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Against Underlying Mid Vowels in Cairene Arabic*

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Abstract
Mid vowels in Cairene Arabic (CA) are claimed to have historically developed from Classical Arabic (CLA) diphthongs through monophthongization. Despite the claims that this is a historical process which no longer applies and that long mid vowels are underlying in CA, the absence of short mid vowels in this dialect raises certain theoretical concerns. This paper examines the distribution of mid vowels and diphthongs in CA and provides evidence that all mid vowels are synchronically derived from underlying diphthongs. Diphthongs, however, surface in systematic environments: after the shortening of underlying long low vowels, across morpheme boundaries, when a geminate glide is involved, and in a few lexical exceptions – contexts which resist phonological processes across languages. I argue that the appearance of CA long mid vowels is the result of total assimilation of two adjacent vocalic root nodes. As a consequence, CA and CLA surface forms can both be derived from diphthongal underlying representations with minimal constraint re-ranking.

1 Introduction

One of the least studied aspects in Arabic phonology involves the development and status of mid vowels and diphthongs in the modern dialects. In Cairene Arabic (CA) the long mid vowels [ee] and [oo] are claimed to have historically developed from Classical Arabic (CLA) diphthongs [aj] and [aw] respectively through monophthongization (Birkeland 1952, Broselow 1976, Ferguson 1957, Fischer & Jastrow 1980, Harrell 1957, Watson 2002, *inter alia*).[1] This is exemplified in (1a–b).

(1) (a)	*CLA*	*CA*	*Gloss*	(b) *CLA*	*CA*	*Gloss*
	[sˤajf]	[sˤeef]	'summer'	[lawn]	[loon]	'color'
	[sˤallˈaj-na]	[sˤallˈee-na]	'we prayed'	[tˈawb-ah]	[tˈoob-a]	'repentance'

On the other hand, when considering the synchronic status of CA mid vowels and diphthongs, three facts stand out as particularly interesting. First is the absence of short mid vowels in CA – long vowels should imply short vowels under some theories of structural markedness and vowel length (e.g. Morén 1999). Second are the systematic exceptions to CA monophthongization in which diphthongs appear on the surface (Ferguson 1957:463). Third

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[1] This is a geographically widespread phenomenon observed in most Arabic dialects of Egypt, Libya, Central Sudan, the Levant, and a few dialects in Tunisia and the Arabian Peninsula (Holes 1995:66, Watson 2002:22, Iványi 2006:642).

are the alternations in CA between long mid vowels and diphthongs in specific morphological environments (Watson 2002:23). Examples are shown in (2).

(2)	[ʕˈawza]	‘wanting (F.SG.)’	[ʕˈooza]	‘want (N.)’
	[ʃˈajla]	‘carrying (F.SG.)’	[ʃˈeela]	‘burden (N.)’

To account for these alternations, it has been suggested that monophthongization is a historical process which no longer applies, and that long mid vowels are underlying in CA (Abdel-Massih 1979, Broselow 1976, Watson 2002). However, careful examination of the synchronic status of CA mid vowels and diphthongs shows the latter proposal to be flawed and suggests that mid vowels are only (and still) derived from underlying diphthongs in this dialect (á la McCarthy 2005). In doing so, I argue that monophthongization in CA is a case of an understudied phonological effect known as Derived Environment Blocking (Hall 2006), in which a surface structure is excluded when it is morphologically or phonologically derived, but allowed when it is nonderived.

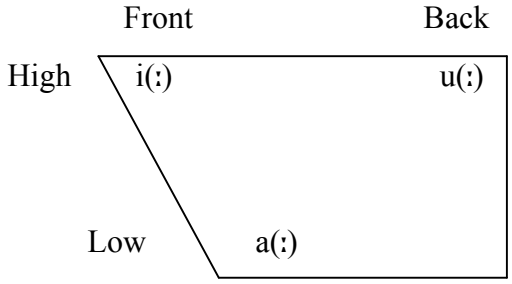
The remainder of the paper is organized as follows. Section 2 lays out the surface inventories of CA and CLA vowels, and argues against the existence of short mid vowels in CA. Section 3 thoroughly examines the morphological distribution of mid vowels and diphthongs in CA and their correspondents in CLA, by classifying the relevant forms under a certain type of weak root. The data provide evidence that CA monophthongization is a synchronic process which applies across the board except in morphologically or phonologically derived environments (diphthongs derived across morpheme boundaries or through shortening of underlying long vowels respectively), in a few lexical exceptions, or when a geminate glide (onset) is involved. Such contexts are known to block certain phonological phenomena cross-linguistically. In Section 4, the appearance of long mid vowels in CA is explained as the result of total assimilation of two adjacent vocalic root nodes of an underlying diphthong. Section 5 consequently shows that CA and CLA morphological paradigms can both be derived from diphthongal underlying representations via dialect-specific phonological processes. I formulate these processes in Optimality Theory (OT; McCarthy & Prince 1993a, Prince & Smolensky 1993/2004) through the interaction of general markedness and faithfulness constraints with positional faithfulness (Beckman 1998) and conjoined faithfulness constraints (Smolensky 1993). Significantly, the last type of constraints accounts for the morphologically conditioned CA diphthongs which alternate with mid vowels in (2) – without having to make reference to different levels of representation. Finally, Section 6 outlines some conclusions.

2 Monophthongs in Cairene and Classical Arabic

2.1 Classical Arabic Monophthongs

Six monophthongal vowel phonemes are generally recognized in Classical Arabic, three long and three short. The length distinction is only durational and does not denote a difference in vowel quality (Ryding 2005:25). The short vowels consist of two close: palatal [i] and labio-velar [u], and one open [a] (Watson 2002:21). Both long and short vowels occur stressed and unstressed, medially and finally (Abdel-Massih 1979:24). Consequently, CLA allows two or more long vowels in the phonological word (Gadalla 2000).

(3) *Chart: Surface vowel monophthongs in Classical Arabic*



2.2 Cairene Arabic Monophthongs

CA has all these six vowels plus two additional long mid vowels [ee] and [oo][2], which exhibit several contrasts with both long-low and long-high vowels and with each other (4a–c).

(4) (a) *Long-mid vs. long high vowels*

[meel]	'inclination'	[miːl]	'incline! (M.SG)'
[door]	'turn (N.)'	[duːr]	'turn! (M.SG)'

(b) *Long-mid vs. long low vowels*

[beet]	'house'	[baːt]	'he spent the night'
[loom]	'blame (N.)'	[laːm]	'he blamed'

(c) *Long-mid vs. long mid vowels*

[deel]	'tail'	[dool]	'those'
[deer]	'monastery'	[door]	'turn (N.)'

The five long vowels [iː, uː, aː, ee, oo] are only allowed in stressed position and may be followed by one or no consonants, but never by two. They occur in either the ultimate or penultimate position of words, never elsewhere (Harrell 1957:61). A consequence of this distribution is that while CLA allows two or more long vowels in the phonological word, CA does not permit more than one (Abdel-Massih 1979, Gadalla 2000, Watson 2002). The three short vowels [i, a, u], on the other hand, may be in stressed, pre-stress, or post-stress position. They may be followed by one or two consonants, or by none (Harrell 1957:62).

