstressed syllables. The mean for vowels in stressed syllables is 187.6 Hz; for vowels in unstressed syllables, 173 Hz with a mean difference of 14.6 Hz. For intensity, stressed vowels also have higher intensity. Mean intensity for stressed vowels is 74 dB; for unstressed vowels, 71.4 dB with a mean difference of 2.58 dB. Vowels in all stressed syllables have higher intensity than vowels in unstressed syllables except for two pairs, namely *'madjik/ma'daam* and *'kuntak/kun'trool*. Note also that the vowels in *'kungris/kung'fuu* have almost the same intensity. For duration, stressed vowels are generally longer than unstressed vowels except for the two pairs *'askimu/as'kiimu* and *'muris/mu'keet*. Average duration of stressed vowels is 60.14 ms while average duration of unstressed vowels comes to 56.29 ms with a mean difference of 3.85 ms. Note also that the difference drops to about one ms in *'madjik/ma'daam*.

To find out whether these differences between stressed and unstressed vowels are statistically significant, ANOVA and two tailed t-tests were conducted. Results show that the differences with respect to F0 and intensity are significant while for duration they are not. More details about the results are given below.

5.1.3.3.1 Statistical analysis of duration

The one-way ANOVA shows that there are no statistically significant differences between vowels in stressed syllables and unstressed syllables in terms of duration at a 0.01 level [F= (1, 190) = 3.426, P = .066)]. This could be affected by the fact that some vowels in unstressed syllables are longer than vowels in stressed syllables, as in *'ʔaskimu/ʔas'kiimu*; thus a further study at a larger scale would shed more light on this issue.

Although the average difference in duration is 3.85 ms, which seems to be considerable, it is statistically insignificant as it is evident from the high standard deviation (17.66947). To further check this, a correlation test was done and it was found the correlation between stressed vowels and duration is very weak at .250.

To sum up, duration does not seem to be used as a cue for lexical stress in AA. This is contrary to Zuraiq’s (2005) and de Jong & Zawaydeh’s (1999) results who found that duration was significant and was used as a stress cue in JA. Recall that our results should be interpreted with caution for lack of minimal pairs and the small-sized sample.

5.1.3.3.2 Statistical analysis of intensity

Results for intensity are different. The one-way ANOVA shows that there are statistically significant differences between stressed vowels and unstressed vowels in terms of intensity at a 0.01 level [F= (1, 190) = 9.647, P = .002). Also, a correlation test shows that there is a strong correlation between stressed vowels and intensity at .639. However, intensity is not always significant for all pairs. It is significant for five pairs while it is not significant for *'kungris/kung'fuu*, *kunt'rool*/*'kuntak*and 'madjik/ma'daam. Intensity results suggest that intensity is implemented by AA speakers to signal out stressed vowels.

5.1.3.3.3 Statistical analysis of F0

The one-way ANOVA shows that there are statistically significant differences between stressed vowels and unstressed ones at a 0.01 level [F= (1, 190) = 7.618, P = .006). (SD 28.0821). A correlation test confirms this where correlation is high at .706. Note that F0 is significant for all pairs except for *kunt'rool*/*'kuntak*.

To see whether duration or sometimes intensity cancel out the effect of F0, I combined the three factors. It was also significant for all except for *kunt'rool*/*'kuntak*. Combining F0 with intensity, the same results were obtained. The differences are still significant for all except for *kunt'rool*/*'kuntak*.

5.1.3.4 Interim summary

This subsection has shown that AA uses F0 and intensity to cue stress, while no concluding evidence was obtained for duration as the findings of the two experiments show. However, it has been found that the most important cue is F0. More evidence for this comes from correlation tests where the highest correlation was for F0 at .709 followed by intensity at .639 and finally for duration at .250. Consequently, stressed vowels in AA do have higher F0, might have higher intensity but they do not usually need to be longer than unstressed vowels. These results do confirm earlier results for stress correlates in JA with respect to F0 but they run counter to them with regard to duration. This is not unusual in that languages that have phonemic vowel length contrasts tend not to use length as a correlate of stress (cf. Gordon, Jany, Nash & Takara 2010).

Findings show that acoustic measurements match our impressionistic judgements regarding stress place for most cases in AA loanwords. Moreover, acoustic readings point out that AA has secondary stress. Results further indicate that the ultimate syllable with a long vowel, e.g. *tat'tuu* 'tattoo' is stressed in AA.

5.1.4. Theoretical analysis of stress assignment

This subsection presents a theoretical analysis couched within OT of stress assignment in both native and loanwords. As has been shown in §5.1.2, stress in the adapted words always falls on one of the last three syllables. It falls on the ultimate syllable iff it is superheavy ending in an extrametrical consonant or heavy ending in a long vowel. Otherwise, stress falls on the penult if heavy, otherwise it falls on the antepenult be it heavy or light. Moreover, when more than one heavy syllable is available within the three syllable window, stress always is assigned to the rightmost syllable. Of particular interest in the adaptation process are two findings, namely stressing long vowels in open syllables word-finally, as in *tat'tuu* and stressing a light penult, as in *munu'buli*. This means that final feet are not always extrametrical in AA so any theoretical account of stress in AA needs to account for these cases. Moreover, along with other findings from gemination (see §5.2.2.2), it has been found that AA opts for aligning feet with the left edge of the word. Finally, it has been observed that the adaptation process strives to yield the least marked output. In this subsection, all these factors will be translated into OT constraints that account for stress assignment in both native and loan words.

First, I review the related literature on stress on similar dialects to AA in §5.1.4.1; then I present a stress algorithm in §5.1.4.2; finally, I suggest an OT constraint ranking that accounts for stress in AA in §5.1.4.3.

5.1.4.1 Previous studies on JA and PA

Although stress was never mentioned by early Arab grammarians leading some researchers, e.g. Birkland 1954, Ferguson 1956, and Garbell 1958 (cited in Watson 2011) to deny the existence of word stress in CA, stress in Arabic has received considerable attention over the last fifty years (Watson 2011). Many researchers have dealt with stress in JA, e.g. Al-Sughayer (1990), Al-Jarrah (2002), Abu-Abbas (2003), Abu-Rakhieh (2009) and in PA,[16] e.g. Abdo (1969), Abu-Salim (1982), Hayes (1995), Kager (2000), Al-Mohanna (2004) and Watson (2011).

Earlier attempts to describe stress in JA and PA before OT followed mainly either a generative approach, as in Abdo (1969), Brame (1974), among others, or a metrical approach, e.g. Abu-Salim (1982), Hayes (1995), Al-Bay (2001) and Watson (2011) (see Watson 2011 for an overview). Recently, OT has given rise to a number of studies that endeavor to account for stress assignment in Levantine Arabic dialects including JA (cf. Kager 2000; Al-Jarrah 2002; Abu-Abbas 2003; Mobaidin 2003; Al-Mohanna 2004; Abu-Rakhieh 2009; among others). All researchers agree that syllable weight and position account for stress assignment in JA, which is almost entirely predictable (Abdo 1969).[17]

In this subsection, I do not intend to review each of these studies for space limitations. I will make reference to these studies and engage with their arguments and constraints where relevant. However, two points are worth mentioning regarding earlier OT-based studies on JA. First, most of them resort to parameterisation of constraints to make them fit their data, which is antagonistic to OT (McCarthy & Prince 2004). Second, they all fail to deal with monomoraic leftover syllables at the left edge of the word, which appears to be crucial in AA, as will be shown.

Although previous studies account for most cases of stress assignment in JA and PA, none of them is able to account for all cases. For example, most of them assume that final feet are extrametrical and stress falls on final superheavy syllables as the last consonant in CVVC and CVCC syllables intervenes between the right edge and the syllable rendering the syllable in non-final position (cf. McCarthy 1979). This analysis cannot account for stress on final open syllables ending in long vowels as nothing separates them from the right edge. Earlier analyses argue that these long vowels appear only before the third person masculine singular pronominal suffix *–h* (cf. Broselow 1976, cited in Abu-Abbas 2003; McCarthy 1979). One might argue that

[16] Recall that PA is very similar to JA (Butros 1963; Abu Abbas 2003).

[17] Many researchers claim that secondary stress does not exist in JA (Mitchell 1960; Kager 1999; Al-Jarrah 2002; among others); however, Abdo (1969) argues that it does exist. Although results here suggest that AA has secondary stress, this study will focus on main stress and secondary stress is left for future research.

such cases are exceptions but the systematic adaptation of such syllables in the corpus of loanwords suggests otherwise. I will argue that final foot extrametricality can still be maintained thanks to the interaction of OT constraints that will account for this phenomenon.

Of all studies on JA, the most successful attempts were Abu-Abbas's (2003) and Abu-Rakhieh's (2009).[18] Abu-Abbas suggests a constraint hierarchy that accounts for most of the data but fails to account for two cases. The first relates to stressing HLL forms. Abu-Abbas adopts HL feet, which are universally marked and absent in trochaic systems as they violate rhythm harmony, which "favours length at the end of constituents" (Prince & Smolensky 1993/2004: 25-26). So a form such as *madras*[*e*] would be parsed as (madra)s[e] in AA according to Abu-Abbas' hierarchy. Moreover, he adopts a moraic as well as a syllabic trochee to account for his data without providing any evidence for the adoption of syllabic trochees.

Abu-Rakhieh (2009) suggests a constraint ranking that is not able to account for words composed of a heavy syllable followed by three light syllables such as (muħ)(tara)m[e] as it predicts that stress would fall on the unattested heavy pre-antepenult as he ranks WSP undominated in the hierarchy. Also, along with Abu-Abbas', it fails to mention foot directionality. Although he assumes it, there is nothing in his hierarchy that enforces footing from the left edge, which is very crucial in AA, as gemination in the adaptation of loanwords demonstrates (see §5.2.2).

Drawing on insights from earlier studies and findings from loanword adaptation, I introduce a stress algorithm in §5.1.4.2 and I put forward a new hierarchy that accounts for stress assignment in loanwords and in native words in AA in §5.1.4.3.

5.1.4.2 Stress algorithm

Drawing on Hayes (1995) and Watson (2002, 2011), I adopt moraic theory couched within OT to analyse stress assignment in AA for both native and loan words. Like other Levantine dialects, AA has moraic trochees (cf. Hayes 1995; Watson 2011). Feet

[18] Other OT attempts to describe JA face serious problems. For example, Al-Jarrah's attempt would apply to a dialect that is identical to Cairene Arabic where a light penult is stressed in HLL forms but not JA despite the fact that he mentions that his data belong to JA in general as he notes that "[F]or the purpose of this research, I will incorporate data from many of these varieties in our attempt to uncover the stress patterns in Jordanian Arabic" (ibid: 186).

are constructed from left to right. Feet can have the forms H(eavy) or LL(ight). HH or uneven trochees are not allowed. Moreover, degenerate feet are forbidden.

The basic stress algorithm in AA is:

(a) Stress the final syllable iff it is superheavy, or ends in a long vowel,[19] as in *naas* 'people', *kara'vaan* 'caravan', *tat'tuu* 'tattoo' and *daras'naa* 'we studied it m.'[20]

(b) Otherwise stress the penultimate syllable if it is heavy or if the word is bisyllabic, as in *'sama* 'sky', *'kastar* 'custard', *'koobra* 'cobra', *say'yaara* 'car' and *mafru'ʃaathum* 'their m. furniture'.

(c) Otherwise stress the antepenultimate syllable regardless of whether it is light or heavy, as in *'madras*[*e*] 'school', *muħ'taram*[*e*] 'respected f. s.', and *'mitalik* 'metallic' (provided that the word is left-aligned with a foot).[21]

Following Hayes (1995), the following formalism is used to account for AA stress assignment:

a. Consonant extrametricality: C → <C> /__]word
b. Foot extrametricality : F → < F> /__]word[22]
c. Foot construction: Form moraic trochees from left to right (iterative).
Degenerate feet are forbidden.

d. Word layer construction: End Rule Right (ERR)

Like other Arabic dialects, consonant extrametricality is motivated on the grounds that CVC syllables behave as light and revoke stress word-finally but they are heavy and attract stress internally (cf. Hayes 1995; Watson 2011; among others). Note that attempts to render the last mora extrametrical (e.g. Abu-Salim 1982) are unsuccessful as they would render a long vowel monomoraic and therefore unstressed.

[19] The motivation for this condition comes from loanwords such as *fii'lee* 'fillet'.

[20] Phonologically this word ends in a superheavy syllable, cf. naah (McCarthy 1979).

[21] This stipulation is needed to account for cases such as *munu'buli*, as will be explained below.

[22] This does not apply if it exhausts the stress domain or violates other constraints, e.g. FTBIN and WSP, as will be demonstrated in the following subsection.

Foot extrametricality is invoked to account for cases where HLL forms receive stress on the antepenultimate syllable. This will also avoid footing final syllables as this would render the foot extrametrical.

For morphologically complex cases where final superheavy syllables are stressed, it has been argued by many researchers that these syllables are not final as a final consonant intervenes between the syllable and the right edge depriving the syllable of peripherality, as in *saʔa'luu(h)* 'they m. asked him' (See Watson 2011). However, a loanword such as 'tattoo', which is realised as *tat.'tuu* with final stress in AA challenges this. This is evident from PRAAT analysis where final open syllables with long vowels are stressed (see §5.1.3). However, revoking extrametricality will pose other problems relating to assigning stress to, e.g. HLL forms. Therefore, we are facing a paradox here. We need to adopt extrametricality to be able to stress HLL and similar forms correctly while we still need to revoke extrametricality to stress final open syllables with long vowels. The above argument that superheavy syllables are not final so they escape extrametricality is not sufficient as it cannot apply to long vowels in open syllables as there is nothing intervening between the final syllable and the right edge. Thanks to OT, the interaction of constraints in OT can accomplish this and solve the paradox. To achieve this, I adopt the WEIGHT-TO-STRESS Principle below and rank it higher than NONFIN(ALITY) (extrametricality), as will be demonstrated in §5.1.4.3. This will ensure that final heavy syllables receive stress, whether a consonant intervenes between the right edge and the syllable or not, violating NONFIN. However, NONFIN will still avoid parsing final light syllables unless this violates FOOT BINARITY and ALIGN-L, as will be demonstrated below.

Footing proceeds from left-to-right forming moraic trochees, so forms with LLL and HLLL syllables are footed as (LL)<L> and (H)(LL)<L> respectively. Since degenerate feet are not allowed, a monomoraic syllable cannot be footed and will remain unparsed, which is consistent with Hayes' (1995) observation that parsing does not need to be exhaustive. Finally, End Rule Right (ERR) ensures that stress is assigned to the head of the rightmost visible foot in a word. So in a form such as (H)(H)(H), the rightmost, the ultimate, syllable receives stress.

5.1.4.3 OT analysis

In this subsection, I introduce the OT constraints that have been already used in the literature on stress assignment in Arabic dialects as well as other languages.

First, in order for a lexical word to receive stress, it needs to satisfy prosodic word minimality. This is achieved by the constraint *PrWdµ below.

(8) *PrWdµ: A prosodic word is minimally bimoraic (cf. Prince and Smolensky 1993/2004).

This constraint is adopted to account for stress in monosyllabic words such as *maal* 'money' *barr* 'over land' and *buṣṣ* 'boss'. A prosodic word must have at least one foot and a foot must be bimoraic. This leads to a closely related constraint, FOOT-BINARITY, which requires feet to be bimoraic.

(9) FOOT-BINARITY (FTBIN): Feet are binary at a moraic level (cf. Hayes 1995; Prince & Smolensky 1993/2004).

Following Abu-Rakhieh (2009) and Watson (2011), I argue that feet are moraic trochees in AA of two forms only, namely H and LL. Uneven trochees are not attested. Recall that HL feet are excluded by rhythm harmony (Prince & Smolensky 1993/2004). Also ruling out heavy syllables from disyllabic feet makes sure that "durational contrasts never arise in a foot with trochaic prominence" (Hyde 2011: 1058), which is consistent with the iambic-trochaic law.

Final consonant extrametricality is translated into OT as *Final-C-µ below.

(10) *FINAL-C-µ: A word-final consonant is weightless (Prince & Smolensky 1993/2004: 49; Kager 1999).

This constraint ensures that consonants in absolute final position are weightless. However, this violates another constraint that requires coda consonants to be moraic, as suggested by moraic theory (Hyman 1985; Hayes 1989, 1995). The WEIGHT-BY-POSITION constraint introduced earlier and repeated in (11) below achieves this.

(11) WEIGHT-BY-POSITION (WBP): Coda consonants are moraic (cf. Hayes 1989).

Feet in AA have initial prominence so the constraint TROCHAIC below ensures that the initial member of bimoraic feet is prominent.