While there is uniformity among researchers as to classifying CA long mid vowels [ee] and [oo] as phonologically distinctive, there is disagreement as to the status of the short mid vowels [e] and [o], which some treat as phonemic and others as allophonic (Drozik 1974:125). Birkeland (1952:48–9), for example, argues that short [e] and [o] may be regarded as mere phonetic variants of originally short /i/ and /u/ for two reasons. Phonetically, the distance between the high and mid pairs is small in Arabic (compared to English, for instance). While this distance is significant in the long vowels, it is nonexistent in the short vowels. In addition, while the short high-mid vowel contrasts are morphologically inactive, the long high-mid contrasts could mark grammatical distinctions. For example, the opposition ee/iː distinguishes the masculine plural ending *–iːn* from the dual ending *–een*.

[2] Notice the representation of long mid vowels as vowel sequences whereas other long vowels are shown with a length mark. See §4.2 for discussion of these representations.

Abdel-Massih (1979), on the other hand, obtains words with short [e] and [o] by adding pronominal suffixes to verbs and nouns with long [ee] and [oo] vowels, respectively. By means of a rule shortening long vowels before two following consonants, he elicits the minimal pair: [betna] 'our house' (from [beet] 'house') vs. [bitna] 'we stayed overnight'– instead of a strictly phonemic /bitna/ in both cases. However, since the shortening of the long mid vowels is morphologically fully predictable, there is no phonemic contrast between [ee]–[e] and [oo]–[o]. Watson (2002:227–8) suggests that when a long mid vowel is shortened (i.e. unstressed), the melody is subject to a negative constraint on monomoraic mid vowels. Once long mid vowels lose their bimoraicity, their 'non-high' feature is lost, and shortened [ee] or [oo] are realized as [i] and [u] respectively (Woidich 2006:7). Examples of these neutralizations are shown in (5).

(5)

[diːn]	'religion'	[deen]	'debt'	[dinna]	'our religion/ our debt'
[ruːħ]	'go!'	[rooħ]	'soul'	[ruħna]	'we went/ our soul'
[duːr]	'turn!'	[door]	'turn (N.)'	[durna]	'we turned/ our turn'
[fuːʔ]	'sober!'	[fooʔ]	'above'	[fuʔna]	'we sobered/ above us'

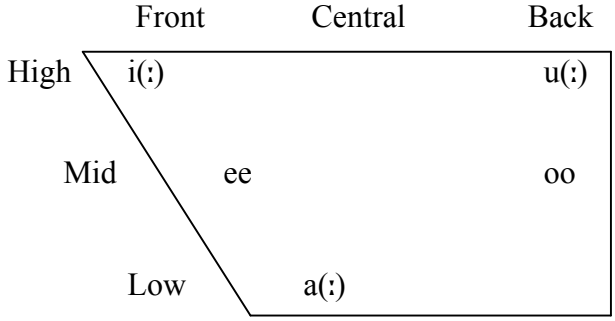
The final concern of this section is vowel length. Since long vowels are always stressed and unstressed vowels are always short, there is some question as to the phonological relevance of both quantity and stress (Birkeland 1952). In stressed non-final open syllables, however, both long and short vowels may occur in minimal or near-minimal pairs (6). In these cases, the length feature is always predictable from the morphological class (templatic form) of the word. Based on these facts, Birkeland argues that vowel length is the redundant element of the length-stress correlation. I conclude that long and short vowels are featurally identical and differ only in having one or two moras on the suprasegmental level (see §4.2).

(6) *Minimal and near-minimal pairs with vowel length difference (Harrell 1957:62)*

[sibtˈiːni]	'you (F.SG.) left me'	[sibtˈini]	'you (M.SG) left me'
[sinnˈuːhum]	'grind (PL.) them!'	[sinnˈuhum]	'grind (M.SG) them!'
[mˈaːlik]	'your (F.SG.) money'	[mˈalik]	'king'

The chart in (7) summarizes the CA monophthongal vowel inventory.

(7) *Chart: Surface vowel monophthongs in Cairene Arabic*



3 Diphthongs and Mid Vowels in Cairene and Classical Arabic

As discussed earlier, the CA vowel system lacks short mid vowels while both low and high vowels alternate between long and short. This is puzzling given that under some theories of structural markedness and vowel length (e.g. Morén 1999), long vowels should imply short vowels. However, if all mid vowels are derived by assimilation and if the product of this process is always a long vowel, then there is no source for short mid vowels (McCarthy 2005:22). In fact, Cairene Arabic long mid vowels are claimed to have historically developed from Classical Arabic sequences of vowel + glide (Birkeland 1952, Broselow 1976, Watson 2002, *inter alia*). This is schematized as follows.

(8)	*CLA*	*example*		*CA*	*example*	*Gloss*
	[aj]	[dˤajf]	→	[ee]	[dˤeef]	'guest'
	[aw]	[ʃawk]	→	[oo]	[ʃook]	'thorn'

In some environments, however, CA exhibits the diphthongs [aj, aw] instead of the expected [ee, oo], leaving such nuclei identical to their CLA correspondents. This section presents the morphological contexts in which diphthongs surface in either or both varieties and the corresponding forms in the other variety. These morphological forms exhibit phonological variation according to the nature of their constituent radicals. This is because the semivowels [*j*] and [*w*] do not behave like full-fledged consonantal radicals; they are 'weak' in the sense that there are restrictions on how they combine and interact with vowels (Ryding 2005:429). According to the position of the weak radical in the root, the root can be classified into three groups: initial weak roots which begin with a semivowel, medial weak (hollow) roots in which the second root consonant is a semivowel, and final weak (defective) roots where the final consonant is a semivowel (Ryding 2005); or a combination of two positions excluding "initial and medial" (Gadalla 2000:58).

3.1 Initial Weak Roots GCC

In derivations of initial weak roots, CA corresponds to CLA in retaining the diphthongs [aj] and [aw] of comparative adjectives (9a), requestive or estimative verbs and their active participles (9b), passive participles (9c), verbal nouns (9d), and some broken plurals (9e). All these cases involve the fusion of two morphological elements, i.e. a prefix ending in [a] and a stem beginning with a glide (Ferguson 1957:464).[3] The diphthong is stressed in some forms and unstressed in others (as indicated).

[3] In addition to non-concatenative/ templatic (level-one) morphology, Arabic makes use of concatenative (level-two) morphology, i.e. regular affixation-based inflection. In many cases, however, a level-one process involves a prefix or suffix in addition to a change in the stem template as in the passive participle [ma**wl**ˈu:**d**] 'born' (Watson 2002:132, 154), making morpheme boundaries very difficult to identify. To resolve these ambiguities, I assume the first radical of a root to always indicate the beginning of the stem. This implies two active 'morphemes' in such level-one processes: a stem-internal morpheme (defined by the templatic pattern and the vocalic melody) and a stem-external morpheme (affix). Note that this may lead to a situation where the stem is not independently syllabifiable (Watson 2002:130).

(9) (a) *Identical CA and CLA comparative adjectives (prefix [ʔa]- diphthong stressed)*

[ʔˈa**wfar**][4]	'more economical'	[ʔˈa**wsax**]	'dirtier'
[ʔˈa**wsaʕ**]	'wider'	[ʔˈa**wħaʃ**]	'uglier'
[ʔˈa**jman**]	(Personal name)	[ʔˈa**jsar**]	'easier'

(b) *Identical CA and CLA requestive or estimative verbs + their active participles (prefixes [ʔista] and [mi-sta/ mu-sta] - diphthong stressed)*

[ʔistˈa**wʕib**]	'he comprehended'	[mistˈa**wʕib**]	'comprehending'
[ʔistˈa**wrad**]	'he imported'	[mustˈa**wrad**]	'imported (ADJ.)'
[ʔistˈa**jsar**]	'he considered easy'	[mistˈa**jsar**]	'considering easy'

(c) *Identical CA and CLA passive participles (prefix [ma]- diphthong unstressed)*

[ma**wʕ**ˈu:**d**]	'promised'	[ma**wl**ˈu:**d**]	'born'
[ma**wg**ˈu:**d**]	'present'	[ma**wd**^{ʕ}ˈu:**ʕ**]	'topic'
[ma**jm**ˈu:**n**]	'blessed'	[ma**js**ˈu:**r**]	'well-off'

(d) *Identical CA and CLA verbal nouns (prefix [ta]- diphthong unstressed)*

[ta**wr**ˈi:**t**^{ʕ}]	'embarrassing'	[ta**ws**^{ʕ}ˈi:**l**]	'delivering'
[ta**wf**ˈi:**r**]	'saving'	[ta**wz**ˈi:**ʕ**]	'distributing'
[ta**wk**ˈi:**l**]	'power of attorney'	[ta**js**ˈi:**r**]	'facilitating'

(e) *Identical CA and CLA broken plurals (prefix [ʔa]- diphthong unstressed)*

[ʔa**wt**^{ʕ}ˈa:**n**]	'home countries'	[ʔa**wl**ˈa:**d**]	'boys'
[ʔa**wb**ˈa:**ʃ**]	'bastards'	[ʔa**wr**ˈa:**m**]	'tumors'
[ʔa**jt**ˈa:**m**]	'orphans'	[ʔa**jm**ˈa:**n**]	'oaths'

Two more classes show diphthongs across morpheme boundaries in CA but not in CLA. The first is the prefixed first person singular verbs in CA (10a), whose CLA correspondents drop the first radical altogether, e.g. [ʔˈa**zin**] 'I weigh' (Ryding 2005:460). Interestingly, CA also preserves diphthongs which span two stem morphemes when the initial glide of the second morpheme re-syllabifies to the coda of the preceding syllable after high vowel syncope (see §4.3 for a discussion of syncope). This is schematized in (10b).

(10) (a) *CA first person singular verbs (prefix [ʔa]- diphthong stressed)*

[ʔˈa**wzin**]	'I weigh'	[ʔˈa**wris**]	'I inherit'
[ʔˈa**wʕid**]	'I promise'	[ʔˈa**ws**^{ʕ}a**l**]	'I arrive'
[ʔˈa**ws**^{ʕ}i**f**]	'I describe'	[ʔˈa**wlid**]	'I give birth'

(b) *CA phrase-level diphthongs*

[maʕa] 'with'	+ [wilˈa:d] 'boys'	→	[ma.ʕa**w.l**ˈa:**d**]	'with boys'
[maʃa] 'he walked'	+ [jimˈi:n] 'right'	→	[ma.ʃa**j.m**ˈi:**n**]	'he walked right'
[ma…ʃ] 'not'	+ [wˈis^{ʕ}il] 'he arrived'	→	[ma**w.s**^{ʕ}ˈi**l**ʃ]	'he didn't arrive'

[4] Where the root is not indicated separately in the data, the radicals are marked with bold in the transcription.

3.2 Medial Weak Roots CGC/ CGCC

Most generic and common nouns derived from medial weak roots are not identical in CA and CLA. Where the diphthongs [aj] and [aw] surface in CLA, they correspond to the long mid vowels [ee] and [oo] in CA as shown in (11a–b).

(11)	*CLA*	*CA*	*Gloss*	*Root*
(a)	[bajʕ]	[beeʕ]	'sale'	bjʕ
	[lajl]	[leel]	'night'	ljl
	[bajdˤ]	[beedˤ]	'eggs'	bjdˤ
	[bˈajdaq]	[bˈeedaʔ]	'pawn'	bjdq
(b)	[nawm]	[noom]	'sleeping'	nwm
	[lawn]	[loon]	'color'	lwn
	[nˈawb-ah]	[nˈoob-a]	'fit'	nwb
	[dˈawraq]	[dˈooraʔ]	'pitcher'	dwrq

Adjectival forms which display this pattern are mostly feminine adjectives denoting color and physical characteristics (Gadalla 2000:161).

(12)	*CLA*	*CA*	*Gloss*	*Root*
	[bajdˤˈaːʔ]	[bˈeedˤa]	'white (F)'	bjdˤ
	[sawdˈaːʔ]	[sˈooda]	'black (F)'	swd
	[ħawlˈaːʔ]	[ħˈoola]	'squint-eyed (F)'	ħwl
	[ʕawrˈaːʔ]	[ʕˈoora]	'one-eyed (F)'	ʕwr

Two classes of morphemes which exhibit glide geminates in their templatic pattern are identical with respect to surface diphthongs in CA and CLA. (13a) is a group of causative and reflexive form III and V verbs and (13b) is a group of derivations of form II verbs, including adjectives of intensity, nouns of instrument and profession, and broken plurals of some lexicalized active participles (all their derivatives naturally show similar effects). Since many of these forms have alternations with mid vowels, they provide synchronic evidence for the learner that long mid vowels are derived from underlying diphthongs.