(12) TROCHAIC: Feet are moraic trochees (cf. Hayes 1995; Kager 1999a; Watson 2011).

The fact that stress does not fall on final syllables unless they are superheavy and it falls on initial syllables in forms with three light syllables or a heavy syllable followed by two light syllables shows that AA final syllables and final feet are treated as extrametrical unless other higher ranked constraints militate against that. To render final syllables and/or feet unstressed, Prince & Smolensky (1993/2004) put forth the following OT constraint that took over 'extrametricality'.

(13) NONFINALITY (NONFIN): No head of PrWd is final in PrWd. (Prince & Smolensky 1993/2004: 56).

This means that NONFIN is violated if either a head foot or a head syllable is final. So a form with stress on the final syllable incurs two violations of NONFIN: one for placing the head syllable in final position and another for locating a foot in final position. For example, a parse such as (H)('LL) violates NONFIN once while (H)('H) violates it twice. However, NONFIN is revoked if it exhausts the stress domain or violates other higher ranked constraints, namely FTBIN and WSP, as will be shown below. Since NONFIN militates against footing final syllables, it follows that it dominates PARSE-σ, given below in (14), which requires all syllables to be footed.

(14) PARSE-σ: All syllables must be parsed into feet (Prince & Smolensky 1993/2004).

Syllable weight is one of the most important factors that govern stress assignment in Arabic and many other languages. AA, being a weight sensitive language, requires that heavy syllables are stressed. This is achieved by the constraint WSP, presented earlier and repeated in (15) below.

(15) WEIGHT-TO-STRESS Principle (WSP): Heavy syllables are prominent in foot structure and on the grid (Prince 1990).

Following Abu-Rakhieh (2009), I argue that heavy syllables always receive stress, be it primary or secondary. If there is more than one heavy syllable, the rightmost syllable receives primary stress while the others are assigned secondary stress. Secondary stress means that footing is iterative in AA (cf. Abu-Rakhieh 2009). Evidence for this comes from acoustic measurements (see §5.1.3) and gemination (§5.2.2.2) where syllables to the left of stressed syllables are augmented via gemination to be bimoraic in order to be footed.

Secondary stress violates another constraint that dictates that adjacent stresses be avoided, namely *CLASH.

(16) *CLASH: No adjacent syllables are stressed (Kager 1999).

However, a heavy syllable cannot always receive primary stress as stress in AA does not go beyond the antepenult. For this reason, I adopt Kager's (2012) WINDOW constraint in (17), which demands that stress be confined to the last three syllables in a word.

(17) WINDOW: Stress is confined to the last three syllables of a word (Kager 2012).

Another constraint that is common to many Arabic dialects is MAIN-RIGHT, given in (18) below.

(18) MAIN-RIGHT (MR): Align the head-foot of the word on the right edge (cf. Prince & Smolensky 1993/2004; Al-Jarrah 2002).

This requires the head of the prosodic word to be aligned with the right edge of the word. Whenever more than one foot is constructed, the rightmost one is the head one. This is not unexpected as AA, like many Arabic dialects, is right-oriented (cf. Abu-Abbas 2003; Abu-Rakhieh 2009; among others).

Another crucial constraint that is ignored by some researchers (e.g. Abu-Abbas; Abu-Rakhieh) is a constraint that requires footing to proceed from left to right. To make sure that footing in AA is rightward and not the other way round, I adopt the alignment constraint below (cf. Al-Jarrah 2002).

(19) ALL-FT-L(eft): All feet should be at the left edge of the prosodic word (McCarthy & Prince 1994).

In AA, ALL-FT-L(eft) will dominate ALL-FT-R(ight). Violations of this constraint are counted by the number of syllables that intervene between the left edge of the prosodic word and all constructed feet. That is, the only way to satisfy this constraint is to construct only one foot at the left edge. Therefore, this constraint must be ranked so low in the hierarchy even lower than PARSE-σ lest one foot only is constructed at the left edge. That is, this constraint is ranked low in the hierarchy but above ALL-FT-R only to ensure rightward footing. A closely related constraint requires alignment of the left edge of a prosodic word with a foot, to which I turn now.

Few previous accounts have dealt with monomoraic syllables preceding heavy syllables at the left edge of the word. Abu-Salim (1982: 85) proposes that these syllables are adjoined as weak members in a right branching word tree. However, loanword adaptation findings show that such a syllable has a special status in AA and perhaps in all Arabic dialects. Findings show that the unmarked status of these syllables is to be footed. If they are heavy, they will construct a bimoraic foot on their own. If they are light, they group up with a following light syllable, if there is any, making a bimoraic foot. However, if they are followed by a heavy syllable, the heavy syllable will form a bimoraic foot so the preceding light syllable can neither join the heavy syllable nor construct a foot on its own due to FTBIN. Loanword adaptation shows that such syllables are almost always augmented via consonant gemination or vowel lengthening to render the light syllable bimoraic and therefore make up a foot on its own (see §5.2.2.2.2).

Inspired by findings from gemination in loanwords and second language acquisition, as will be demonstrated below, I suggest that AA requires aligning the left edge of the prosodic word with a foot. To this end, I adopt the alignment constraint in (20).

(20) ALIGN-LEFT **(**Prwd, F) (ALIGN-L)**:** Every prosodic word begins with a foot (Kager 1999: 169; Gordon 2011b).

A tentative reader might argue that using two alignment constraints is redundant and this last constraint does the job. However, although this constraint guarantees constructing a foot at the left edge it does not ensure that directionality of footing is left to right as this constraint will be satisfied if only one foot is aligned with the left edge of the word while other feet can be not left-aligned in polysyllabic words. That is, this constraint would not be violated if one foot is left-aligned and the rest of feet are right-aligned.

Having presented the most important OT constraints operative in AA, I suggest the following constraint hierarchy to account for stress assignment in AA.

(21) WINDOW, *PrWdμ, *FINAL-C-μ, TROCHAIC, MR, ALIGN-L, FTBIN >> WSP, WBP ›› NONFIN >> PARSE-σ >> ALL-FT-L, *CLASH >> ALL-FT-R[23]

Now I show how these constraints interact to assign stress in loanwords in AA, which will also account for native words.

5.1.4.3.1 Stress assignment in monosyllabic words

As there is only one syllable in monosyllabic words, stress falls on this syllable. This syllable must be bimoraic to satisfy the constraint *PrWdμ. Given that final consonants in absolute final domain are moraless, which violates WPB but satisfies *FINAL-C-μ, a syllable should end in a long vowel or in a cluster to be able to receive stress as dictated by FTBIN. When a loanword ends in a short vowel followed by one consonant, gemination of the last consonant is induced to render the form bimoraic. Recall that AA here does not generally opt for vowel lengthening to achieve binarity suggesting that IDENT-V(Length) (henceforth IDENT-V(L), which requires faithfulness to vowel length, is ranked higher than a constraint against geminating consonants, namely *GEM(INATE). The tableau in (22) below demonstrates this.

(22) *Final-C-μ, *PrWdμ, FTBIN >> IDENT-V(L), WBP >> *GEM

Input: buṣṣ[24] ‘boss’	*FINAL-C-μ	*PrWdμ[25]	FTBIN	IDENT-V(L)	WBP	*GEM
a. ☞ (buṣ)<ṣ>					*	*
b. (buṣ)	*!					

[23] Some more constraints will be added in due course.

[24] This form corresponds to the loanword as it is realised in AA. I assume that the word is adapted into AA and then stress constraints apply.

[25] These two constraints *Final-C-μ and *PrWdμ are undominated in AA and will not be shown in later tableaus.

	*FINAL-C-μ	*PrWdμ	FTBIN	IDENT-V(L)	WBP	*GEM
c. (bu)<ṣ>		*!	*!		*	
d. buṣṣ		*!				
e. (buu)<ṣ>				*	*	
f. (buṣṣ)	*!		*!			*

The tableau above shows that candidate (b) is ruled out as it fatally violates the undominated constraint *FINAL-C-μ. Candidate (c) satisfies *FINAL-C-μ but falls victim to FTBIN and *PrWdμ. Circumventing FTBIN by the null parse in (d) is penalised by *PrWdμ. The competition between *(buṣ)<ṣ>* and (*buu)*<ṣ> is resolved in favour of the former which means that IDENT-V(L) is ranked higher than *GEM. As the tableau shows, if such words were pronounced with one consonant, to be faithful to the input, an ill-formed AA form would result; hence gemination (see §5.2 below).

5.1.4.3.2 Stress assignment in polysyllabic words

Given that a heavy syllable is always stressed whenever it is within the three syllable window, I assume that WSP is ranked high and dominated only if the heavy syllable is outside the syllable window. So a heavy syllable in final position will receive stress violating NONFIN. This means that WSP also dominates NONFIN. Recall that NONFIN here applies to both syllables and feet so stressing a final syllable will violate NONFIN twice.[26] If the heavy syllable is the penult, as in *'kiiwi*, *bik'kiini* and *karbu'reetar* 'carburettor', it is stressed and NONFIN is satisfied. If the heavy syllable is in antepenultimate position, as in *'fabrak*[*e*], it is also stressed. This leaves two syllables unstressed so it violates PARSE-σ twice.[27] This is identical to AA native words such as *'madras*[*e*] and *'maktab*[*e*]. The tableaus below exemplify this. (Only relevant constraints are shown to establish their ranking status).

[26] There is no need to assume that CVVC and CVCC syllables are not final and the consonant intervenes between the right edge and the foot as this will not account for final open syllables with long vowels. My constraint ranking ensures that these syllables receive stress even if they are in final position. So it will be more economical to do without that argument.

[27] There is no need to introduce a special constraint that penalises unparsing two successive syllables like Kager (1999) and others. The PARSE-σ constraint will do the job.

(23) WSP >> NONFIN

Input: maraθoon ‘marathon’	WSP	NONFIN
a. ☞(mara)('θoo)<n>		**
b. ('mara)(θoo)<n>	*	

As is clear in tableau (23), violating NONFIN twice is more harmonic than violating WSP; hence WSP dominates NONFIN. The tableau below shows that NONFIN dominates PARSE-σ; otherwise, candidate (b) would be optimal, as MR will show.

(24) WSP >> NONFIN >> PARSE-σ

Input: batwane ‘between’	WSP	NONFIN	PARSE-σ
a. ☞ ('bat)wa.ne			**
b. (bat)('wane)		*	
c. bat(wane)	*	*	*

In (kar)bu('ree)tar ‘carburettor’ below, the heavy penultimate syllable receives stress, as dictated by WSP. The final syllable is unparsed to satisfy NONFIN. PARSE-σ is violated twice: once to satisfy NONFIN and a second time to satisfy FTBIN. The tableau in (25) demonstrates this.

(25) FTBIN, WSP >> NONFIN >> PARSE-σ

Input: karbureetar ‘carburettor’	FTBIN	WSP	NONFIN	PARSE-σ
a. ☞(kar)bu('ree)tar				**
b. (karbu)('ree)(tar)	*!		*	
c. (kar)(bu)('ree)tar	*!			*

In (bik)(kii)ni 'bikini' below, the penult receives stress by virtue of WSP. NONFIN avoids parsing the final light syllable while (bikii)ni is eliminated as it violates FTBIN. However, to yield the correct output, we still need one more constraint to exclude bi(kii)ni, which respects FTBIN. First, we need to understand what makes bi(kii)ni lose out to (bik)(kii)ni. The latter has a stressed syllable in the penult that is preceded by a heavy syllable that is aligned with the left edge of the word while the former has a light syllable which cannot construct a foot on its own as it would violate FTBIN. This suggests that this syllable needs to be footed in AA and in order to be footed it must be bimoraic. Here, I adopt the constraint ALIGN-L presented earlier in (20), which requires the left edge to be aligned with a foot in AA. The tableau below demonstrates the interaction of these constraints.

(26) ALIGN-L, FTBIN, WSP >> NONFIN >> PARSE-σ

Input: bikkiini 'bikini'	ALIGN-L	FTBIN	WSP	NONFIN	PARSE-σ
a. ☞(bik)('kii)ni[28]					*
b. (bi'kii)ni		*!			*
c. bi('kii)ni	*!				**
d. (bik)('kii)(ni)		*!		*	

As the tableau shows, although candidate (c) fares better than the winner on faithfulness, it does not surface as it fails to align its left edge with a foot violating ALIGN-L. Incorporating ALIGN-L into the constraint hierarchy eliminates this candidate in favour of (bik)('kii)ni. An attempt to satisfy ALIGN-L by footing the initial syllable with the second bimoraic syllable in (b) is ruled out by FTBIN. More on ALIGN-L is given below.

There are no loanwords in the database with a heavy syllable followed by three light syllables. However, such forms are attested in AA native words such as *muħtaram*[*e*] 'respectable f. s.', where stress falls on the peninitial light syllable violating WSP. Our ranking should also be able to account for these cases as the tableau below shows, after incorporating WINDOW and demoting WSP below WINDOW.

[28] This candidate also violates *GEM, as will be shown in the following section.

(27) WINDOW, FTBIN, ALIGN-L >> WSP >> NONFIN >> PARSE-σ

Input: muħtarame	WINDOW	FTBIN	ALIGN-L	WSP	NONFIN	PARSE-σ
a. ☞ (muħ)('tara)me						*
b. ('muħ)(tara)me[29]	*!					*
c. muħ('tara)me			*!	*		**
d. (muħta)('rame)		*!			*	

As can be seen from the tableau above, stress does not retract to the pre-antepenult, so a light syllable is stressed. This is the only case where a heavy syllable loses out to a light syllable in AA due to the WINDOW constraint. Demoting WSP below WINDOW guarantees that stress does not retract to the heavy syllable in the pre-antepenult.

The presence of more than one heavy syllable within the stress window requires that one of them bears the primary stress. MR ensures that the rightmost visible foot bears main stress, as laid out in tableau (28) below.

(28) MR, FTBIN, ALIGN-L >> WSP >> NONFIN >> PARSE-σ

Input: tartaan ‘tartan’	MR	FTBIN	ALIGN-L	WSP	NONFIN	PARSE-σ
a. ☞(tar)('taa)<n>					**	
b. ('tar)(taa)<n>	*!				*	
c. ('tar)taa<n>				*		*
d. tar('taa)<n>			*!	*	**	*

Stressing either syllable here will incur a violation of WSP as a heavy syllable is not stressed. However, I assume that this constraint is satisfied if the other heavy syllable is footed and has secondary stress. Nevertheless, even if both syllables tie on WSP, evaluation is passed onto other constraints. NONFIN would pick out the one with

[29] This also violates MR as will be shown later.

initial syllable yielding ('tar)(taa)<n>. However, the actual form is (tar)('taa)<n>, with stress on the final syllable. So this means the constraint that requires the main stressed syllable be the rightmost syllable, i.e. MR dominates NONFIN. The same arguments apply to forms with more than two heavy syllables such as *bankir'yass* 'pancreas' as shown in (29).

(29) MR, ALIGN-L >> WSP >> NONFIN >> PARSE-σ

Input: bankiryaas 'pancreas	MR	ALIGN-L	WSP	NONFIN	PARSE-σ
a. ☞(ban)(kir)('yaa)<s>				**	
b. (ban)('kir)(yaa)<s>	*!			*	
c. ('ban)(kir)(yaa)<s>	*!			*	
d. (ban)('kir) yaa<s>			*		*
e. ban(kir) ('yaa)<s>		*!	*	**	*

As the tableau shows, candidate (a) wins although it fares worse on NONFIN as it violates it twice. Candidates (b) and (c) fare worse on MR and thus lose out to candidate (a). Candidate (d) avoids violating NONFIN but falls victim to WSP. Candidate (e) is ruled out as it violates all constraints except for MR. Below, it will be shown that NONFIN is also violated when it would exhaust the stress domain.

Having established the fact that AA stresses the rightmost heavy syllable provided it is within the three syllable window, I turn now to polysyllabic words with light syllables. Light syllables cannot construct feet on their own, as dictated by FTBIN. So two light syllables are grouped together to make a binary foot. The fact that AA stresses the first member of these syllables means that feet in AA are trochaic. If there are only two light syllables, as in *galan* 'gallon', FTBIN requires parsing both syllables violating NONFIN, in order not to exhaust the stress domain.

The tableau below shows that stress falls on the first light syllable according to TROCHAIC and the final syllable is parsed violating NONFIN to obey FTBIN. The output ('gala)<n> bests the other candidates because it satisfies the top ranked two constraints. Candidate (b) is ruled out as it has an iambic foot with stress on the second syllable, while candidate (c) is eliminated as it violates FTBIN.

(30) FTBIN, TROACHAIC >> NONFIN

Input: galan ‘gallon’	FTBIN	TROCHAIC	NONFIN
a- ☞('gala)<n>			*
b. (ga'la)<n>		*!	**
c- (ga)la<n>	*!		