(13) (a) *CA and CLA verbs with identical geminates*

CLA	CA	Gloss	Root
[bˈajjadˤ-a]	[bˈajjadˤ]	'he painted'	bjdˤ
[taɣˈajjar-a]	[ʔitɣˈajjar]	'he changed'	ɣjr
[sˤˈawwar-a]	[sˤˈawwar]	'he photographed'	sˤwr
[tatˤˈawwaʕ-a]	[ʔitˤtˤˈawwaʕ]	'he volunteered'	tˤwʕ

(b) *Adjectives & Nouns of intensity, instrument, and profession (identical in CA & CLA)*

[**sˤajj**ˈaː**d**]	'fisherman'	[**ʃajj**ˈaː**l**]	'porter'
[**xaww**ˈaː**f**]	'timid'	[**baw**ˈ**waːb**]	'doorkeeper'
[**tˤajj**ˈaː**r**]	'pilot'	[**tˤajj**ˈaː**r**a]	'plane'
[**bajj**ˈaːʕ]	'salesman'	[**bajj**ˈaːʕa]	'salesmen'

Some derivationally unproductive or semi-productive words in CA tend to retain their original diphthongs [aj] and [aw] stem-medially as in CLA. These comprise lexical items derived from quadriliteral consonantal roots[5] (14a), foreign borrowings (14b) and lexicalized forms from triliteral roots (14c). The last group includes open monosyllabic words (e.g. [law] 'if'), words derived from doubly weak roots in which the last two consonants are glides (e.g. [kawj] 'ironing')[6] and a few semi-productive Classical Arabic borrowings (e.g. [qˈawmi] 'national'). Thus a technical term may be borrowed in CA with the diphthong (Ferguson 1957:466); compare [dawra] 'tournament' to the more nativized [doora] 'bathroom', both derived from the same consonantal root *dwr*.

(14)	(a)	[**l**ˈa**wl**a**b**]	'spiral'	[**k**ˈa**wk**a**b**]	'planet'
		[**t**ˈa**wʔ**a**m**]	'twin'	[**ʃ**ˈa**wʃ**a**r**]	'he interfered'
		[**h**ˈa**wh**a**w**]	'he barked'	[**sˤ**ˈa**ws**ˤa**w**]	'it cheeped'
		[**sˤ**a**jd**ˈa**l**a]	'pharmacy'	[**ʃ**a**jt**ˤˈa**n**a]	'naughty behavior'
	(b)	[qawlˈoon]	'colon'	[tˤˈawla]	'backgammon'
		[tajfˈuːd]	'typhus'	[qajsˤˈari]	'Caesarean'
		[fajrˈuːs]	'virus'	[nˈajlun]	'nylon'
	(c)	[law]	'if'	[ʔaw]	'or'
		[**ka**w**j**]	'ironing'	[**ʃ**a**wj**]	'roasting'
		[**d**ˈa**wr**a]	'tournament'	[**ʕ**ˈa**wr**a]	'private parts'
		[**q**ˈa**wm**i]	'national'	[**l**ˈa**jl**a]	(personal name)

Finally, there is a significant class of new and borrowed non-alternating stems in CA with long [ee] and [oo] in their first syllable, which have no correspondent in CLA (15). These long mid vowels provide evidence that monophthongization is not sensitive to the stem-final position as claimed by Gadalla (2000). Learners who can infer from other alternations that some mid vowels are derived from underlying diphthongs will allow these non-alternating forms to take a 'free ride' (McCarthy 2005) by deriving them from an underlying diphthongal base. Thus, there is no need to assume underlying mid vowels for this class of stems.

(15)	[sˈoraʔ]	'he fainted'	[ʃˈobaʃ]	'joyous clamor' (Coptic)
	[sˈogar]	'he locked up' (Italian)	[nˈovi]	'brand-new' (Italian)
	[mˈodˤa]	'fashion' (Italian)	[ʔˈodˤa]	'room' (Turkish)
	[lˈezar]	'laser' (English)	[zˈeebaʔ]	'mercury'

[5] Most quadriliterals were derived historically either from biliteral roots by complete reduplication, or from triliteral roots by various processes of extension: through reduplication of C1 or C3, insertion of an augmenting consonant as C2 or C3 (commonly sonorants), or addition of C4 (Holes 1995:115). Quadriliterals have also been, and continue in the modern period to be, derived from nominal or adjectival sources or foreign borrowings (Holes 1995:86, Watson 2002:142). Watson (2002:143) notes that quadriliteral verbs are derivationally unproductive, usually having at most one derived verbal form through prefixation of *ʔit-*. An exception is the prefix *ʔisti-* which can be added to a few quadriliteral verbs.

[6] These forms in CA correspond to geminate glides in CLA (cf.13). Consider pairs like [kawj– kajj] 'ironing', [ʃawj–ʃajj] 'roasting' and [lawj–lajj] 'twisting' in CA and CLA respectively.

3.3 Opaque Cases of Medial Weak Roots

A challenging set of data consists of minimal pairs from hollow verbs in which mid-vowel monophthongs alternate with diphthongs in CA. The left-hand examples in (16) denote feminine singular active participles and the right-hand examples denote nouns of instance.[7]

(16)

[ʕˈa**wz**-a]	‘wanting (F.SG.)’	[ʕˈooz-a]	‘want (N.)’
[ʃˈa**jl**-a]	‘carrying (F.SG.)’	[ʃˈeel-a]	‘a burden’
[**b**ˈa**jd**ˤ-a]	‘laying eggs (F.SG.)’	[bˈeedˤ-a]	‘egg’
[**h**ˈa**js**ˤ-a]	‘excited (F.SG.)’	[hˈeesˤ-a]	‘excitement’

To reconcile these alternations, Broselow (1976:152–3) argues that monophthongization in CA is a historical process which no longer applies. As a result, newer forms with diphthongs were preserved intact, leading to a situation in which mid-vowel monophthongs contrast with derived diphthongs in minimal pairs in the modern dialect. However, by comparing the two varieties we realize that CA diphthongs which surface in feminine singular active participles (17c) correspond to CLA forms with no diphthongs (17d), whereas CA mid-vowel monophthongs (17e) correspond to CLA diphthongs (17f). The data in (17) support Watson’s (2002:23) claim that diphthongs derived through shortening of a long vowel are not subject to monophthongization. In other words, monophthongization is blocked in this case because the diphthongs are derived through earlier phonological processes (see §4.3 for a detailed explanation).