In forms with three light syllables such as '*mitalik* ‘metallic’, the first two light syllables group together to construct a bimoraic trochee and the final syllable is left unfooted. This satisfies TROACHAIC, FTBIN and NONFIN as the tableau below shows.

(31) TROCHAIC, FTBIN >> NONFIN

Input: mitalik ‘metallic’	TROCHAIC	FTBIN	NONFIN
a- ☞('mita)li<k>[30]			
b. (mi'ta)li<k>	*!		
c- ('mitali)<k>		*!	*

Now I turn to quadrisyllabic words to test the proposed hierarchy. A word such as ‘adrenaline’ is parsed as (ad)(rina)('lii)<n> with three bimoraic feet. Although Hayes (1995) proposes the device of weak local parsing where footing does not need to parse the whole phonological string, it does not mean that parsing all syllables is odd. Rather, parsing all syllables should be the unmarked case (cf. Halle & Vergnaud 1987). Iterative footing means that these syllables have secondary stress. Recall that evidence for secondary stress comes from acoustic measurements and gemination in loanwords (see §5.1.3 & §5.2.2.2). Thus, I assume that AA parses all syllables into

[30] It can be argued that the parse (LL)L suggests that footing directionality is left-to-right. However, this evidence is not sufficient because it could be the case that this footing is due to NONFIN.

binary feet whenever possible. It does not parse final light syllables if FTBIN is already satisfied and word medial light syllables if they cannot group with another light syllable to erect a bimoraic foot, as in (kar)bu(ree)tar. So heads of binary feet are stressed and main stress falls on the rightmost foot. The tableau below lays this out.

(32) FTBIN, MR, ALIGN-L >> WSP >> NONFIN >> PARSE-σ

Input: ʔadrinaliin 'adrenaline'	FTBIN	MR	ALIGN-L	WSP	NONFIN	PARSE-σ
a. ☞(ʔad)(rina)('lii)<n>					**	
b. ('ʔad)(rina)(lii)<n>		*!			*	
c. (ʔadrina)('lii)<n>	*!				**	
d- (ʔad)('rina)(lii)<n>		*!			*	
e- ʔadrina('lii)<n>			*!	*	**	***

There are no AA native words with four light syllables (LLLL). Such forms are always subject to syncope in AA (cf. Kager 2007 for other Arabic dialects). Fortunately, loanwords provide us with four light syllables that will enable us to further test the proposed hierarchy. These words will provide evidence for the stress window and directionality, among other things.

The different possible parsings of such forms are laid out below in (33) with their performance with respect to AA stress constraints. (Y means it satisfies the constraint, while N means it does not and a blank cell means that the constraint is vacuously satisfied).

Of all the candidates, the most interesting and relevant are (a) and (f). The parse L('LL)L would be optimal according to the constraints presented in the literature on Levantine Arabic, while according to my analysis (LL)('LL) should win.

(33) Parsing LLLL forms

LLLL	WINDOW	MR	ALIGN-L	TRO-CHAIC	FTBIN	WSP	NONFIN	PARSE-σ	ALL-FFET-L
a. L('LL)L	Y		N	Y	Y		Y	N	N
b. ('LL)LL	N		Y	Y	Y		Y	N	Y
c. LL ('LL)	Y		N	Y	Y		N	N	N
d. ('LL)(LL)	N	N	Y	Y	Y		N	Y	N
e. ('LLL)L	N		Y	Y	N		Y	N	Y
f. (LL)('LL)	Y	Y	Y	Y	Y		N	Y	N
g. ('LLLL)	N		Y	Y	N		N	Y	Y

Let us take the word ‘monopoly’ which is realised as *munu'buli* in AA.[31] The attested form (munu)('buli) with a final bimoraic stressed foot is identical to candidate (f) above. However, this incurs a violation of NONFIN and looks odd not only in AA but perhaps in all Levantine rural and urban dialects because it stresses a light penult, where stress is expected to retract to the antepenult according to the literature on Levantine Arabic.

I argue that the parsing (LL)('LL) is optimal in AA and all we need is to rank ALIGN-L high in the hierarchy above NONFIN. To yield such a parsing, ALIGN-L ensures that the word starts with a foot erected at the left edge. To satisfy FTBIN the initial light syllable groups with the second light syllable to construct a binary foot. Two syllables remain unfooted, which is accepted in AA (e.g. HLL forms such as *'madras*[*e*]).

[31] Similar words are (ambi)('faya)<r> ‘amplifier’ and (tili)('tabi)<z> ~ (tili)ta('bii)<z> ‘teletubbies’.

However, this is still not possible as it would assign stress to the preantepenult, which is penalized by the constraint WINDOW. Therefore, AA further scans the phonological string parsing the final two syllables violating NONFIN, which is dominated by FTBIN and other constraints. MR assigns stress to the rightmost foot yielding (LL)('LL), as laid out in the tableau below.

(34) WINDOW, MR, ALIGN-L, TROCHAIC, FTBIN >> NONFIN >> PARSE-σ >> ALL-FEET-L

Input: munubuli 'monopoly'	WINDOW	MR	ALIGN-L	TROCHAIC	FTBIN	NONFIN	PARSE-σ	ALL-FEET-L
a. ☞ (munu)('buli)						*		**
b. ('munu)(buli)	*!	*!				*		**
c. mu('nubu)li			*!				**	*
d. ('munu)buli	*!						**	
e. munu('buli)			*!			*	**	**

Ranking ALIGN-L above NONFIN forces footing the last two syllables to avoid violating WINDOW. Ranking ALIGN-L with respect to FTBIN needs further elaboration (see below). No interaction with other constraints such as WNDOW and MR has been observed so ALIGN-L will not be ranked with respect to these constraints.

5.1.4.3.3 Evidence for ALIGN-L

Evidence for this constraint comes primarily from a strong tendency for vowel lengthening or consonant gemination in monomoraic pretonic initial syllables in loanwords to render the initial syllable bimoraic in order to form a well-formed bimoraic foot, as will be explained in §5.2.2.2.2.

More evidence comes from acoustic measurements. It has been found that more often than not such syllables have relatively comparable F0 readings to stressed syllables, which suggests that such syllables might receive secondary stress (see §5.1.3). The fact that there is no solid acoustic evidence in favour of stressed syllables to the left of tonic syllables may relate to Hyde's (2008)[32] contention that some syllables can be headed by a foot; nevertheless, they can be stressless (see Hyde 2008 for more details).

Again, many loanwords with a short vowel in an open syllable followed by a binary foot are realised with a long vowel by many informants. This suggests that these short vowels are phonologically long but shorten phonetically. Some illustrative examples are given below.

(35) bakeet ~ baakeet 'packet'
matoor ~ maatoor 'motor'
ʔuzoon ~ ʔoozoon 'ozone'
brutiin ~ brootiin 'protein'

Note also that this is attested in native words where vowels shorten before stressed syllables postlexically, as in baab > *ba.been*. This again suggests that these short vowels satisfy FTBIN phonologically.

More evidence comes from frequency effects. The overwhelming majority of adapted loanwords satisfy this constraint. 89% of them start with a foot. Only 44 (11%) words seem to violate it. However, on closer inspection it is evident that 38/44[33] words do satisfy this constraint as they have a long vowel phonologically that is shortened phonetically, as shown in (35) above. More evidence for positing an underlying long vowel for such forms comes from the fact that they are all spelt with a long vowel in Arabic. Frequency effects are also attested in native words, as will be shown below.

More evidence for this alignment constraint comes from gemination results. It will be demonstrated in §5.2.2.2 that gemination is invoked to align the prosodic word with a

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[32] Hyde claims that a foot must be headed but can be stressed or unstressed to account for stress in odd-parity forms where overlapping feet are suggested.

[33] The six words that violate this constraint are *ka'taawt* 'cut-out', *ʔa'ṣanṣ* 'essence', *ʔi'kistra* 'extra', *ma'daam* 'madam', *ma'saadʒ* ~ mas.'saadʒ 'massage' and *ba'lanti* 'penalty'. Note that all of them except for one have the low short vowel in their initial syllable. Also *ʔi'kistra* alternates with *ʔa'kistra* in AA.

foot, as in *bik.ˈkii.ni* ‘bikini’ when the pretonic syllable is light. In contrast, words such as ‘million’, ‘billion’ and ‘billiards’ which are spelt with double consonants do not undergo gemination. Anticipating the discussion in the next section, I argue that the second syllable here is stressed and has an onset. The first syllable is already bimoraic and forms a well-formed foot by itself. Hence, there is no need for gemination.

Additional evidence comes from vowel epenthesis in loanwords, as explained in §4.4.4. In a form such as ‘flow master’ > *fuluˈmaatar *flumaastar*, epenthesis is invoked to break up the consonant cluster, which would otherwise appear in a monomoraic syllable followed by a stressed heavy syllable. However, the same cluster is tolerated if it appears in a bimoraic foot, as in ‘flash’ > *flaaʃ*. Another piece of evidence comes from child language acquisition of AA. I have noticed that four to five year-old children produce similar forms with geminates, as in *ʔal.ˈlaaʔ* for *ʔa.ˈlaaʔ* ‘a female name’ and *ʕal.ˈlaaʔ* for *ʕa.ˈlaaʔ* ‘a male name’.

Further evidence comes from second language acquisition. AA speakers produce words such as ‘correct’ as *kur.ˈrikt* with a geminate /r/ and stress on the rightmost syllable. As will be demonstrated in §5.2.2, this cannot be attributed to spelling as AA speakers produce even words without a double orthographic consonant such as ‘select’ > *sil.ˈlikt* with a geminate. Compare this with ‘common’ > *ˈkumun* where spelling would tempt learners to geminate /m/; nevertheless, it does not geminate as the word is left-aligned and stress falls on the first syllable. More examples are given below in (36).

(36)	ʕad.ˈdaabt	‘adapt’
	kul.ˈlikt	‘collect’
	sadʒ.ˈdʒist	‘suggest’
	sab.ˈboort	‘support’

The common denominator among all these examples is that they have a light syllable followed by a stressed heavy syllable, as produced by AA learners. That is, the first syllable would be unfooted; hence gemination. Interestingly, English words such as ‘subordinate’ are pronounced as *sabˈʔoordinit* by AA bilinguals. This also shows that ALIGN-L is crucial here as ONSET would syllabify the labial obstruent as onset of the second syllable; however, this renders the first syllable monomoraic. AA bilinguals opt for syllabifying the labial as a coda of the first syllable rendering it bimoraic, and then inserting the default glottal stop to satisfy ONSET.

Turning to native words, note first that native words, unlike loanwords, are expected to abide by faithfulness constraints more than loanwords (Ito & Mester 1995), so adherence to this constraint is not expected to be as strict as in loanwords. Moreover, we need to differentiate between derived and nonderived native words. Again, it is expected that nonderived words, which constitute the core vocabulary of AA, will abide by this constraint more than words at the periphery (cf. Ito & Mester 1995; Paradis & LaCharite1997).

To investigate the status of ALIGN-L in native AA words, I checked the most common 500 polysyllabic words in AA. It was found that 85% of words satisfy this constraint. This means that the appearance of this constraint in loanwords may reflect frequency effects. The native words that violate this constraint are all derived words such as *naxiil* ‘palm trees’, *ʃabaab* ‘young ‘people’ and *ħabiib* ‘beloved’. Note also that the vowel in the first syllable of almost all these words is the low short vowel /a/, which has a special status, as will be shown below.[34]

More evidence also comes from high vowel syncope in AA native words. As shown in §4.4.3, AA syncopates short high front vowels in unstressed open non-final syllables to eliminate monomoraic syllables as much as possible (cf. Broselow 1992; Farwaneh 2009). Besides avoiding short high vowels in open syllables, this can be related to ALIGN-L in that it avoids a marked structure where the prosodic word is not left-aligned.

For the short low vowel /a/ which appears in such a position, I think it is related to the duration and sonority of this vowel compared with the other two short vowels.[35] Low vowels are longer and more sonorous than high vowels. This led Kirchner (1996, cited in Adra 1999) to posit that short low vowels are assigned two grid marks on a prominence scale making them more prominent than high vowels which are assigned

[34] In this regard, the researcher noticed that some AA native speakers report that such words have two stresses. This is left for further study.

[35] Note also that the most frequent sound in Arabic is /a/ followed by /i/ and /u/. Their frequency in SA native words is 46%, 18.4% and 14.6% respectively (Nour Al-Deen 1992).

one grid mark. That being the case, short low vowels could be interpreted as binary in terms of prominence. So parsing a syllable with a short low vowel would satisfy FTBIN. Therefore, it could be argued that both FTBIN and ALIGN-L are not ranked with respect to each other and the few cases where a light syllable appears to the left of a stressed syllable at the left edge pertain to derived words where faithfulness to a morphological infix ranks higher than ALIGN-L and FTBIN. This is left for further investigation in native words.

More evidence comes from the 'abracadabra effect' noted by van der Hulst (2014: 31-2) where initial syllables in right-edge primary stress languages such as Dutch tend to be prominent. This is explained as pitch typically declines cross-linguistically across an utterance so the highest pitch falls on the initial syllable, which leads to the percept of initial stress leading to polar stresses (ibid). Finally, some evidence comes from what is known as the "hammock" or "dual" stress systems, as reported by Gordon (2011b) for a number of languages where word edges align with foot edges. (See Gordon 2011b for more details).

To conclude, it seems that parsing such syllables is crucial not only in AA but also in other Arabic dialects. This is consistent with Hayes' observation that unparsed syllables are universally located at the right edge of prosodic words (Hayes 1995: 57).

To a sceptic reader, if we want to reject the arguments above for ALIGN-L, it still can be argued that the effect of this constraint represents a case of TETU (cf. McCarthy & Prince 2004; Becker & Potts 2011) as faithfulness requirements in loanwords are not as strict as those in native words.

5.1.5 Section summary

This section has accounted for stress assignment in AA. It has reviewed stress assignment in native AA words and accounted for stress assignment in loanwords. It has been found that loanwords in AA are stressed according to native stress phonology where stress falls on one of the last three syllables and phonological processes, e.g. vowel lengthening, are induced to make the adapted form fit the phonological properties of AA.

As AA native speakers seem to lack the ability to perceive stress position not only in English words but also in native Arabic words (Al-Jarrah 2002; Zuraiq 2005), they tend to ignore it altogether and assign stress according to native constraints (cf. Broselow 2009 for other languages). That is, source stress is ignored and the source input is adapted into an AA accepted form that is assigned stress according to AA native stress constraints that are primarily based on syllable weight and position. This runs counter to TCRS model which predicts that priority would be given to metrical constraints rather than to lower level ones as stress in AA is not contrastive.

Also, results lend support to the fact that stress is highly correlated with syllable weight. Stress falls on a heavy syllable in 94% of cases, which is consistent with the literature on stress where heavy syllables tend to attract stress in stress languages (Takahashi 2006) and stressed syllables are heavy in many languages (Owino 2003; Kang 2010; Tu 2013; among others). This is corroborated by the fact that lengthening is mainly invoked to render the stressed syllable heavy. Also stress shift lends support to this as it almost always shifts to the rightmost heavy syllable. This renders the output less marked in AA, which could represent a case of TETU because phonetic cues are better realised in long syllables (cf. Takahashi 2006; Tu 2013). Similarly, 97% of stressed syllables are at the right edge of the word, which is consistent with the cross-linguistically demarcative property of stress (cf. Kager 1999) giving rise to another case of TETU. This is consistent with Altmann's (2006: 87) finding that Arab speakers tend to assign stress to the penultimate syllable. A thorough statistical analysis of this tendency is highly recommended.

Comparing AA with other world languages with regard to stress adaptation, AA exhibits some of the Japanese borrowing strategies reported by Davis et al. (2012). AA does not seem to consider SL prosodic features in the adaptation process. Rather it ignores them and assigns stress according to native constraints, i.e. there are no specific mechanisms that apply to loanwords only. Moreover, prosodic features, specifically syllable weight, determine stress position. No effect of segmental features is noticed in the adaptation.

There is no evidence that a MATCH-STRESS constraint, which requires source stress to be mapped onto L1, is highly ranked in loanwords although SL stress is preserved in more than half the words. Rather, I argue that the stressed syllable in the source is in conformity with AA stress constraints. Consider for example the word *kungris* 'congress' where its realisation in terms of weight is intact and it recives stress on the penult according to AA constraints, hence no stress shift is invoked. However, in *ʔoo'zoon* ‘ozone’ where source pronunciation is almost intact, source stress is shifted to the ultimate syllable by the dictates of AA constraints.

Finally, this section has presented a simpler and more economical constraint hierarchy than earlier attempts by other researchers. The suggested hierarchy repeated in (37) for convenience seems to be better able to account for stress assignment in both native and loanwords in AA.

(37) WINDOW, *PrWdμ, *FINAL-C-μ, TROCHAIC, MR, ALIGN-L, FTBIN >> WSP, WBP >> NONFIN >> PARSE-σ >> ALL-FT-L, *CLASH >> ALL-FT-R

The hierarchy introduces two new constraints that have never been used in any previous account of stress in JA or PA. The WINDOW constraint guarantees that stress does not retract beyond the antepenult, which is an established fact for almost all Arabic dialects. The ALIGN-L constraint ensures that all prosodic words start with a binary foot, which is also a very common tendency in all Arabic dialects.

Furthermore, this new hierarchy still holds that NONFIN is still active in AA; nevertheless, it is able to assign stress to final heavy syllables without superfluous parameterization and ad hoc assumptions, thanks to the high ranking constraint WSP.

5.2 Gemination

This section examines gemination in loanwords. It attempts to answer why words such as ‘bikini’, ‘block’, and ‘boss’ are realised with geminates in AA whereas words such as ‘million’, ‘dollar’ and ‘rally’ are not. The discussion here will shed more light on a somewhat neglected area in Arabic phonology in general and AA in particular (cf. Davis & Ragheb 2014).

A geminate is a long or ‘doubled’ consonant that contrasts phonemically with its shorter or ‘singleton’ counterpart (Davis 2011). Representation of geminates has been a debated issue. The two major views of geminate representation are the prosodic length analysis which postulates that a geminate is represented as linked to two timing slots and the moraic analysis, which posits that a geminate is underlyingly moraic (cf. Davis & Ragheb 2014). Observations from Arabic dialects point out that the moraic representation is superior to the prosodic length representation (ibid). However, one problem with the moraic representation of geminates relates to word medial geminates, as in *kull.na* ‘all of us’ (Davis 2011). To solve this problem, I follow Watson (2007) and argue that a tautosyllabic geminate has its own mora and shares a mora with the preceding vowel. This violates *NSu, presented earlier in Chapter four (see §4.3.2). On this view, degemination, which often affects such segments, means that the geminate no longer shares a mora with the preceding vowel. In general, results here lend support to the moraic representation of geminates.

Results show that medial and final gemination in loanwords is mainly invoked to satisfy bimoraicity and other prosodic factors. More interestingly, gemination is invoked to satisfy a hidden AA constraint that requires left-aligning the prosodic word with a foot. The remainder of this section is organized as follows: §5.2.1 reviews gemination cases in AA native words while §5.2.2 accounts for gemination in loanwords within an OT framework.

5.2.1 Gemination in AA native words

Like all other Arabic dialects, AA contrasts singletons with their geminate counterparts (cf. Al-Tamimi, Abu-Abbas & Tarawnah 2010; Amer et al 2011; Davis & Ragheb 2014). Geminates in AA are attested word-initially, medially and finally as the examples below illustrate.

(38) Initial gemination

a. l-ʃabaab > ʃʃabaab ‘the youth’[36]
l-daar > ddaar ‘the house’

b. t-diir > ddiir[37] ‘you m.s. turn’

c. b-baali > bbaali ‘in my mind’

d. mumawwadʒ > mmawwadʒ ‘wavy m.s.’

As the examples above show, initial geminates are not true geminates.[38] Rather they are fake geminates that result from assimilation of the definite article in (38a), the concatenation of a proclitic to a stem-initial consonant in (38b-c) or from syncope of short high vowels as in (38d). Note that all these initial geminates are optionally attested with an anaptyctic vowel, which is mostly deleted in Arabic dialects (cf. Mitchel 1993).

Medial geminates are attested in causative verbs, as in (39a) below and their corresponding instrumental nouns, as in (39b). Also, they are attested in final segments of the plural affix /hum/ and /hin/ before the negative suffix /ʃ/, as in (39c), or in the applicative morpheme -*l*, as in (39d) or in some lexical words, as in (39e).

(39) Medial geminates

a. massaħ ‘erased m.s. over and over’[39] cf. masaħ ‘erased m.s.’

b. massaaħa ‘eraser’

c. ma-ʃuft-hin-ʃ > maʃufthinniʃ ‘I did not see them f.’

d. katab-t-l-u > katabtillu ‘I wrote for him’

[36] The -*l* of the definite article obligatorily assimilates totally before coronal consonants due to an OCP at the place node (see Watson 2002 for more details).

[37] This assimilation relates to *t*- of the detransitivizing prefix, which assimilates totally to a following coronal stop and optionally to a following coronal sibilant. It does not apply before other sounds such as sonorants or gutturals, as in t-muut > *tmuut* ‘you m. die’.

[38] Note that fake geminates, unlike true geminates, do not resist epenthesis (cf. Abu-Salim 1982; Farwaneh 2007).

[39] Geminated roots in SA are not very common. There are only 122 geminated roots (Zemanek 2007: 83).

e. barra ‘outside’ cf. bara ‘he sharpened’
dabbuur ‘wasp’

Finally, geminates are also attested word-finally in AA as the examples below show.

(40) Final geminates

a) ʔamal ‘hope’ vs. ʔamall ‘more boring’
b) ʔamar ‘he ordered’ vs. ʔamarr ‘more bitter’
c) ʃadd ‘he fastened’
d) ʔab > ʔabb vs. ʔabuuk ‘father’
e) ʔumm vs. ʔummak ‘mother’

The examples above show that final gemination is contrastive in AA, like many other Arabic dialects. However, whether this contrast is maintained phonetically is debated in Arabic dialects. For example, Abu-Salim (1982) argues that degemination applies so a contrast is lost. In contrast, Al-Tamimi et al. (2010) found that they are still contrastive phonetically. This will be investigated acoustically in §5.2.2.1.

5.2.2 Gemination in loanwords[40]

This section accounts for gemination in loanwords. It is attested in 48 loanwords.[41] These words will be categorized into two main types according to the constraints that govern them. Generally speaking, results show that gemination is an output-oriented process that optimizes output structure while it is blocked if a more marked structure would result.

Gemination in loanword adaptation is a common process cross-linguistically that is attested in many languages, e.g. Japanese (Kubozono, Ito & Mester 2008), Italian (Repetti 2009), Finnish (Kroll 2014). Interestingly, gemination is attested in these languages where the source does not have a geminate, which suggests that markedness constraints on the part of the borrowing language are behind this phenomenon.

[40] An earlier version of this section was presented at the NINJAL international conference on phonetics and phonology (ICPP 2011) in Japan.

[41] In addition to 40 cases in older borrowings.

Gemination in world languages has been analysed as an attempt to preserve the moraic status of a final syllable, to render the stressed syllable heavy or to align a morphological stem with a syllable (Repetti 2009). Another reason relates to perceptual factors where some acoustic details of the source language are realised into a geminate, as in Korean (Vendelin & Peperkamp 2004). It will be shown that the first two reasons are attested also in AA. Moreover, it will be demonstrated that AA invokes gemination for another reason, namely to align the left edge of the prosodic word with a foot—a hidden AA constraint that is stimulated by the introduction of English loanwords. Also, it will be shown that orthography has a marginal role in accounting for gemination.

Results suggest that gemination does not have a high functional load in AA, and perhaps many Arabic dialects. That is, since AA opts for gemination to optimize the metrical structure of adapted words and not for other means, it can be argued that the constraints against geminates in AA are lower ranked than constraints on vowel length constraints. That is, faithfulness to vowel length constraints, which are phonemic in AA, is more important than faithfulness to consonant length constraints. This appears odd as gemination is also contrastive and morphologically significant in Arabic. However, recall that there are only 122 geminated roots in SA (Zemanek 2007: 83). A future examination of this phenomenon in AA native phonology is highly recommended.

Below, I present results of gemination in loanwords according to the reason for gemination.

5.2.2.1 Gemination for minimality

The first and most common reason for gemination in loanwords is to satisfy minimal prosodic word requirements in AA as the examples below show

(40) Gemination for minimality

Source word	AA pronunciation	Source word	AA pronunciation
boss	buṣṣ	airbus	ʔeer baṣṣ
clip	klibb	coffee shop	kufi ʃubb
dish	diʃʃ	double kick	dabil kikk

drill	drill	full option	full ʔubʃin
net	nitt	seven up	sivin ʔabb

This type of gemination is also attested in older borrowings, as in *ʃakk* ‘check’ and *waṭṭ* ‘watt’. These words are of two kinds. The first relates (in the first two columns) to source monosyllabic words that are realised in AA with a short vowel so they are monomoraic in AA and violate minimality. The second type (in the last two columns) relates to polysyllabic words that are treated as compounds and each member of the compound needs to satisfy minimality independently; hence gemination. Some evidence for this comes from the realisation of words such as *fullʔubʃin*. Here the lateral is geminated to satisfy minimality and glottal stop insertion applies to provide an onset to the second word. If this was taken as one word, there would be no need for glottal stop insertion as the lateral would be resyllabified as onset to satisfy the undominated ONSET constraint in AA.

The undominated constraint that requires lexical words to be at least bimoraic in Arabic (cf. Broselow 1992; Watson 2002; Abu-Abbas 2003; among others) accounts for gemination in this group. Recall that short vowels contribute one mora, while long vowels and diphthongs contribute two. Geminates contribute one mora, and coda consonants count as moraic through WEIGHT-BY-POSITION (WBP) except for absolute final consonants, which are extrametrical (Hayes 1995; Watson 2002; among others). For example, the words *buṣṣ* ‘boss’, *drill* ‘drill’, *rull* ‘roll’ and *full* ‘full’ are all pronounced with a short vowel followed by a geminate consonant in AA. Because of the extrametricality of final consonants in AA, these words would be monomoraic if final consonants were not geminated. To solve this problem, either the consonant is geminated or the vowel is lengthened. AA seems to prefer consonant gemination to vowel lengthening, as can be seen in the examples above.

More evidence for this constraint comes from words such as ‘roll’ and ‘break’, which can be pronounced in two ways in AA: one with a long vowel without consonant gemination; the other with a short vowel and a geminate consonant. In the first instance, if the word is pronounced with a long vowel, there would be no need for a geminate as the output does not violate bimoraicity. However, when it is pronounced with a short vowel, the following consonant is geminated to satisfy the minimality constraint.[42]

In OT terms, I adopt the following four constraints to account for gemination in this group. First, we need to account for the fact that word-final consonants are weightless. This results from the undominated constraint *FINAL-C-μ, which bans the moraicity of final consonants, repeated in (42) below. Thus a form such as *bu*<ṣ> would be monomoraic.

(42) *FINAL-C-μ: The final consonant is weightless (Prince & Smolensky 1993/2004: 49; Kager 1999).

Due to this constraint, which dominates WBP, the final /s/ in *buṣ* is non-moraic so the word is monomoraic, which is ill-formed in AA by virtue of the constraint *PrWdμ, presented earlier in (8) and repeated in (43) below.

(43) *PrWdμ: A prosodic word is minimally bimoraic (cf. Prince & Smolensky 1993/2004).

Note that this type of gemination is also attested in native biliteral roots where the second melody geminates to satisfy minimality (McCarthy & Prince 1990).

There are two ways to satisfy this constraint: lengthening the vowel, which violates IDENT-V(L), or geminating the final consonant, which violates *GEM. Since AA opts for gemination, it can be concluded that IDENT-V(L) dominates *GEM as tableau (44) shows.[43]

[42] Note that words such as ‘clutch’ > *klatʃ*, ‘switch’ > *switʃ* are not geminated, which means that the English affricate is treated as a sequence of two sounds in AA (cf. Davis and Abu Elhij’a Mahajna 2016).

[43] Almost all cases show that being faithful to vowel length is very crucial. However, four cases show that this is violated where the vowel is shortened and followed by a geminate, as in ‘break’ > *brikk* ~ *breek*. Frequency effects might influence the adaptation strategy in that the most frequent strategy, gemination, dominates.

(44) *FINAL-C-μ, *PrWdμ >> IDENT-V(L) >> *GEM

Input: boss	*FINAL-C-μ	*PrWdμ	IDENT-V(L)	*GEM
a. (buṣ)	*!			
b. ☞(buṣ)<ṣ>				*
c. (buu)<ṣ>			*	
d. (bu)<ṣ>		*!		

The tableau above shows that candidate (a) is ruled out as it fatally violates the undominated constraint *FINAL-C-μ. The competition between *buṣṣ* and *buuṣ* is resolved in favour of the former, which suggests that AA prefers to violate consonant length constraints rather than vowel length constraints, which is in line with the fact that vowel length is phonemic in Arabic dialects. It seems that vowel length has a higher functional load than consonant gemination in AA. As the tableau shows, if such words were pronounced with one consonant, to be faithful to the input, an ill-formed AA form would result; hence gemination.

The following initial ranking can be established:

(45) *PrWdμ, *FINAL-C-μ >> WBP, IDENT-V(L) >> *GEM

Let us further investigate these constraints by looking at words such as 'gramme' and 'mall'. Although these words are spelt with double consonants, they are nativised with a singleton. The reason behind this is that they already satisfy bimoraicity as they are pronounced with a long vowel followed by a consonant. Gemination would render the word trimoraic, violating the undominated AA FTBIN constraint that dictates that feet are bimoraic.This constraint is also related to another cross-linguistically attested markedness constraint that bans a geminate after a tense/long vowel presented below in (46).

(46) *VV+GEM: No geminate is allowed after a tense/long vowel (Kubozono et al. 2008).

However, I argue that the effect of this constraint is achieved by FTBIN as a long vowel followed by a geminate would render the syllable trimoraic. Thus, FTBIN alone will suffice for our purposes.

The tableau below shows the interaction of these constraints to yield *mool*.

(47) FTBIN, *PrWdμ, *FINAL-C-μ >> IDENT-V(L) >> *GEM

input: mall	FTBIN	*PrWdμ,	*FINAL-C-μ	IDENT-V (L)	*GEM
a. ☞**(**moo)<l>					
b. (mul)<l>				*	*
c. (mool)<l>	*!				*

Candidate (b), although it satisfies *PrWdμ and *FINAL-C-μ, is less faithful to the input as it violates IDENT-V(L). Candidate (c) fatally violates FTBIN. As a result, candidate (a) is more harmonic than its geminated counterpart and wins the competition.

To summarize, all the words in this list undergo gemination to satisfy the undominated *PrWdμ constraint at the expense of the lower ranked constraint *GEM.

5.2.2.1.1 Evidence for final gemination

Given that AA, like other Arabic dialects (cf. Abu-Salim 1982 for PA), tends to degeminate word-final geminates, as in *saarr* >*saar* 'pleasant', we need to find evidence for the above type of gemination. Evidence comes from two sources: acoustic and morphological. Acoustic evidence comes from the fact that the duration of final geminates is significantly longer than that of their singleton counterparts[44] and morphological evidence is evident from the gemination of word-final consonants on suffixation.

[44] This is not the only difference between final geminates and singletons, as Al-Tamimi & Khattab (2011, cited in Embarki 2013) report that in Lebanese Arabic other differences include F0, intensity and voicing degree.

5.2.2.1.1.1 Duration of word-final singletons and geminates

Phonetically a geminate is distinguished from its singleton counterpart, other things being equal, by the hold phase in their production (Catford 1977, cited in Al-Tamimi et al. 2010). Although the ratio between a geminate and its singleton counterpart differs to the extent that an overlap occurs (Embarki 2013: 36), normally, the geminate is lengthened to approximately twice the length of the singleton (Ham 2001).

Word-final geminates are shorter than intervocalic geminates (Thurgood 1993; Pajak 2009, cited in Al-Tamimi et al. 2010), and many Arabic dialects tend to reduce the length of final geminates (Mitchell 1990: 88); nevertheless, a contrast with singletons still holds. However, the contrast in Arabic is debated. Abu-Salim (1982) claims that word-final geminates degeminate so a contrast would be lost; however, he does not support his claim with any acoustic evidence. The first acoustic study to be carried out on the distinctiveness of word-final singletons and geminates in JA was done by Al-Tamimi et al. (2010). They found that geminates in JA contrasted with their singleton counterparts in word-final position. They reported that the average ratio of a singleton to its geminate counterpart was 1:1.5. Another study that compared final geminates and singletons was done by Ham (2001). Based on the productions of two Jordanians and one Palestinian, he found that final geminates were significantly different from their singleton counterparts. This subsection further examines this issue and reports on the results of acoustic measurements of final geminates and compares them with their singleton counterparts.