(17) *CA and CLA corresponding active participle and noun forms*

	(a)	(b)	(c)	(d)		(e)	(f)	
Root	*CA (M.SG.)*	*CLA (M.SG.)*	*CA (F.SG.)*	*CLA (F.SG.)*	*Gloss (ACT. PART)*	*CA (NOUN)*	*CLA (NOUN)*	*Gloss*
ʕwz	[ʕˈaːwiz/ ʕˈaːjiz]	[ʕˈaːʔiz]	[ʕˈawz-a/ ʕˈajz-a]	[ʕˈaːʔiz-ah]	‘wanting’	[ʕˈooz-a]	[ʕˈawz-ah]	‘want (N.)’
ɣjb	[ɣˈaːjib]	[ɣˈaːʔib]	[ɣˈajb-a]	[ɣˈaːʔib-ah]	‘absent’	[ɣˈeeb-a]	[ɣˈajb-ah]	‘absence’
xjb	[xˈaːjib]	[xˈaːʔib]	[xˈajb-a]	[xˈaːʔib-ah]	‘hopeless’	[xˈeeb-a]	[xˈajb-ah]	‘failure’
ʃjb	[ʃˈaːjib]	[ʃˈaːʔib]	[ʃˈajb-a]	[ʃˈaːʔib-ah]	‘having grey hair’	[ʃˈeeb-a]	[ʃˈajb-ah]	‘grey hair’
bjʕ	[bˈaːjiʕ]	[bˈaːʔiʕ]	[bˈajʕ-a]	[bˈaːʔiʕ-ah]	‘selling’	[bˈeeʕ-a]	[bˈajʕ-ah]	‘sale’
ʕjb	[ʕˈaːjib]	[ʕˈaːʔib]	[ʕˈajb-a]	[ʕˈaːʔib-ah]	‘indecent’	[ʕˈeeb-a]	[ʕˈajb-ah]	‘shame’
bjt	[bˈaːjit]	[bˈaːʔit]	[bˈajt-a]	[bˈaːʔit-ah]	‘staying overnight’	[beet]	[bajt]	‘house’
mjl	[mˈaːjil]	[mˈaːʔil]	[mˈajl-a]	[mˈaːʔil-ah]	‘tilting’	[meel]	[majl]	‘inclination’
xjf	[xˈaːjif]	[xˈaːʔif]	[xˈajf-a]	[xˈaːʔif-ah]	‘afraid’	[xoof]	[xawf]	‘fear’

[7] Nouns that refer to actions in general (generic nouns) can be contrasted with a singular occurrence or instance of that action. The generic term is often masculine singular (e.g. [raʔsˤ] ‘dancing’), whereas the individual instance is often feminine singular (e.g. [raʔsˤ-a] ‘a dance’) (Ryding 2005:89).

Several other forms in CA show diphthongs which surface upon suffixation, clearly after the shortening of a long vowel (18).

(18) *Diphthongs in CA inflected words*

[ʃˈaːjib]	'king of cards'	+	[een]	(DUAL)	→	[ʃa**j**.**b**ˈeen]	'two kings of cards'
[xˈaːjib]	'loser'	+	[iːn]	(PLURAL)	→	[**x**a**j**.**b**ˈiːn]	'losers'
[ħˈaːwil]	'he tried'	+	[it]	(F.SG)	→	[**ħ**ˈa**w**.**l**it]	'she tried'
[ʔitʕˈaːwin]	'he cooperated'	+	[u]	(PL)	→	[ʔit.**ʕ**ˈa**w**.**n**u]	'they cooperated'

One case in which the alternations with a long vowel are not as straightforward is an adjectival derivative of hollow verbs which takes the template (CaCCaːn). This derivation is very common and productive in CA (19), while much more restricted in CLA. It is generally derived from intransitive verbs and indicates the attaining of a state by the subject (Watson 2002:156). I will show in §4.3 that diphthongs in this morphological class are also phonologically derived through shortening of an underlying long vowel, and therefore are not subject to monophthongization.

(19) *(CaCCaːn) adjectival forms in CA*

[**x**a**jb**ˈaːn]	'good-for-nothing'	[**n**a**jm**ˈaːn]	'sleepy'
[**s**a**jb**ˈaːn]	'loose'	[**ħ**a**jr**ˈaːn]	'perplexed'
[**m**a**jl**ˈaːn]	'inclined'	[**ʕ**a**jʔ**ˈaːn]	'dandified'
[**x**a**wj**ˈaːn]	'empty'	[**z**a**wr**ˈaːn]	'choking'

3.4 Final Weak Roots CCG

Phonologically, CA differs from CLA in the case of pronominal suffixation to verbs with a final weak radical. Although the diphthongs [aj] and [aw] are employed before a consonant-initial pronominal suffix in CLA, they are invariably replaced by the long vowel [ee] in CA, whether the source is [aj] or [aw], as shown in (20). This is due to a historical process of paradigm convergence which replaced the final [w] of defective verbs with the much more frequent [j] (Holes 1995:109). The resulting [aj] sequence was then reinterpreted as an independent affix and applied in other contexts (Gadalla 2000:69, cf. Watson 2002: 145). This sequence is synchronically monophthongized to [ee] (Abu-Mansour 1992:67).

(20)

CLA	*CA*	*Gloss*	*Root*
[daʕˈaw-tu]	[daʕˈee-t]	'I invited'	dʕw
[sˤallˈaj-na]	[sˤallˈee-na]	'we prayed'	sˤlj
[ɣatˤtˤˈaj-tum]	[ɣatˤtˤˈee-tu]	'you (M.PL) covered'	ɣrj
[taħaddˈaj-ta]	[ʔitħaddˈee-t]	'you (M.SG) challenged'	ħdj

3.5 Miscellaneous

The preposition [ʕalaː] 'on' has two allomorphs in CLA [ʕalaː] and [ʕalaj-]. So, we can propose the underlying form /ʕalaj/. These allomorphs have their reflexes in CA: [ʕala] and [ʕalee-], the latter derived by monophthongization (Gadalla 2000:216). The geminated form [ʕalˈajja] 'on me' preserves the diphthong, as we would expect given (13).

(21) *The 'on' preposition in CA*

[ʕala]	'on'	[ʕalˈajja]	'on me'		
[ʕalee]	'on him'	[ʕalˈee-na]	'on us'	[ʕalˈee-hum]	'on them'

A second observation concerns the dual marker. CLA has two dual markers *–aːn* for nominative and *–ajn* for accusative and genitive case. CA does not have case marking and uses only one form. It appears that Cairene has maintained only the form corresponding to CLA *–ajn*, which surfaces as *–een*. For examples: *ʔal-bint-aːn* / *ʔal-bint-ajn* (CLA) = *ʔil-bint-een* (CA) 'the two girls'.

3.6 Interim Generalizations

In the previous sections we have seen that many forms which retain the diphthongs in CLA correspond to those with long mid vowels in CA. This process of monophthongization in CA takes place regardless of stem position or stress, and the claim in the literature is that there was a particular historical stage in which this was an active process. However, not all CLA [aj] and [aw] become [ee] and [oo] in CA. Significantly, monophthongization applies within any morpheme including a suffix (see §3.5), but is blocked from applying in four contexts: (i) in morphologically derived environments, i.e. where diphthongs are formed across two adjacent morphemes (9a–e); (ii) in phonologically derived environments, i.e. when diphthongs are derived through shortening of an underlying long vowel (17–19); (iii) when the low vowel of the diphthong is followed by a geminate glide (13); and (iv) in some lexical exceptions, i.e. stems which preserve the diphthong morpheme-internally (14).

The contexts in which monophthongization is blocked have led to claims in the literature that this process is no longer synchronically relevant and that the 'exceptions' to monophthongization indicate the addition of underlyingly long mid vowels (e.g. Broselow 1976, Ferguson 1957, Watson 2002). However, I provided ample new evidence that the modern diphthongs and long mid vowels are in complementary distribution, thus indicating that the monophthongization process is still active and that there are particular environments in which it does not apply.