To test whether final geminates are significantly different from their singletons, four pairs, presented in Table 5.9 below, with final singletons and geminates were selected. All the words were pronounced in the same frame sentences used to elicit the pronunciation of loanwords as explained in §2.6.3. To minimise the effect of the temporal compensation between geminates and preceding vowels (cf. Al-Tamimi et al. 2010), and to control for other phonetic variables such as position in word, consonant clusters and type of preceding vowel or consonant, consonants in almost identical syllables were selected because loanwords do not have minimal pairs where a geminate and its singleton counterpart contrast word-finally. Note that two sibilants and two voiceless stops were selected because their identification, unlike that of sonorants, is easier and more straightforward as closure onset and offset points of stops are easily identified and sibilants are easily identified by their high frequency noise spectrum.

Using PRAAT, the duration of each final consonant was measured in milliseconds, as shown in Table 5.9 below. Of the three phases of stop articulation, the most relevant for our purposes is the hold phase. The hold phase was measured from the end of glottal pulses to the burst. For the sibilants, the duration of the noise was measured.

Measurements were obtained for ten participants (see §3.6.3 for details on participants). These were tabulated into Excel and fed into SPSS for comparisons. Table 5.9 compares average duration of geminates and their singleton counterparts as produced by the ten participants.

Table 5.9 Average duration of singletons and geminates (as produced by the ten participants)

Geminates	Average duration in ms	Singletons	Average duration in ms	Ratio of singleton to geminate
buṣṣ	155	baaṣ	102	1: 1.52
diʃʃ	169	raabiʃ	102	1: 1.66
dʒakk	125	kuntak	59	1: 2.11
nitt	125	rikit	60	1: 2.08
Geminate	143.5	Singleton	82.5	1: 1.74

As the table shows, geminates are longer than their singleton counterparts. Average ratio of a singleton to a geminate is 1: 1.7. It is a little higher for the voiceless stops (1: 2.10), and lower for the sibilants (1: 1.59). Note that a 20 ms difference is sufficient for a perceptual distinction between a geminate and a non-geminate according to Obrecht (1965).[45]

To test whether these differences between geminates and their singleton counterparts are significant, a two tailed t-test was conducted. Results show that there are statistically significant differences between singletons and geminates in word-final position at a 0.01 significance level [(T= (1, 39) = 19.697, P = .000)]. This gives evidence that these consonants are really geminated in AA. These findings are consistent with Al-Tamimi et al.'s (2010) and Ham's (2001) results, which confirm that geminates do contrast with their singleton counterparts word-finally in JA.

5.2.2.1.1.2 Morphological evidence

A second piece of evidence for these final geminates comes from morphology. When these words are amplified with vowel initial pronominal suffixes, the geminate appears as shown below.

(48) Morphological evidence for final geminates

drill vs. drilli 'my drill'
rull vs. rullak 'your roll'
yann vs. yannu 'his yen'

One might argue that this does not constitute evidence for a geminate because gemination could be invoked as the suffix is vowel initial and it is onsetless. However, words such as mool-u > *moo.lu* 'his mall' and sarag-u > *saragu* 'he stole it m.' where no gemination is attested show that this is not the case. There is no need for gemination because the first syllable is still bimoraic after syllabifying the consonant as an onset of the following syllable.

5.2.2.2 Gemination for markedness

The second type of gemination is attributed to markedness factors. It is assumed that gemination would render the output less marked. That is, gemination is invoked to satisfy one or more of the following markedness constraints: ONSET, which requires syllables to have an onset; FTBIN, which requires feet to be bimoraic; SWP, which

[45] Note here that I did not measure the duration of the preceding vowel for lack of enough data, which could be a topic for further research.

dictates that stressed syllables be heavy; ALIGN-L, which demands that every prosodic word begin with a foot and NONFIN, which militates against footing the final syllable of a prosodic word. Recall that NONFIN does not apply if the syllable is heavy. Heavy syllables, which have dual status as they constitute syllables and feet simultaneously, are prosodically visible and receive stress word-finally by virtue of WSP, which dominates NONFIN (see §5.1.4.3). This suggests that AA prefers not to parse final syllables unless they constitute feet. Recall also that NONFIN is blocked if it exhausts the stress domain (Hayes 1995 for other Arabic dialects).

All cases of gemination in this group are motivated to satisfy one or more of the constraints above. For ease of explanation, I further subdivide this type into two groups.

5.2.2.2.1 Group A: Gemination for ONSET, SWP, FTBIN and NONFIN

In this group, gemination is induced to render the output more well-formed with respect to ONSET, SWP, FTBIN and NONFIN. Some illustrative examples are presented in (49) below.

(49) Gemination for ONSET, SWP, FTBIN and NONFIN

No	Source word	AA pronunciation
1.	roundel	run'deella
2.	spaghetti	sbaa'gitti
3.	trailer	'treella
4.	vanilla	vaa'neella
5.	baby	'bubbu
6.	block	'blukk[e]

This type of gemination is also attested in many proper nouns such as *koo'rul.la* ‘Corolla’, suu*'zukki* ‘Suzuki’ and *too'yutta* ‘Toyota’ and older borrowings such as *'veella* ‘villa’ and *'milli* ‘millimetre’.

To explain why gemination is invoked here, take as an example the word ‘spaghetti’. If this form is realised without gemination, it would surface as '*sbaagiti*. It seems that this form is rather marked in AA as it is composed of a heavy syllable followed by two light syllables. This can be parsed as (sbaa)giti or (sbaa)(giti). Both forms look marked. The former fails to parse two syllables violating PARSE-σ twice and the latter violates NONFIN and SWP as stress falls on a light syllable. One might argue that such forms do exist in AA (e.g. *(mad.)ra.se* 'school') so (*sbaa)giti* should be a legitimate form in AA. I argue here that although ('*sbaa)giti* could be a possible form in AA, still (*sbaa)('git)ti* is more well-formed violating only a faithfulness constraint against gemination. (*sbaa)('git)ti* is less marked in that it parses more syllables and satisfies SWP,[46] NONFIN and ONSET simultaneously as gemination renders the penult heavy, and ensures that the last syllable is rendered extrametrical and appears with an onset.

Let us take another example to see how these constraints interact to yield the least marked output. Take the word 'block', which is realised as *'bluk.ke,* after amplifying the feminine marker. Without gemination, the word would be formed of two light syllables *(*blu.ke*). This should not look ill-formed in AA as many native words in AA can appear with two light syllables that form a bimoraic trochee. However, a heavy stressed syllable is less marked than a light one. This accords with AA phonology, which is weight-sensitive where the majority of stressed syllables in AA tend to be heavy, as shown in §5.1.4.3. This is also consistent with many findings from other languages where stressed syllables tend to be heavy (cf. Kubozono 1999 for Japanese).

So gemination in *bluk.ke* renders the output less marked with respect to SWP. Furthermore, it can be argued that there is still another factor that motivates gemination here. Gemination in *bluk.ke* makes the first syllable bimoraic so the first syllable satisfies FTBIN on its own and therefore there would be no need to parse the final syllable. This suggests that AA avoids parsing light final syllables. This tentative suggestion might look unwarranted as words composed of two light syllables are attested in AA. However, observations from other phonological aspects of AA such as stress assignment constraints, which ignore final light syllables unless this exhausts the stress domain, suggest that this constraint is plausible.[47] Although this might

[46] This is in line with the fact that in some languages the most reliable stress cue is geminating the coda of the stressed syllable (Gordon 2011: 826).

[47] Kenstowicz (1983) also suggested rendering final light syllables (to the exclusion of superheavy ones) to account for stress assignment in Arabic dialects.

invoke the adoption of the controversial uneven trochee in forms such as *madras*[*e*] ‘school’, I think this can be maintained and the uneven trochee is dispensed with. A dialect would construct a trochee over the first syllable and since the final syllable is extrametrical there would be not enough input to construct a bimoraic foot. This entails that foot binarity dominates NONFINAL, as discussed in §5.1.4.3.

Evidence for the invisibility of final light syllables to metrical structure comes from the fact that extrametricality of final syllables is attested cross-linguistically (Hayes 1995; Hyde 2003; among others). More evidence comes from Hyde’s observation. He asserts that trochaic lengthening is attested to avoid parsing final syllables. Prima facie, this contradicts stressing a final heavy syllable. However, a final heavy syllable is stressed due to the fact that WSP is ranked higher than NONFIN, as pointed out in §5.1.4.3. More evidence comes from intonation findings. Fox (2000), citing Hyman (1977) points out that “if the basic intonation pattern is a fall, and this is analysed as High + Low, then this will ideally require two syllables for its execution, hence the High pitch (which constitutes the accent) will occur on the penultimate syllable” (ibid: 171). This means that it is less marked for stress to fall on a penult that is followed by a light syllable.

A similar case of gemination is attested in AA native phonology. Recall the gemination of the applicative morpheme *-l*, as in katab-t-l-u > *ka.tab.'til.lu*. Some researchers, e.g. Farwaneh (1995), argue that gemination results from the moraic status of the dative morpheme, but this does not account for gemination in a similar case, as in ma-ʃuf-t-hin-ʃ > *maʃufit'hinniʃ* ‘I did not see them f.’ where the negative morpheme /ʃ/ triggers gemination. It also fails to account for lack of gemination when the dative morpheme is realised after a long vowel in onset position, as in *katab'tiilu* ‘you f. wrote to him’. Therefore, I argue that gemination in native words and in these loanwords is mainly motivated to avoid parsing the last light syllable, which invokes gemination in the preceding syllable to satisfy FTBIN, ONSET, NONFIN and SWP. The tableau below demonstrates the interaction of these constraints to yield *blukk*[*e*].

(50) ONSET, FTBIN>> SWP,[48] NONFIN >> IDENT-V(L)>> *GEM

block	ONSET	FTBIN	SWP	NONFINAL	IDENT-V (L)[49]	*GEM
a. ☞('bluk).<ke>						*
b. ('blu.ke)			*	*		
c. ('bloo). <ke>					*	
d. ('bluk.)e	*!					
e. ('blu).<ke>		*!	*			

Candidate (c) violates IDENT-V(L). Also candidate (d) fatally violates the undominated constraint ONSET. The crucial candidate is (b), which should be acceptable in AA. Although it is well-formed in terms of FTBIN and ALIGN-L, it does so at the expense of parsing a light final syllable, which seems to be marked in AA. Moreover, its stressed syllable is marked as it violates SWP. Candidate (e) satisfies NONFIN but falls victim to FTBIN.

Further evidence for this assumption comes from free variants of similar words. For example, the word ‘millimetre’ can be pronounced either as *'miili*, with a long vowel in the first stressed syllable with no gemination or with gemination of the lateral yielding *'mil.li*. This shows that the first syllable bimoraicity is the decisive factor, which is accomplished through vowel lengthening or gemination.

These constraints also apply within longer words. Consider as an example a word such as ‘Piccadilly’, which is realised as *(bi.ka)('dil)li* in AA. Gemination of the lateral renders the penult bimoraic and the light ultimate syllable extrametrical.

[48] Ranking SWP below ONSET and FTBIN is motivated on the grounds that it is violated as light vowels are stressed in AA.

[49] Some forms are attested either with a long vowel or gemination. If we assume that the constraints against *GEM and IDENT-V(L) are unranked with respect to each other, we should have more free variation, which is not the case. To account for such cases, a weighted-constraint approach can be adopted whereby the constraint IDENT-V(L) would have more weight than *GEM (for details see Pater 2009).

Without gemination, it would surface as **bi('kadi)li*. This is marked as it fails to comply with ALIGN-L and SWP. Moreover, it could be argued that stress in AA is right-oriented so stress tends to fall as close as possible to the right edge, unless the ultimate syllable is monomoraic (more on this argument is presented below).

One might argue that source stress is behind gemination in these words as borrowers attempt to be faithful to the source stress position. Although this could be a supporting factor, it cannot account for all cases as source stress does not always fall on the source syllable that has gemination in AA, e.g. ‘ˈroundel’ > *run.'deel.la*

To sum up, gemination in this group renders the output less marked as it satisfies SWP, ONSET, FTBIN and NONFIN. Because these syllables that appear with gemination in loanwords should be licit forms in AA as there are similar cases that appear without gemination in AA native words, I argue that this type of gemination represents a case of TETU.

5.2.2.2.2 Group B: Gemination for ONSET, ALIGN-L and FTBIN

In this group, gemination is invoked to satisfy ONSET, ALIGN-L and FTBIN. Consider the examples in (51) where gemination satisfies ONSET and renders the first syllable bimoraic and simultaneously left-aligns the word with a foot.

(51) Gemination for ONSET, ALIGN-L and FTBIN

No	Source word	AA pronunciation
1	bikini	bik'kiini
2	collage	kul'laadʒ
3	okay	ʔuk'kee
4.	tattoo	tat'tuu

Similar cases are found among many older borrowings such as *bal'loon* ‘balloon’ and *daz'ziine* ‘dozen’.[50]

To demonstrate how gemination in this group renders the output less marked with respect to ONSET, FTBIN and ALIGN-L, take as an example the gemination of /l/ in

[50] Interestingly, this is also attested in a very old loanword from Persian, namely duk′ kaan < dukaan ‘shop’.

bal'loon ‘balloon’ and /k/ in *bik.'kii.ni* ‘bikini’. Without gemination, the first syllable in these words would be monomoraic as the intervocalic consonant cannot be syllabified as a coda due to the undominated ONSET constraint. This will leave the first syllable unfooted as degenerate feet are absolutely prohibited in AA, as dictated by the undominated FTBIN constraint (cf. Hayes 1995 for PA). Thus, in order for the initial syllable to be parsed, it needs to belong to a bimoraic foot. This can happen if the first syllable is followed by another light syllable forming a bimoraic foot together, as in (*'bala)dak* ‘your m.s. country’. In case the initial syllable is light and followed by a bimoraic syllable, the second syllable will form a foot on its own rendering the initial syllable unfooted as it is monomoraic. So, **ba.'loon* would be ill-formed in AA because the second syllable is heavy and consequently receives stress leaving behind a monomoraic initial syllable. To repair this marked structure, AA resorts to gemination of the lateral rendering the initial syllable bimoraic satisfying ALIGN-L and FTBIN. The interaction of these constraints is laid out in the tableau below.

(52) ONSET, FTBIN, ALIGN-L >> IDENT-V(L) >> *GEM

Input: balloon	ONSET	FTBIN	ALIGN-L	IDENT-V (L)	*GEM
a. ☞(bal).(loo)<n>					*
b. (ba).(loo)<n>		*!			
c. ba.(loo)<n>			*!		
d. (baa).(loo)<n>				*	
e. (bal).(oo)<n>	*!				

As the tableau shows, candidates (b) and (c) incur a fatal violation of FTBIN and ALIGN-L, respectively. To avoid violating these highly ranked constraints, candidate (d) falls victim to IDENT-V(L). Candidate (e) is excluded as it fatally violates ONSET. Candidate (a) is optimal because it only violates the low ranked constraint *GEM.

Returning to candidate (c), one wonders why it cannot surface given that such forms are well-attested in AA native words. A closer look at AA native words shows that some words start with unfooted monomoraic syllables followed by a bimoraic foot such as *banaat* ‘girls’.[51] So why should loanwords need to satisfy this ALIGN-L constraint? Does this case represent TETU as in the first group of gemination or does it reflect a hidden high ranked AA constraint that has not had the chance to appear before? Although this can be a case of TETU, I think that this constraint represents a hidden AA constraint as AA data show (See §5.1.4.3.3 for evidence for ALIGN-L). Recall that evidence for ALIGN-L comes from high front vowel syncope; foreign language acquisition where AA learners tend to opt for gemination in words such as ‘adopt’, ‘collect’ and ‘select’; from vowel epenthesis in loanwords, as in ‘flow master’ > *fulu'maatar*; from child language acquisition, as in *ʔal.ˈlaaʔ* for *ʔa.ˈlaaʔ.*

Recall also that an important piece of evidence comes from frequency effects. As pointed out before, 85% of the most common AA polysyllabic words satisfy this constraint and the words that violate it are all derived words where the majority of those words have the low vowel /a/ in the first syllable, which has a special status, as shown in §5.1.4.3.3.[52]

More evidence for this alignment constraint comes from non-geminated words which are spelt with double consonants but fail to geminate (see below). Words such as ‘million’, ‘billion’ and ‘billiards’ are realised with one ‘l’ in AA. The second syllable here is stressed and has an onset; the first syllable is already bimoraic and forms a well-formed foot by itself. Hence, there is no need for gemination. (For more details see §5.2.2.3 below).

Note in passing that some evidence for this comes from the fact that words such as ‘balloon’ appear with a long vowel in the first syllable in other Jordanian dialects and

[51] It could be argued that these monosyllabic syllables are affiliated immediately to the prosodic word violating Strict Layering.

[52] Based on a random sample of 100 native AA words, I found that gemination occurs in 15 words. In nine words, gemination renders a pretonic syllable bimoraic while in six words gemination makes the stressed syllable heavy. I also found that the pretonic syllable was bimoraic in 31 words out of 40 possible words. Moreover, the stressed syllable in 92% of the words is heavy; while 8% have a light stressed one. It is worth noting that the short stressed vowel in seven of these words is /a/, while /i/ appeared in only one case. Investigating this phenomenon in native words needs more in-depth research.

in SA. Therefore, gemination does not obtain as the vowel is lengthened, which makes the first syllable bimoraic.

Besides these two types of gemination, a few cases of gemination are attributed to morphology. That is, a morphological process results in a phonologically marked structure that triggers gemination. This relates to the feminine suffix *-at* and the *nisba* suffix *-iyya*. Recall that nouns in AA are either masculine or feminine and feminine nouns are usually marked for gender using *-a(t).* For example, words such as 'party' are assigned feminine gender in AA and consequently require the feminine suffix *-a(t).* Amplifying the suffix to 'party' results in hiatus, which is strictly prohibited in AA. Thus, glide formation yields **bar.ti.y*[*e*]. Still, this output is marked so gemination would make it less marked by rendering the penult heavy as argued above yielding *bar'tiyy*[*e*]. The same argument applies to many other older loanwords that end with the *nisba* ending *-iyya* such as *dimugraa'ṭiyy*[*e*] 'democracy' and *diktaatur'iyy*[*e*] 'dictatorship'.

Finally, gemination is attested in two verbs, namely *'ʃayyat* 'to chat' and *'fallal* 'to fill'. This suggests that either the triliteral verb form II or the quadriliteral verb form I is more productive than other verb forms. Many earlier borrowings follow this pattern, e.g. *'talfaz* 'he televised' and *'talfan* 'he phoned' (cf. McCarthy 2007a: 300-1). I think that the quadriliteral is the default verb form and the geminated triliteral is in fact the quadriliteral form where gemination is invoked to provide a forth melody.[53, 54]

5.2.2.3 Role of orthography

It is tempting to assume that gemination is triggered by spelling. That is, the presence of double consonants in spelling invokes gemination; a double orthographic consonant would be mistakenly treated as a geminate in AA. This can be motivated by the fact that Arabic spelling uses a special diacritic for geminates, which always

[53] Classical Arabic has four measures of quadriliteral verbs (Wright 1955, cited in Sakarna 1999). AA uses only the first two /faˤlal/ (CVCCVC, e.g. *tardʒam*) and /t-faˤlal/ (CCVCCVC, e.g. *ttardʒam*).

[54] Gemination is also attested in two more words for phonotactic reasons. In *ʃallistun* 'charleston' and *staallis* 'stainless', /r/ and /n/ assimilate in place to the following lateral. This assimilation relates to syllable contact law. Without gemination a bad syllable contact results in that the coda is less sonorous than the following onset (assuming that a trill is less sonorous than a lateral) (cf. Clements 1990; Davis 1998; among others).

appears in spelling, unlike the diacritics for short vowels. Upon investigating loanwords that are realised in AA with a geminate and loanwords that are spelt with orthographic double consonants in source language but realised in AA without a geminate, I come to the conclusion that the role of orthography in gemination is minimal.

In support of this argument, I found that 53 loanwords that are spelt with double consonants in English are realised with a singleton in AA. If orthography was behind gemination, such words with double consonants could potentially be geminated. However, I argue that there is no motivation for gemination in these words and consequently they appear with a singleton. Moreover, of the 48 geminated words, only 12 (25%) are written with double consonants. Suppose for the sake of argument that these 12 words were geminated because of source spelling, why would the others have gemination? It can be said with greater certainty that spelling does not account for gemination or non-gemination processes; gemination is invoked for purely phonological factors.[55] Below, I cite some examples in support of this argument.

Consider the words in (53) below where no gemination is needed as these words already satisfy AA markedness constraints. Recall that gemination in type two words is invoked to render the output more well-formed with respect to markedness constraints.

(53) No gemination in words with double orthographic consonants

a. ˈbaagi ‘baggy’
b. karaˈdoor ‘corridor’
c. ʔitiˈkeet ‘etiquette’
d. malˈyoon ‘million’
e. baaṣ ‘pass’
f. ˈraali ‘rally’
g. ṣnooˈbarṣ ‘snubbers’
h. ˈtoof[e] ‘toffee’
i. ˈtinar ‘thinner’

[55] One might argue that this claim runs counter to findings from segmental adaptation where 15% of cases could be attributed to orthography. I argue that there is no contradiction as gemination relates to prosodic levels. That is, the influence of orthography is attested at the segmental level only.

Take as an example the word ‘million’, which is realised as *mal'joon.* The output is well-formed in AA. The initial syllable is bimoraic and the second stressed syllable has an onset so there is no need for gemination. Also in *'raali* ‘rally’, there is no need for gemination as the output has a bimoraic syllable that is followed by an extrametrical light syllable.

Similarly, gemination is not invoked in words such as *'tinar* ‘thinner’. These words form a moraic trochaic foot with no left-over syllables. It would be expected to have gemination in these words to avoid parsing the ultimate syllable. However, it seems that faithfulness to the source has a role here. Note that there are only seven words of this type.

Finally, in a word such as ‘pass’> *baaṣ*, no gemination is needed because the word is already bimoraic as the vowel is faithfully realised as a long vowel in AA. That is, minimality is satisfied and consequently there is no need for gemination.

5.2.2.4 What consonants are more susceptible to gemination?

It has been found out that the most commonly geminated sound is the lateral /l/ followed by /b/, /k/ and /t/, respectively (see Table 5.10 below). Moreover, plosives are more geminated than all the other sounds, which is consistent with findings from other languages where the most frequent geminate phonemes are the plosives (Kraehenmann 2011: 1129). They are followed by liquids, fricatives, nasals and glides, respectively. Similarly, obstruents (stops & fricatives) are more geminated than sonorants, which is cross-linguistically attested (cf. Shirai 1999). Obstruents are geminated 65% while sonorants 35%. This is in line with phonetic universals where sonorant length is more difficult to perceive resulting in more confusion with singletons (Kawahara 2005). In terms of voicing, contrary to markedness constraints (Shirai 1999), voiced sounds are more frequently geminated than voiceless ones. This can be partly explained by the fact that /l/ is the most geminated sound, which is a voiced sound. It seems that there is some phonetic characteristic that is peculiar to the lateral sound that makes it geminate.[56]

[56] Note also that the lateral geminates even when the syllable has a long vowel, as in *vaa'neella*. This issue is left for further research.

Table 5.10 Distribution of geminates in terms of sound categories

Sound	Percentage	Sound	Percentage	Sound	Percentage
Voiced	58	Stops	52	/l/	23
Voiceless	42	Liquids	23	/b/	18
		Fricatives	12.5	/k/	13.5
		Nasals	8.3	/t/	8.3
		Glides	4.2	/f/	7
Total	100%		100%		70%

5.2.2.5 Section summary

This section has shown that gemination in loanwords is an output-oriented process that seeks to improve the prosodic structure of the borrowed words. The first category relates to an undominated constraint that requires the minimal AA lexical word to be bimoraic. The second comprises words where gemination is accounted for by a number of markedness constraints such as FTBIN, ONSET, SWP, ALIGN-L and NONFIN whereby gemination renders the output unmarked by providing onsets to syllables, rendering a stressed syllable heavy, forming a bimoraic foot or unparsing a final light syllable.

It has also revealed that AA has a hidden constraint, or at least a striking tendency, that triggers consonant gemination not only in loanwords but maybe in native Arabic words. This tendency requires the left edge of the prosodic word be aligned with a bimoraic foot.

Non-gemination is accounted for by the fact that the prosodic structure of the words in question already satisfies the above-mentioned constraints. Also, it is confirmed that orthography, contrary to other studies (Iverson & Lee 2004), cannot account for gemination in loanwords as many words spelt with double consonants are not geminated on one hand and other words that are spelt with a singleton are geminated on the other hand.

Findings lend support to a moraic representation of geminates in AA as AA generally disprefers coda clusters; nonetheless, gemination is invoked to satisfy minimality and to augment syllable weight that in turn attracts stress (cf. Davis & Ragheb 2014). It is highly recommended that a full scale in-depth study that investigates gemination in native words is conducted to further unveil the constraints that account for gemination in Arabic phonology.

5.3 Conclusion

This chapter has accounted for two prosodic aspects in loanword adaptation: stress and gemination. It has enhanced our understanding of these two phonological phenomena in AA by uncovering hidden AA constraints that have been stimulated by the introduction of challenging input.

It has revealed that source stress is ignored in the adaptation process and stress is assigned to the adapted phonological string according to AA constraints. Results lend support to the fact that stress in AA is governed by syllable weight and position. Stress is attracted to heavy syllables within a three-syllable window at the right edge where the rightmost heavy syllable receives stress. Stress shift within loanwords also point to the same conclusion. It has been found that shift strongly correlates with weight and position whereby shift is almost always rightward toward a heavy syllable. Findings also suggest that the unmarked stress position in AA is on the penult.

This chapter has proposed an OT constraint hierarchy that incorporates two constraints, namely WINDOW and ALIGN-L, which have never been used by earlier stress analyses of Levantine Arabic. The suggested hierarchy can also be applied to other Levantine dialects, which share the basic stress constraints with AA. This hierarchy can account economically for stressing heavy ultimate syllables without revoking NONFIN and it can even account for the unexpected stress on a light penult, as in *munu'buli*.

This chapter has also provided acoustic evidence for stress position in loanwords. It has been shown that acoustic results match impressionistic judgements on stress place, which is cued by higher F0 and intensity but not necessarily longer duration. Moreover, results suggest that AA has secondary stress, which is supported mainly by acoustic analyses and gemination cases.

Moreover, it has been shown that gemination within loanwords is a purely phonological phenomenon that is invoked to satisfy AA structural constraints. The first type of gemination is induced to satisfy prosodic word minimality where a prosodic word must be bimoraic. The second type of gemination is further subdivided into two types. The first type is invoked to yield an unmarked output giving rise to TETU. The second type is mainly invoked by a hidden AA constraint that requires prosodic words to start with a foot.

Finally, it has been shown throughout the chapter that the prosodic adaptation could be affected by non-phonological factors. It has been shown that stress position and gemination are sometimes affected by morphological factors and frequency effects.

Chapter six

Concluding remarks and recommendations

This chapter summarizes the main findings of the thesis and suggests directions for future research. The aim of this thesis was to account for the phonological adaptation of English loanwords in order to better understand AA phonology and contribute to phonological theory. It has been shown throughout the thesis that the adaptation of English loanwords is mainly governed by AA phonology and secondarily by other linguistic factors chief among which are perceptual/phonetic, orthographic, morphological and sociolinguistic factors. By accounting for the adaptation of English loanwords into AA, this thesis has shed light on many phonological aspects of the dialect.

This chapter is organised as follows: §6.1 presents a summary of the main findings of the study, §6.2 summarizes the main contributions of the study, §6.3 addresses the limitations of the study, finally §6.4 outlines a number of issues for future study.

6.1 Conclusion

This subsection summarizes the main findings of the thesis and highlights their significance to understanding the phonology of AA in particular and Arabic dialects in general. It then moves on to review the phonological adaptation of loanwords and other non-phonological factors that account for the adaptation processes.

Chapter two established AA segmental phonology and its feature system. This is the first attempt to describe the AA phonological feature system, which is based on phonological behaviour and phonetic similarity. It was demonstrated in that chapter that the methodology adopted in this study avoids the problems encountered by previous studies in collecting data and eliciting the pronunciation of loanwords. The researcher took serious measures to select established loanwords that are accessible only to monolinguals and used mainly pictures to elicit the pronunciation of loanwords, which were recorded using a digital professional recorder for acoustic analysis. These measures give reason to believe that the findings of this study are more reliable and robust than those of previous studies. Chapter two also reviewed the most common models of loanword adaptation and demonstrated that a single model cannot account for the sophisticated processes of loanword adaptation.

In terms of the first research question, which examines how English consonants and vowels are mapped onto AA and explores the role of non-phonological factors in the adaptation of these segments, results show that the adaptation process of English segments is mainly phonological. English segments are adapted into their AA phonological counterparts. The adaptation is specifically based on the phonological status of L2 segments in L1 phonology. That is, a source phonetic feature, e.g. emphasis, that is phonemic in L1 was usually adapted faithfully into its L1 phonological counterpart, as in the realisation of emphatics in §3.1.2.1. On the other hand, a phonemic feature in the source that is allophonic in AA was ignored, as in the adaptation of the voiceless aspirated labial stop /p/ (cf. §3.1.1.1.1).

Moreover, the chapter touched on the understudied feature geometry in Arabic phonology in general. Findings suggest that features are not artefacts of analysis and above all that place features have a special status in the feature geometry (§3.1.3). It was shown that faithfulness to the place features of a consonant was more important than faithfulness to other features such as manner and laryngeal features. This could point to the primacy of place features in Arabic phonology in terms of phonological representation and processing. This awaits further evidence from related studies.

It was demonstrated that faithfulness was sometimes violated in order to satisfy markedness constraints, which is consistent with the literature on loanword phonology (Kenstowicz 2007; Paradis & LaCharite 2011; among others). For example, lengthening and shortening of vowels, vowel harmony, and monophthongisation were accounted for by the fact that they yield a less marked output in AA.

Chapter four addressed the second research question and accounted for the syllable structure of the loanwords in AA and the phonological processes that AA borrowers adopt to optimize syllable structure. Findings confirmed that the maximal syllable in AA is bimoraic and the optimal onset and coda are simple. It suggested a new constraint, CODACON, instead of the widely used SSP to account for the few two-consonant codas in AA. The chapter suggested a syllabification algorithm within a Stratal OT framework that incorporates semisyllables and mora sharing to account for complex margins and CVVC syllables. Finally, it was shown that the adaptation process invoked a number of phonological processes such as deletion, syncope, and epenthesis, to render the output less marked.

Chapter five addressed the third and forth research questions. The first part of Chapter five accounted for stress assignment in AA and confirmed that syllable weight and position are the main determinants of stress place in AA. Stress adaptation demonstrated that source stress was ignored in the adaptation process and stress was assigned according to AA native stress constraints. It suggested a new OT constraint hierarchy that better accounts for paradoxical cases such as final syllable extrametricality, as argued in §5.1.4.3. This new hierarchy incorporated two new constraints, namely ALIGN-L, which was considered as a hidden AA constraint provoked by the introduction of loanwords, and WINDOW, which made the hierarchy simpler and more economical than previous accounts of Levantine dialects. This chapter also provided acoustic evidence to verify stress assignment in loanwords and it was revealed that the most important correlate of stress in AA is higher F0 followed by higher intensity whereas no concluding evidence was reached for the use of duration to cue stress in AA.

Results from the second part of Chapter five showed that AA resorts to consonant gemination to avoid marked structures. More specifically, results revealed that gemination is an output-oriented process that is motivated to satisfy minimality constraints (§5.2.2.1), and to render the output less marked giving rise to TETU and a hidden AA constraint that requires the prosodic word be left-aligned with a foot, as explained in §5.2.2.2.

In general, the findings of this study show that the adaptation process is mainly phonological from the perspective of L1 such that the phonological status of a certain feature in L1, not in source, determines its adaptation. However, it was shown that although the adaptation process was mainly phonological, it was not always faithful to source input. This was partly accounted for in terms of markedness, which is in line with OT basic assumptions that faithfulness is violated to yield unmarked structures (McCarthy 2008: 238).

Results show that markedness plays a considerable role in the adaptation process. Markedness is manifested in two ways. First, it was demonstrated that ill-formed source structures were mapped onto L1 unmarked outputs. Second, it was shown that licit source input was mapped onto less marked AA structures giving rise to TETU, as discussed throughout the thesis. Cases that can be considered as TETU include intervocalic voicing, final devoicing, and guttural harmony (cf. Chapter three). Moreover, lengthening processes to render stressed vowels heavy can be taken as another case of TETU, as phonetic cues are better realised in long syllables (cf. Takahashi 2006; Tu 2013). TETU implies that adults still have access to UG constraints/rules where the unmarked feature surfaces.

On the other hand, it was shown that phonology alone could not account for the whole picture. If the process was completely phonological, there would be no variation and every phoneme would be mapped onto its phonological counterpart (cf. Davis & Cho 2006) though. This is not always the case. Other non-phonological factors play a role in the adaptation process.

Phonetic and perceptual factors seem to play an important role in the adaptation process, which is broadly in line with Hayes' (2004) observation that "phonology is phonetically governed". For example, phonemes with salient features, such as sibilants, were almost always realised unchanged in the adaptation process while features with impoverished acoustic features or in non-salient positions were more violated than other features.