4 Representation of Mid Vowels and Diphthongs

This section outlines the featural and moraic representations of long vowels and diphthongs, and moves to investigate the phonological processes that CA employs to form its syllabic nuclei, leading to the monophthongization or preservation of underlying diphthongs or the derivation of new surface diphthongs. The discussion shows that the surface realizations are easily accounted for using different levels of derivation.

4.1 Autosegmental Representations

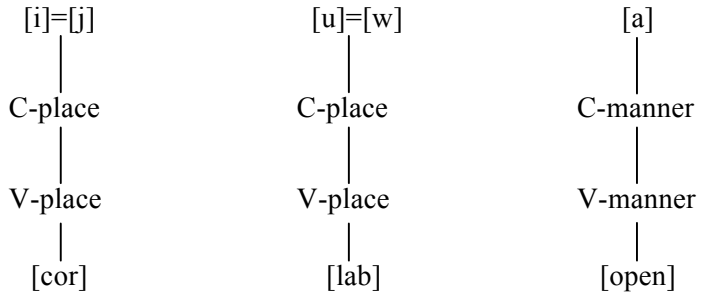
Using the Parallel Structures Model of feature geometry (PSM; Morén 2003, 2006, *inter alia*), I propose the feature specifications and representations for CA vowels as in (22a–b). The low vowel [a] is represented with an [open] feature under the V-manner node. The labial glide [w] and the high round vowel [u] bear a V-place [labial] feature, while high front [i] and the palatal glide [j] have a V-place [coronal] feature. Note that high vowels and glides are featurally identical in both CA and CLA; only the syllabic position determines which form surfaces (Holes 1995:47, Watson 2002:47). The generalizations made in §3.6 confirm that

CA long mid vowels and diphthongs have identical featural composition; both have the features for a low and a high vowel.

(22) (a) *Feature specifications for CA surface & underlying monophthongs and diphthongs*

	Phonological Form		V-place		V-manner
	Underlying	Surface	lab	cor	open
High	/i/	[i] , [j]		✓	
	/u/	[u] , [w]	✓		
Low	/a/	[a]			✓
	/a/ + /i/	[ee], [aj]		✓	✓
	/a/ + /u/	[oo], [aw]	✓		✓

(b) *Autosegmental representations of monophthongs*



It must be noted that these feature specifications and surface representations are quite similar in both intuition and formulation to Watson's (2002:47–8) representations of CA vowels: /a/ as primary [guttural], /i/ as primary [dor], /u/ as primary [dor] + non-primary [lab], /ee/ as the combination of /a/ + /i/ features, and /oo/ as the combination of /a/ + /u/ features. The major difference is that the present analysis is more restrictive in that it removes the featurally and prosodically complex mid vowels from the underlying inventory and derives them strictly on the surface, as both their complementarity with diphthongs and their invariant length would suggest is appropriate.

4.2 Moraic Representations

The moraic theory developed by Hyman (1985) and Hayes (1989) is a restrictive theory of syllable weight which elegantly accounts for quantity-sensitive stress. The three principal aspects of Hayes's (1989) moraic theory are summed up in (23).

(23) *Sources of Syllable Weight*

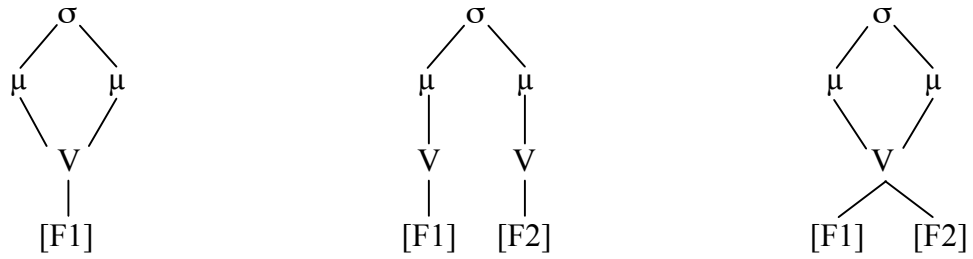
(a) Short vowels are associated with one mora and long vowels are associated with two moras (universal).

(b) Geminate consonants are associated with one mora (universal).

(c) Weight-by-Position: a 'coda' consonant is assigned a mora in the course of syllabification in some languages and in some contexts (parametric).

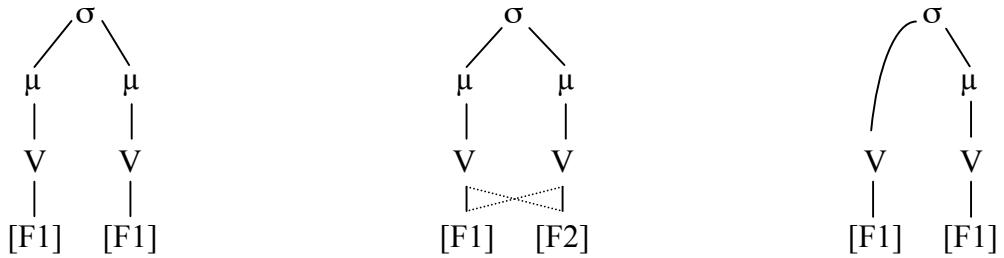
There are six logical possibilities for combining moras, root nodes and features that will be explored here. The most common discussions include the representations in (24a–b). (24a) is a 'true' long vowel with two moras associated to a single root node that has a particular feature. (24b) is a diphthong and has two moras associated with two root nodes that have different features. If we combine more than one feature under a single root node, we get a true long vowel that has the same featural composition as a diphthong (24c).

(24) (a) *True Long Vowel* (b) *Diphthong* (c) *True Long Vowel*



Three other logical possibilities are illustrated in (25). (25a) is a 'false' long vowel composed of two root nodes associated with different moras and different tokens of the same feature, (25b) is a 'false' long vowel composed of two root nodes associated with different moras but the same tokens of multiple features, and (25c) is a glide-high-vowel sequence composed of two root nodes associated with different tokens of the same feature, but only one of which is associated with a mora.