It was also shown that the adaptation process was affected by orthography and frequency of use. The role of orthography was evident in the adaptation of short vowels especially in the adaptation of the English schwa (§3.2.1.7). Also frequency effects were noticed in stress assignment whereby the most frequent position was on the penult. Furthermore, the most frequent CV templates also showed that frequency effects could play a role in the adaptation process. Many loanwords were adapted such that they conform to one of these templates, as pointed out in Chapter four.

Again, the effect of morphology was apparent in many cases such as the adaptation of verbs where all loanwords that were realised as verbs in AA followed AA morphological templates (§3.3.5). Likewise, the surface form of some nouns was affected by morphological factors such as the *nisba* morpheme and the feminine suffix.

It was suggested that sociolinguistic factors such as level of bilingualism, attitudes, and prestige could play a role in the adaptation process (§3.3.5), which is in line with Blevins' (2004) observation that "sociolinguistic variables always appear to be able to trump markedness constraints" (ibid: 128).

Taken together, these results show that a linguistic model that takes the interplay of all these factors could better account for the adaptation of loanwords. As demonstrated in §2.3.3, a purely phonological or a purely phonetic/perceptual account of the adaptation process is unrealistic. A purely phonological model cannot account for some cases such as emphasis, while a purely phonetic model cannot account for the adaptation of the majority of cases such as the adaptation of vowels and consonants where English segments were mapped onto their AA phonological counterparts. Moreover, both models fail to account for apparent orthographic influences, which means that such effects have to be taken into consideration in any model of loanword adaptation (cf. Vendelin & Peperkamp 2006). Accordingly, an eclectic approach that takes into account all these complementary factors is a better model to account for the integration of loanwords into recipient languages.

6.2 Contribution of the study

The contribution of this thesis is threefold. Firstly, it is the first in-depth comprehensive study of loanwords in AA that investigates not only segmental levels but also suprasegmental levels. Recall that all previous studies on loanwords in JA failed to account for syllable structure, stress and gemination besides encountering methodological problems (cf. §2.4).

Secondly, the study serves as a documentation of the dialect in a constant state of flux due to various reasons, as pointed out in Chapter one. This thesis managed to establish AA phoneme system and its feature system in Chapter two, the syllable structure in native AA phonology in Chapter four and stress assignment constraints in Chapter five. Although there are previous studies that address Amman dialect, none of them tackled the subdialect that this study has described. Recall that Amman dialect is not a homogenous dialect and so far any description that refers to Amman dialect as one dialect is far from the truth.

The third and most important contribution of this study pertains to the fact that the adaptation processes have resulted in a better understanding of AA phonology and maybe the phonology of other Arabic dialects by highlighting a number of phonological aspects of AA. These aspects would not have been challenged had it not been for the introduction of English loanwords that stimulated hidden AA phonological constraints. For example, the study revealed that monophthongisation is better thought of as a diachronic process, which is clear from the adaptation of English diphthongs, as demonstrated in §3.2.7.3. Moreover, the adaptation of English dark /l/ indicates that dark /l/ is not a phoneme in AA —a finding which could extend to the other secondary emphatics. Results also point out to the primacy of place features in the phonology of Arabic dialects, which is in line with Arabic root co-occurrence restrictions that are based on place of articulation (cf. Frisch et al. 2004). Similarly, findings highlighted the status of co-occurrence restrictions in AA. It was shown that AA places restrictions on the co-occurrence of certain features or phonemes as is the case of emphatic consonants and low back vowels (§3.1.2.1).

Moreover, it was established that AA, like other Arabic dialects, requires obstruent clusters to agree in voice (§3.1.2.2). In the same regard, results suggest that the voiced labial stop /b/ and sonorants are underspecified for [voice]. Likewise, results suggest that a nasal, especially the alveolar nasal /n/, is the unmarked coda in AA and maybe other Arabic dialects (§3.1.1.5.1). Moreover, the adaptation of /v/ and /p/ suggests that

/v/ could represent an accidental gap in AA while /p/ is a systematic gap due to its phonetic inefficiency (§3.1.1.1.1).

At the suprasegmental level, the adaptation of loanwords has shed light on many phonological aspects of AA suprasegmental structure. For example, it was shown that the maximal syllable is bimoraic and the optimal margins are simplex, as shown in Chapter four. Most importantly, it was shown that complex onsets are not basic in AA and may not be basic in other Arabic dialects. Also, results pointed out that light final syllables are generally extrametrical, which casts light on the unusual behaviour of the applicative morpheme *-l* ‘to/for’ in Arabic dialects in general.

Again, results highlighted a hidden constraint in AA that requires aligning the left edge of the prosodic word with a foot. This constraint, which called for consonant gemination, as discussed in §5.2.2.2.2, proved to play a major role in stress assignment and forced stress to fall on a light penult in four-syllable words. More importantly, the study suggested a constraint hierarchy to account for stress assignment in AA that could be applied to other Arabic dialects, with a possible re-ranking of the same constraints for some Arabic dialects. Along the same lines, results suggest that AA has secondary stress, as pointed out in §5.1.3. Finally, results from epenthesis in §4.4.4.2 show that AA would be better described as an intermediate dialect between a VC and a C dialect rather than as a VC dialect according to Kiparsky’s (2003) classification.

Before closing this subsection, note that free variation for many forms is attested in the corpus. This is attributed to the complicated interacting factors that account for the adaptation processes and to the changing level of bilingualism in AA community where AA speakers are attempting to be more faithful to the source pronunciation/orthography. In fact, it is not unusual to find bilinguals deliberately correcting the pronunciation of loanwords in AA in an attempt to air their knowledge of English, presumably due to increased exposure to English. This, unfortunately, exacerbates the phonological analysis and makes phonologists’ job even harder. This undoubtedly calls for a rigorous control of all non-phonological variables to limit the effect of such factors on the adaptation process as much as possible. In the next subsection, I turn to the limitations of the study.

6.3 Limitations of the study

The study has a number of limitations that I describe below.

In hindsight, it was felt that the results of this study would be more reliable and valid if the pronunciation of loanwords had been elicited in a more natural informal context, e.g. extracting loanwords from everyday conversations. Unfortunately, this could not be adopted in this thesis due to time constraints given the large number of loanwords. The construction of a spoken corpus of AA would make this possible in the future.

This study could not select all loanwords to analyse stress position or to include minimal pairs to verify the place of stress and its acoustic correlates. It would be better to take all loanwords and involve more speakers to verify the correlates of stress. In this regard, although the sample size of a qualitative study such as this thesis is enough to elicit the pronunciation of loanwords, it is not ideal for statistical tests, which require larger sample sizes. Therefore, the generalizability of these results should be taken with caution.

Controlling for non-phonological factors was not possible in this study. This is because the study contains loanwords that may have come into AA via other Arabic dialects or other languages. Although systematic measures have been taken to exclude problematic words, as explained in §2.6.1, it is still by no means possible to be absolutely sure that a word has entered AA directly from English. Moreover, there was no way to control for agents of borrowing. Recall that loanwords can be introduced by many agents such as bilinguals and monolinguals, which ultimately affects the integration of loanwords, as discussed in §2.3. Consequently, a future study that focuses only on recent English loanwords (from one English variety) that are adapted online, i.e. foreign words that are borrowed 'here-and-now' (see, for instance, Vendelin & Peperkamp 2004; Peperkamp 2005) would give more reliable results.

6.4 Recommendations for further study

Although this study has shed light on many AA phonological aspects, it has thrown up many questions in need of further investigation. The following paragraphs suggest some outstanding issues for future research.

A possible area for further investigation includes the phonetic and phonological behaviour of /r/ to establish its underlying representation in AA and the contexts where it undergoes de/emphaticisation. Similarly, the peculiar behaviour of the lateral phoneme /l/ in the adaptation process deserves further investigation. It has been observed in §5.2 that the lateral geminates even when it is a coda of an already heavy syllable, as in *vaaneella*. This seems to relate to some phonetic properties of this phoneme, which was also the most geminated phoneme in the adaptation process.

Another aspect that merits further study is foot binarity. As has been pointed out in §5.1.2.3.3, words such as *tiknuloodʒya* suggest that foot binarity can be moraic or syllabic. A study of this kind would advance our understanding of foot binarity in Arabic and enhance our understanding of prosodic structure of Arabic dialects in general.

Without further research into the constraint ALIGN-L and gemination, it will not be possible to generalize the results of this study with respect to ALIGN-L. A further analysis of these issues in AA native words would deepen our understanding of these two aspects of Arabic phonology. This can be further investigated by examining how Arab monolingual speakers would adapt foreign words composed of four light syllables. It would also be interesting to discuss these aspects in more Arabic dialects.

Further acoustic work at a large scale needs to be done to compare lexical vowels and epenthetic vowels to shed more light on the opacity of epenthetic vowels in Arabic. A final avenue for further study would be research at a large scale into the acoustic correlates that AA uses to cue stress.

The researcher, as a second language speaker and instructor of English, has noticed that many of the findings of this study parallel observations and findings of second and foreign language acquisition (cf. Suleiman 1985; Al-Jarrah 2002; Zuraiq 2005; among others). Therefore, the findings of this study may have significant implications in the field of English language teaching and can stimulate more research to shed more light on the many questions that this study addressed.

Appendix: Loanword corpus (Words in bold have gemination)

English word	English Pronunciation	AA typical pronunciation
accordion	əˈkɔːdɪən	ʔu'koordyun (S)[1] ~ ʔa'koordyun
acetone	ˈasɪtəʊn	'ʔasitun
acid	ˈasɪd	ʔa'siid (S)
action	ˈakʃ(ə)n	'ʔa(a)kʃin
adrenaline	əˈdren(ə)lɪn	ʔadrina'liin (S)
advantage	ədˈvɑːntɪdʒ	ʔad'vaantidʒ
aids	eɪdz	ʔeedz ~ ʔiidz
airbag	ˈeəbag	ʔer'baag ~ ʔer'baak
airbus	**ˈe(ə)rˌbəs**	'ʔerbaṣ ~ **ʔer'baaṣṣ**
album	ˈalbəm	ʔal'buum
ambulance	ˈambjʊl(ə)ns	ʔamba'lanṣ
amplifier	ˈamplɪfʌɪə	ʔambi'fa(a)yar
antenna	anˈtenə	ʔan'teen ~ ʔan'tiin
antifreeze	ˈantɪfriːz	ʔanti'friiz
antivirus	ˈantivʌɪrəs	ʔanti'vaayrus
archive	ˈɑːkʌɪv	ʔar'ʃiif
aspirin	ˈasp(ə)rɪn	ʔasbi'riin ~ ʔasb'riin
axle	ˈaks(ə)l	ʔaks
baby	ˈbeɪbi	'beebi
baby	**ˈbeɪbi**	**'bubbu**
back axle	'bak aks(ə)l	ba'kaks (S)
backfire	bakˈfʌɪə, ˈbakfʌɪə	baak'fa(a)yar
baggy	ˈbagi	'baagi
baking powder	'beɪkɪŋ paʊdə	bakim'bawdar ~ bikim'bawdar

[1] S here means that this word is part of the 41 words that were used for the acoustic analysis of stress.

balance	ˈbal(ə)ns	'balanṣ ~ ba'lanṣ
band	band	band
bandana	banˈdanə	ban'daan[e]
beige	beɪ(d)ʒ	beedj
bermuda	bəˈmjuːdə	bar'mooda
between	bɪˈtwiːn	'batwan([e])
bikini	**bɪˈkiːni**	**bik'kiini** (S)
billionaire	bɪljəˈneə	bilju'neer
biology	bʌɪˈɒlədʒi	bu'loodʒya ~ biloodʒya
block	**blɒk**	**'blukk[e]**
body	ˈbɒdi	'badi
body	ˈbɒdi	'budi
boiler	ˈbɔɪlə	'boylar
boot	buːt	boot
boss	**bɒs**	**buṣṣ**
bouquet	bʊˈkeɪ, bəʊˈkeɪ, ˈbʊkeɪ	bo(o)'kee (S)
boutique	buːˈtiːk	bo(o)'tiik
box	bɒks	buks
brake	**breɪk**	**breek/brikk**
bravo	brɑːˈvəʊ, ˈbrɑːvəʊ	'braavu
bulldozer	ˈbʊldəʊzə	bal'doozar ~ bil'doozar
bye	bʌɪ	baay
cafeteria	kafɪˈtɪərɪə	kaf'tiirya
caffeine	ˈkafiːn, ka'fiːn	kafa'yiin
cake	keɪk	keek
cakes (pl)	keɪks	kiks
camellia	kəˈmiːlɪə,ˈmelɪə	kaa'miilya

cancer	ˈkansə	'kaansar (S)
cappuccino	ˌkapʊˈtʃiːnəʊ	kabat'ʃiinu
caravan	ˈkarəvan, karəˈvan	kara'vaan
carbohydrate	kɑːbəˈhʌɪdreɪt	karbuhay'draat
carburettor	kɑːbjʊˈretə, bə	karbu'reetar
carnival	ˈkɑːnɪv(ə)l	karna'vaal
case	keɪs	kees
cash	kaʃ	kaaʃ
cashew	ˈkaʃuː, kəˈʃuː	'kaaʃu ~ 'kaadʒu
cashier	kaˈʃɪə, kə	ka(a)'ʃiir
casket	ˈkɑːskɪt	kas'keet
cassette	kəˈset	'kasit
caviar	ˈkavɪɑː, ˌkavɪˈɑː	kav'jaar
centre	sentə	'santar
central locking	**sentə lɒkɪŋ**	**'santarlukk**
ceramic	sɪˈramɪk	sara'miik ~ sira'miik
chamois	ˈʃamwɑː	ʃam'waa (S)
chance	tʃɑːns	ʃanṣ
charleston	ˈtʃɑːlstən	ʃal'listun (S) ~ ʃar'listun
chat	**tʃat**	**'ʃayyat**
chat	tʃat	ʃaat
cheetah	ˈtʃiːtə	'ʃiita (S)
chef	**ʃef**	**ʃiff**
chenille	ʃəˈniːl	'ʃanil
chimpanzee	tʃɪmpanˈziː	ʃam'baazi ~ ʃam'baanzi
chips	tʃɪps	ʃibs
cholesterol	kəˈlestərɒl	kulis'trool
christmas	ˈkrɪsməs	'kriṣmaṣ

clip	**klɪp**	**klibb**
clips (pl)	klɪps	'klibse
clutch	klʌtʃ	klatʃ
cocaine	kə(ʊ)ˈkeɪn	kuka'?iin
cobra	ˈkəʊbrə	'koobra
coffee shop	**ˈkɒfi ʃɒb**	**kufi'ʃubb**
coiffure	kwɑːˈfjʊə	kwaa'feer ~ kawa'feer
coil	kɔɪl	'koyl
collage	**ˈkɒlɑːʒ**	**kul'laadʒ**
compressor	kəmˈpresə	kum'breeṣa
computer	kəmˈpjuːtə	kum'byuutar
condenser	kənˈdensə	kun'dinsar
condition	kənˈdɪʃ(ə)n	'kundiʃin
condom	ˈkɒndəm	'kundum
congress	ˈkɒŋgres	'kungris
contact	ˈkɒntakt	'kuntak
container	kənˈteɪnə	kun'teenar
control	kənˈtrəʊl	kun'trool (S)
convoy	ˈkɒnvɔɪ	kam'boy
cooler	ˈkuːlə	'kuular ~ 'kular
corn flakes	ˈkɔːnfleɪks	ko(o)rnif'liks (S)
corner	ˈkɔːnə	'koornar
corridor	ˈkɒrɪdɔː	kara'door
cortisone	ˈkɔːtɪzəʊn	kurti'zoon ~ kurtu'zoon
counter	ˈkaʊntə	'kaawntar
coupon	ˈkuːpɒn	koo'boon
cowboy	ˈkaʊbɔɪ	ka(a)'boy
crystal	ˈkrɪst(ə)l	kris'taal

custard	ˈkʌstəd	'kastar
cut-out	kʌtaʊt	ka'tawt
cyanide	ˈsʌɪənʌɪd	saya'niid
defrost	diːˈfrɒst	di(i)'frust (S)
deluxe	dɪˈlʌks, ˈlʊks	di(i)'luks
derby	ˈdɑːbi	'deerbi
desk	desk	disk
dettol	ˈdetɒl	di(i)'tool
diesel	ˈdiːz(ə)l	'diizil
digital	ˈdɪdʒɪt(ə)l	'didʒital
dinosaur	ˈdʌɪnəsɔː	dayna'ṣoor
disco	ˈdɪskəʊ	'diisku
dish	**dɪʃ**	**diʃʃ**
distributor	dɪˈstrɪbjʊtə	disbara'toor
double	ˈdʌb(ə)l	'dubul
double	ˈdʌb(ə)l	'dabil
double kick	**ˈdʌb(ə)l kɪk**	**dabil'kikk**
drill	**drɪl**	**drill**
drum(s)	**drʌm**	**dramm/dramz**
dry clean	drʌɪ kli:n	dray'kliin
dumdum	ˈdʌmdʌm	'dumdum
duplex	ˈdjuːpleks	dub'liks
earth	ɜ:θ	ʔeerθ
emulsion	ɪˈmʌlʃ(ə)n	ʔa'milʃin ~ ʔaminʃin
eskimo	ˈeskɪməʊ	ʔas'kiimu
eskimo	ˈeskɪməʊ	'ʔaskimu (S)
essence	ˈes(ə)ns	ʔa'ṣanṣ (S)
etiquette	ˈetɪket	ʔiti'keet