(25) (a) *False Long Vowel* (b) *False Long Vowel* (c) *Glide-High-Vowel Sequence*



The structural difference between 'true' long vowels of the type given in (24c) and 'false' long vowels of the type given in (25b) is crucial to explaining why the mid vowels must be long in CA. As discussed in Morén (1999), a model of phonology like classic OT that does not have intermediate levels of derivation and does not allow morpheme structure constraints to pre-specify non-contrastive inputs (richness-of-the-base, RotB) captures vowel length distinctively via underlying bimoraicity and a particular ranking of faithfulness and markedness constraints on moraicity. That is, underlyingly bimoraic vowels do not lose their bimoraicity unless some highly ranked markedness constraint(s) forces it. On the other hand, surface short vowels can be underlyingly either monomoraic or non-moraic, and they will surface as monomoraic because of surface prosodic requirements. When a language has no contrast between surface monomoraic and non-moraic vowels, RotB requires us to entertain both input possibilities. This results in a serious problem for analyses of CA that propose that all surface long mid vowels are underlyingly long and mid because any constraint ranking

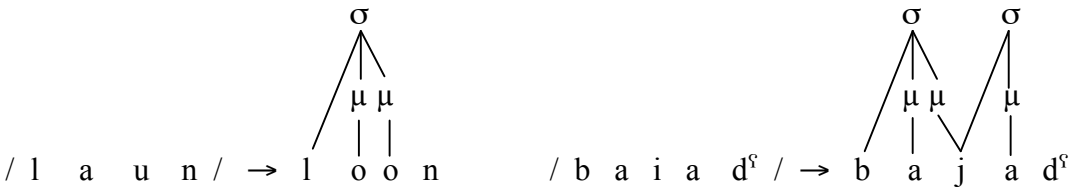
that would yield the correct surface patterns for long mid vowels will also predict that the language has contrastive short mid vowels as well. This is empirically incorrect. The answer to this seeming paradox is to analyze the long mid vowels, not as underlyingly long and mid, but as underlying diphthongs that become false long vowels of the (25b) type on the surface due to feature assimilation (rather than coalescence as in (24c)). Thus, a non-moraic /ai/ in the input remains a sequence of root-nodes on the surface. Each of these vocalic elements must gain a mora because of standard prosodification requirements and we have /ai/ → [ee].

In the case of CA long high (or low) vowels, there are two logical possibilities: a true long vowel with a single root node and one set of features (24a) or a false long vowel with two root nodes and the same tokens of multiple features (25a). As I discussed above, the true long vowel option is underlyingly bimoraic, whereas the two identical short vowels of the second option are underlyingly either monomoraic or non-moraic. (24a), therefore, represents long high (or low) vowels which are contrastive in CA. On the other hand, only the option of two root nodes and one mora (25c) is possible if an (non-moraic) onset is involved. Given that there is no underlying syllable structure and that [i] and [j] are featurally identical, onset formation would only take place if there was a sequence of identical segments, at least one of which is underlyingly non-moraic and we have /ii/ → [ji].

4.3 Phonological Strategies

The previous section has described the formation of long mid vowels in CA as assimilation. CA assimilates all diphthongs into long mid vowels regardless of stem position or stress. To handle this representationally, a long mid vowel, as in [loon] 'color', is underlyingly composed of a low and a high vowel, /laun/. The two root nodes of the nucleus are preserved, and underlying diphthongs appear as false long vowels on the surface as illustrated in (26a). However, diphthong assimilation does not apply in certain contexts. In morphologically derived environments, i.e. when the two vowels of a diphthong span two morphemes, they fail to assimilate in order to preserve morpheme identity. Assimilation also fails when medial gemination is involved. True geminates are often argued to escape processes whose application would modify one half of the geminate while leaving the other unchanged, a phenomenon known 'geminate inalterability' (Hayes 1986). Since the only vowel-initial syllables allowed in CA begin with high vowels in the phonetic form of glides (Abdel-Massih 1979, Watson 2002), monophthongization (i.e. the creation of false long mid vowels from diphthongs) is blocked in environments where the surface mid vowel would be syllabified as an onset (26b). This accounts for the lack of monophthongization involving geminates.

(26) (a) *CA Monophthongization* (b) *CA Geminate Diphthongs*



Section 3.3 showed that CA preserves diphthongs in specific morphological contexts which are neither associated with a morpheme boundary nor with a geminate glide – one of which is the feminine singular active participle of a root with a medial weak radical.

Feminine forms in Arabic are morphologically derived through the suffixation of *–a* to the masculine forms. To figure out the underlying representation for this morphological paradigm, it is important to first consider the masculine singular active participle for a root without weak radicals. An example is /saːkit/ ‘maintaining silence (M.SG)’ from *skt*, with a /CaːCiC/ underlying templatic structure. To derive the feminine active participle, *–a* is suffixed to the corresponding masculine form, i.e. /saːkit-a/, after which the prosodic strategies in (27) produce the surface form [sakta].

(27) (a) *CA Syncope*
/i, u/ → Ø / V C— CV(C)

(b) *CA Closed-Syllable Shortening*
(V)VV → (V)V / — C]$_\omega$ CV

The first strategy (27a) states that a non-final unstressed /i/ or /u/ is elided in an open syllable after another open syllable (Broselow 1992:33, Woidich 2006:30). The functional reason for vowel deletion is simple. Since high vowels make poor syllable nuclei because of their low sonority, syncope is used to get rid of them wherever possible (Gouskova 2003:250). The second strategy (27b) states that a non-final long vowel is shortened in a closed syllable (Abdel-Massih 1979:318) to avoid word-medial non-moraic codas (Watson 2002:66). Since the language does not allow CVːC syllables except phrase-finally where the coda consonant does not count toward syllable weight (i.e., it is extrametrical), non-final closed syllable shortening is the result of the non-final coda consonant crowding out a vowel from the second mora in order to escape stray erasure (Kenstowicz 1994:297). Both syncope and closed-syllable shortening can be understood as strategies to avoid violation of a bimoraicity constraint (Broselow 1992:10) which states that “syllables are maximally and optimally bimoraic”. Syncope, therefore, applies in CA to minimize vulnerable monomoraic syllables (Broselow 1992:35) and close-syllable shortening applies to eliminate illicit trimoraic syllables (Abu-Mansour 1992:53).

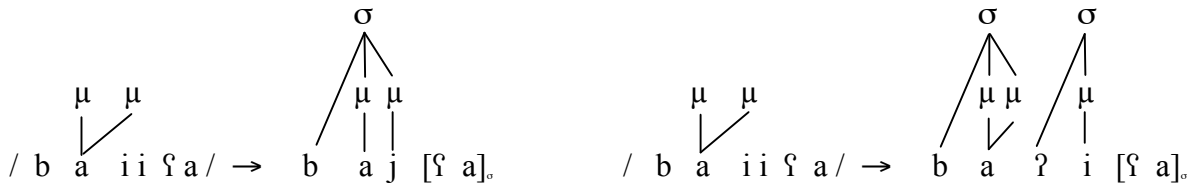
The CA feminine active participle surface form [sakta] from the sound root *skt* can now be derived in a rule ordering account as in (28), based on Abu-Mansour (1992:72–73). Forms with a weak second radical in their root have the same underlying representation, with [j] replacing C2 after onset formation. The derivation for [bajʕa] ‘selling (F.SG)’ [from *bjʕ*] can be derived in the same fashion as for [sakta].