exhaust	ɪgˈzɔːst	ʔug'zust ~ ʔig'zust
extra	ˈekstrə	ʔi'kistra ~ ʔa'kistra
fabricate	ˈfabrɪkeɪt	'fabrak([e])
facebook	ˈfeɪsbʊk	'feesbuk
fax	faks	faks ~ faaks
fibre glass	ˈfʌɪbə glɑːs	fiibarig'laaṣ
fillet	ˈfɪlɪt, US fiˈlā	fii'lee (S)
filter	ˈfiltə	'filtar
flash	flaʃ	flaaʃ
flasher	ˈflaʃə	'flaʃar
flow master	fləʊ mɑːstə	fulu'maastar (S)
fluoride	'flʊərʌɪd, flɔː	floo'rayd/fulu'rayd
folklore	'fəʊklɔː	fulu'kloor
foolscap	ˈfuːlzkap, ˈfuːls	fulis'kaab ~ fuluskaab
football	ˈfʊtbɔːl	'faṭbul ~ 'fuṭbul
formica	fɔːˈmʌɪkə	fur'maayka ~ furu'maayka
foul	faʊl	'fawl
freezer	ˈfriːzə	'freezar
full	**fʊl**	**full**
full	**fʊl**	**'fallal**
full options	**fʊl ˈɒpʃ(ə)nz**	**full'ʔubʃin**
fuse	fjuːz	fjuuz
gallon	ˈgalən	'galan (S)
gardenia	gɑːˈdiːnɪə	gar'diinya
gateau	ˈgatəʊ, ga'təʊ	'gaatu
gear	gɪə	giir
gel	**dʒel**	**dʒill**
gene	dʒiːn	dʒiin

gentle	ˈdʒent(ə)l	'dʒintil
georgette	dʒɔːˈdʒet	dʒur'dʒeet
geyser	'giːzə	'kiizar ~ 'giizar
gin	**dʒɪn**	**dʒinn**
glucose	'gluːkəʊs/z	klo(o)'kooz ~ glo(o)'kooz
goal	gəʊl	goon ~ gool
grapefruit	'greɪpfruːt	kara'foot
hamburger	ˈhambɜːgə	ham'burgar (S)
hand brake	**'hand breɪk**	**handib'rikk**
hand rummy	handˈrʌmi	hand
hands	han(d)z	hanz
hangar	ˈhaŋə	hangar
hard luck	**'hɑːd lʌk**	**haard'lakk**
hatchback	ˈhatʃbak	hatʃ'baak
head phone	ˈhedfəʊn	'hitfun ~ 'hitifun
heater	ˈhiːtə	'hiitar (S)
hula-hoop	**ˈhuːləhuːp**	**hila'hubb**
hummer	ˈhʌmə	'hamar
insulin	ˈɪnsjʊlɪn	ʔansu'liin
intercom	**ˈɪntəkɒm**	**ʔantar'kamm ~ ʔintar'kamm**
internet	**ˈɪntənet**	**ʔantar'nitt ~ ʔintar'nitt**
interpol	ˈɪntəpɒl	ʔantar'bool ~ ʔintar'bool
jack	**dʒak**	**dʒakk**
jacuzzi	dʒəˈkuːzi	dja(a)'kuuzi
jeans	dʒiːnz	dʒinz
jelly	ˈdʒeli	'dʒili
jerry can	ˈdʒerɪkan	'dʒarkan ~ dʒalkan
jersey	ˈdʒɜːzi	dʒur'zaaye

joker	ˈdʒəʊkə	'dʒookar
judo	ˈdʒuːdəʊ	'dʒuudu
jumbo	ˈdʒʌmbəʊ	'dʒaambu
kaki	ˈkɑːki	'kaaki
karate	kəˈrɑːti	kara'tee (S)
kata	ˈkɑːtɑː	'kaata
ketchup	**ˈketʃəp, -ʌp**	**kat'ʃabb ~ katʃ '?abb**
key board	ˈkiːbɔːd	ki(i)'boord (S)
kiwi	ˈkiːwiː	'kiiwi
kong fu	kʊŋ ˈfuː	kung'fuu ~ kun'fuu(S)
land cruiser	landˈkruːzə, ˈland kruːzə	landik'roozar ~ land'roozar
land rover	landˈrəʊvə	land 'roovar
laptop	**ˈlaptɒp**	**laab'tubb**
large	lɑːdʒ	'laardʒ
laser	ˈleɪzə	'leezar
lego	ˈlegəʊ	'liigu
limousine	ˈlɪməziːn, lɪməˈziːn	limu'ziin
list	lɪst	'leesta
lobby	ˈlɒbi	'luubi
lux	lʌks	luks
madam	ˈmadəm	ma'daam
mafia	ˈmafɪə	'maafya
magic (marker)	' madʒɪk	'madʒik (S)
mall	mɔːl	mool
manhole	'manhəʊl	'munhul
manicure	ˈmanɪkjʊə	mana'kiir
manifold	ˈmanɪfəʊld	mana'vult
marathon	ˈmarəθ(ə)n	mara'θoon

marshmallow	**mɑːʃˈmaləʊ**	**marʃa'millu ~ mariʃ'millu**
mascara	maˈskɑːrə	mis'kaara
mask	mɑːsk	maask
massage	ˈmasɑːʒ, məˈsɑːʒ -dʒ/	ma'saadʒ ~ massaadʒ
master key	ˈmɑːstə	maastar 'kii
matriculation	mətrɪkjʊˈleɪʃ(ə)n	'matrik
mauve	məʊv	muuv
maxi	ˈmaksi	maksi
mayonnaise	meɪəˈneɪz	mayu'niiz ~ mayu'neez
melamine	ˈmeləmiːn	mila'miin ~ milu'miil
metallic	mɪˈtalɪk	'mitalik ~ 'matalik
microscope	ˈmʌɪkrəskəʊp	maykru'skoob (S)
microwave	ˈmʌɪkrə(ʊ)weɪv	maykru'weev/f
militia	mɪˈlɪʃə	mi'liiʃya ~ ma'liiʃya
millionaire	mɪljəˈneə	milyu'neer
mini market	mɪni mɑːkɪt	mini 'maarkit
minus	ˈmʌɪnəs	'maaynus
mobile	ˈməʊbaɪl	mo(o)'bayl
monopoly	məˈnɒp(ə)li	munu'buli (S)
montage	mɒnˈtɑːʒ, ˈmɒntɑːʒ	mun'taadʒ
moquette	mɒˈket	moo'keet
morris (trademark)	ˈmɒrɪs	'muris (S)
motor	ˈməʊtə	maa'toor
naphthalene	ˈnafθəliːn	nifta'liin ~ nafta'liin
NASA	ˈnasə	'naasa
NATO	ˈneɪtəʊ	'naatu
nectarine	ˈnektərɪːn	nikta'riin ~ nikta'liin
negative	ˈnegətɪv	'nigativ

negro	ˈniːgrəʊ	'niigru
neon	ˈniːɒn	'niyun
nescafe	ˈneskafi/, neskaˈfee	niska'fee (S)
net	**net**	**nitt**
neuter (neutral)	ˈnjuːtə	'nootar
niagara (a trademark)	nʌɪˈag(ə)rə	na'yaagra ~ ni'yaagra
nicotine	ˈnɪkətiːn	niku'tiin
night club	**ˈnʌɪtklʌb**	**naaytik'labb** (S)
nougat	ˈnuːgɑː	'nooga
nurse	nɜːs	neers
off side	**ɒfˈsʌɪd**	**ʔuff 'saayd**
off white	**ɒfˈwʌɪt**	**ʔuff 'waayt**
okay	**əʊˈkeɪ**	**'ʔukkee** (S)
optics	ˈɒptɪks	'ʔubtikus ~ 'ʔubtukus
orchid	ˈɔːkɪd	ʔur'kiida
organ	ˈɔːg(ə)n	ʔoorg
ounce	aʊns	ʔoonṣa
out	aʊt	ʔawt
overtime	ˈəʊvətʌɪm	ʔuvar'taaym
ozone	ˈəʊzəʊn	ʔo(o)'zoon
packet	ˈpakɪt	ba(a)'keet
pager	ˈpeɪdʒə	'beedʒar
pancreas	ˈpaŋkrɪəs	bankir'yaas
panda	ˈpandə	'baanda
panel	ˈpan(ə)l	ba(a)'neel
party	**ˈpɑːti**	**bar'tiyy[e]**
pass	pɑːs	baaṣ
patron	ˈpeɪtr(ə)n	baṭ'roone

pedicure	ˈpedɪkjʊə	budi'keer
penalty	ˈpen(ə)lti	ba'lanti
pentagon	ˈpentəg(ə)n	bin'taagun
pepsi	'pepsi	'bibsi
piano	pɪˈanəʊ	'byaanu
pick up	'pɪk ʌp	'bikam
pixel	ˈpɪks(ə)l, sel	'biksil (S)
pizza	ˈpiːtsə	'biidza
plaster	ˈplɑːstə	'blaastar
playstation	pleɪ ˈsteɪʃ(ə)n	blee 'steeʃin (S) ~ blis'teeʃin
poker	ˈpəʊkə	'bookar
polish	ˈpɒlɪʃ	'buliʃ
polyester	ˌpɒlɪˈestə	bu'listar
polystyrene	ˌpɒlɪˈstʌɪriːn	bulis'triin
polytechnic	ˌpɒlɪˈteknɪk	buli'tiknik
porcelain	ˈpɔːs(ə)lɪn	bursa'laan ~ bursa'liin
poster	ˈpəʊstə	'boostar
power steering	ˈpaʊə stɪərɪŋ, paʊə ˈstɪərɪŋ	'bawar ('stiiring)
primus	ˈprʌɪməs	'briimus
prince	prɪns	brins
printer	ˈprɪntə	'brintar
professor	prəˈfesər	brufu'soor ~ brufi'soor
prostate	ˈprɒsteɪt	brus'taat ~ broos'taat
protein	ˈprəʊtiːn	bro(o)'tiin (S)
puncture	ˈpʌŋ(k)tʃə	'banʃar
racquet	ˈrakɪt	'rikit ~ 'rakit
rally	ˈrali	'raali
range (rover)	reɪndʒ ˈrəʊvə	rindʒ (roovar)

radiator	ˈreɪdɪeɪtə	ro(o)'deetar
receiver	rɪˈsiːvə	ri(i)'siivar
regime	reɪˈʒiːm	ro(o)'dʒiim
remote (control)	rɪˈməʊt	ri(i)'moot
reverse	rɪˈvɜːs	ri(i)'virs
ribs	ribz	'ribs[e]
ring (spanner)	rɪŋ	ring
roll	**rəʊl**	**rull ~ rool**
rolls royce	rəʊlzˈrɔɪs	ro(o)z'raayz
roof	ruːf	ruuf
roundel	**ˈraʊnd(ə)l**	**run'deella**
routine	ruːˈtiːn	ro(o)'tiin
rubbish	ˈrʌbɪʃ	'raabish
salmon	ˈsamən	'salamun
samsonite	' samsənʌɪt	sansu'naayt ~ samsu'naayt
sandwich	ˈsan(d)wɪtʃ	'sandwiʃ (S), sand 'wiiʃ[e]
satellite	ˈsatəlʌɪt	sata'laayt (S)
sauna	ˈsɔːnə, US ˈsou	'saawna
scallop	**ˈskɒləp/ˈskaləp**	**ska(a)'lubb**
scanner	ˈskanə	'skanar
scooter	ˈskuːtə	'skootar
scrap	skrap	sik'raab
seesaw	ˈsiːsɔː	'siisu
self	self	silf
sensor	ˈsensə	'sinsur ~ 'sunsur
service	ˈsɜːvɪs	sar'fiis ~ sar'viis
seven up	**ˈsev(ə)n ʌp**	**sivin 'ʔabb**
sex	seks	siks

shampoo	ʃamˈpuː	'ʃaambu
shell	**ʃel**	**ʃill**
shift	ʃɪft	ʃift
shoot	ʃuːt	ʃuuṭ ~ ʃuut
short (circuit)	ʃɔːt	ʃurṭ
shorts	ʃɔːts	ʃurṭ
shower	ˈʃaʊə	'ʃawar (S)
silicon	ˈsɪlɪk(ə)n	'silikun
single	ˈsɪŋg(ə)l	'singil
siphon	ˈsʌɪf(ə)n	si(i)'foon
snubbers	ˈsnʌbəz	ṣno(o)'barṣ
solid	ˈsɒlɪd	ṣuld
sonar	ˈsəʊnɑː	so(o)'naar
spade	speɪd	'sbaati
spaghetti	**spəˈgeti**	**sba(a)'gitti ~ sba(a)'kitti**
spare	speə	sbeer
spiky	ˈspʌɪki	'sbaayki
spoiler	ˈspɔɪlə	'sboylar
spray	spreɪ	ʔasbiree ~ sib'ree
stainless steel	steɪnləsˈstiːl	staallisis'tiil
starter	ˈstɑːtə	'staartar
steak	**steɪk**	**steek/stikk**
steam	stiːm	stiim
steering	ˈstɪərɪŋ	'stiiring
stereo	ˈstɪərɪəʊ, ˈsterɪəʊ	'stiiryu (S)
stick	stɪk	ʔas'tiika
stock	**stɒk**	**stukk**
super market	ˈsuːpə mɑːkɪt, suːpə ˈmɑːkɪt	subar'maarkit ~ suubar'maarkit

superman	ˈsuːpəman	subar'maan ~ suubar'maan
surf (trademark)	sɜ:f	sirf
sweater	ˈswetə	'swiitar
switch	swɪtʃ	switʃ
syringe	sɪˈrɪn(d)ʒ, ˈsɪ-/	'srindʒ[e]
system	ˈsɪstəm	'sistim
tank	taŋk	tank
tanker	ˈtaŋkə	tank
tape	**teɪp**	**tibb**
tartan	ˈtɑːt(ə)n	tir'taan ~ tar'taan
tattoo	**taˈtu**ː	**tat'tuu** (S)
taxi	ˈtaksi	'taksi
technology	tekˈnɒlədʒi	tiknu'loodjʒa
telefax	ˈtelɪfaks	tili'faaks
tester	ˈtestə	'tistar
thermos	ˈθɜ:mɒs	'teermus
thermostat	ˈθɜ:məstat	θeermu'staat ~ teermu'staat
thinner	ˈθɪnə	'tinar
tights	tʌɪts	taayt
toffee	ˈtɒfi	'toof[e] (S)
topsider (a trademark)	ˈtɒpsʌɪdə	tub'saydar
tractor	ˈtraktə	ta'raktur/'traktur (S)
trailer	**ˈtreɪlə**	**'treella**
trampoline	ˈtrampəliːn	trambu'liin
transit	ˈtransɪt , ˈtrɑːns-, -nz	tran'ziit
tricks	trɪks	triks
trump	trʌmp	ṭar'niib
tsunami	tsuːˈnɑːmi	so(o)'naami ~ tso(o)'naami

tube	tjuːb	tjuub
tubeless	'tjuːbləs	'tjuublis
tuna	ˈtjuːnə	'tuuna
tupperware	ˈtʌpəweə	ṭabar'weer ~ ṭabar'weel
turbo	ˈtɜ:bəʊ	'teerbu
twitter	ˈtwɪtə	twiitar
valium	ˈvalɪəm	'vaalyum
valve	valv	balf
van	van	vaan
vanilla	**vəˈnɪlə**	**va(a)'neella**
video	ˈvɪdɪəʊ	'viidyu
vitrine	ˈvɪtriːn	bat'riina
vodka	ˈvɒdkə	'vootka ~ 'vutika (S)
voile	vɔɪl/ vwɑːl	vwaal/ʔav'waal
wafer	ˈweɪfə	'weevar
x large	'eks lɑːdʒ	ʔiks 'laardʒ
yen	**jen**	**yann**
yoga	ˈjəʊgə	'yooga
you tube	juː tjuːb	yu(u)'tyuub
zigzag	ˈzɪgzag	zig'zaag
zoom	zuːm	zuum

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