(28)	/saːkit-a/	←	*Underlying Representation*	→	/baːiiʕ-a/
	saː]$_\omega$ki]$_\omega$ta]$_\omega$	←	Onset Formation	→	baː]$_\omega$ji]$_\omega$ʕa]$_\omega$
	saː]$_\omega$k]$_\omega$ta]$_\omega$	←	Syncope	→	baː]$_\omega$j]$_\omega$ʕa]$_\omega$
	saːk]$_\omega$ta]$_\omega$	←	Coda Formation	→	baːj]$_\omega$ʕa]$_\omega$
	sak]$_\omega$ta]$_\omega$	←	Closed Syllable Shortening	→	baj]$_\omega$ʕa]$_\omega$
	[sakta]	←	*Surface Representation*	→	[bajʕa]

One should, therefore, view the CA feminine active participle as having a /CaːCiCa/ underlying templatic structure (29a) identical to CLA. The answer for why [bajʕa] does not monophthongize to [beeʕa] follows straightforwardly. Monophthongization is not only

blocked in morphologically derived environments, but also in phonologically derived ones. That is, monophthongization does not apply to forms such as [bajʕa] because [aj] is phonologically derived as a result of syncope and closed syllable shortening. CLA, on the other hand, is characterized by the loss of intervocalic glides which are replaced by glottal stops (29b), as a result of a high-ranking constraint against this particular structure (see 36a).

(29) (a) *CA Derived Diphthong* (b) *CLA Correspondent Form*



Another context in which CA preserves diphthongs morpheme-internally is the adjectival derivative of hollow verbs which takes the template (CaCCaːn). While the (CaCCaːn) form is used as the only active participle for a number of stative form I verbs (Woidich 2006:84), most use it alongside the (CaːCiC) active participle to indicate a state attained by the doer of the action. I propose that (CaCCaːn) adjectival forms are derived from (CaːCiC) active participles in CA (but not necessarily in CLA) through the addition of the suffix *–aːn* and subsequent phonological changes. Derivation of the surface [CaCCaːn] from underlying /CaːCiCaːn/ is reached in the same way as the feminine active participle forms through syncope and closed syllable shortening, as shown in (30). The appearance of the diphthong is therefore attributed to the shortening of an underlying long vowel, and the phonologically derived diphthong escapes monophthongization. The fact that all CA productive forms in (19) have an active participle with a long vowel provides independent evidence for the current proposal.

(30)	/naːiim-aːn/	←	*Underlying representation*
	naːˌjiˌmaːnˌ	←	Onset Formation
	naːˌjˌmaːnˌ	←	Syncope
	najˌmaːnˌ	←	Coda Formation
	najˌmaːnˌ	←	Closed Syllable Shortening
	[najmaːn]	←	*Surface Representation*

To summarize, monophthongization in CA is a case of an understudied phonological phenomenon known as Derived Environment Blocking (DEB), in which a surface structure is excluded when it is morphologically or phonologically derived, but allowed when it is nonderived (Hall 2006). I have shown how DEB can be explained through derivations. However, in a model that has no such notion (e.g. OT), DEB can be more challenging.

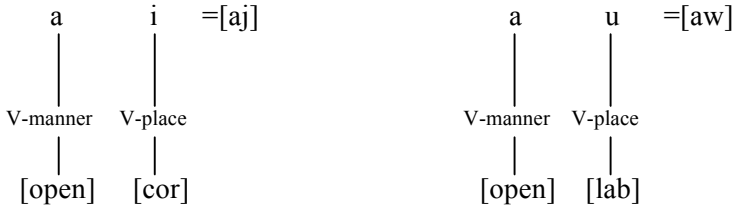
5 Constraint Interactions

This section proposes an analysis to CA monophthongization as DEB and provides a typology of CA and CLA diphthong/monophthong surface forms that result from constraint interactions in classic Optimality Theory (McCarthy & Prince 1993a, Prince & Smolensky 1993/2004). This is important because it demonstrates that DEB can be modeled in a theory

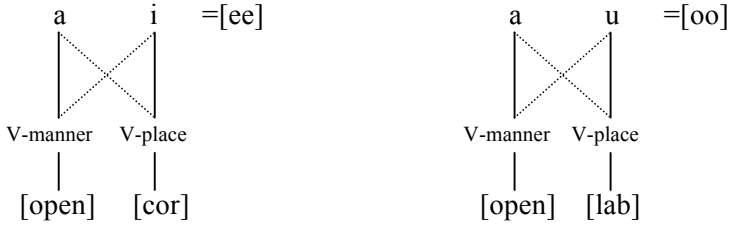
that does not have intermediate levels of derivation. I will show that general alignment constraints which refer to the syllable rime interact with faithfulness constraints against feature insertion and with more specific faithfulness constraints against associating features to a new morpheme, to a following onset, or to an underlying long vowel.

In the previous section, I claimed that long mid vowels in CA result from full feature assimilation of particular underlying vowel sequences in particular morpho-phonological environments. Sometimes these sequences surface faithfully and sometimes they result in false long vowels. The language-specific realization of this using the features from §4.1 and representations from §4.2 is given in (31), with the consonantal root nodes omitted for ease of illustration.

(31) (a) *CA/ CLA diphthongs*



(b) *CA long (false) mid vowels*



To achieve this assimilation, I propose the alignment markedness constraint (McCarthy & Prince 1993b) in (32a), which aligns the feature V-manner [open] (/a/) to the right edge of the rime, and another constraint that aligns any V-place feature (whether [lab]=/u/ or [cor]=/i/) to the left edge of the rime (32b). These constraints are unranked with respect to one another, but ranked with respect to a constraint that prohibits linking features to segments that are not linked in the input. This DEP-LINK constraint (32c), following Akinlabi (1994) and Morén (1999), penalizes exactly the structures in (31b) in favor of (31a).

(32) (a) R-ALIGN V-manner [open] *shorthand* R-ALIGN
Align a V-manner [open] feature to the right edge of the rime.

(b) L-ALIGN V-place *shorthand* L-ALIGN
Align a V-place feature to the left edge of the rime.

(c) DEP-LINK
Do not associate a feature to a segment that did not have it underlyingly.

5.1 Mid Vowel Formation

Setting aside exceptional cases for the moment, underlying diphthongs in CA systematically become long mid vowels on the surface. In OT terms, CA diphthongs are generally less harmonic than mid vowels, i.e. alignment constraints are higher ranked than faithfulness constraints, as shown in (33a). In CLA, however, mid vowels are never allowed, so the opposite ranking must hold, as in (33b).

(33) (a) *CA: R-ALIGN, L-ALIGN >> DEP-LINK*

	/dain/	R-ALIGN	L-ALIGN	DEP-LINK
a	da$^{\mu}$j$^{\mu}$n	*!	*!	
☞ b	de$^{\mu}$e$^{\mu}$n			**

(b) *CLA: DEP-LINK >> R-ALIGN , L-ALIGN*

	/dain/	DEP-LINK	R-ALIGN	L-ALIGN
☞ a	da$^{\mu}$j$^{\mu}$n		*	*
b	de$^{\mu}$e$^{\mu}$n	*!*		

5.2 Morphologically Derived Diphthongs

Recall that diphthongs are preserved in CA across a morpheme boundary, resulting in identical surface forms in CA and CLA. As the alignment constraints in (32) are violated in the optimal candidate, they must be outranked by faithfulness constraints that make reference to morphology. There are a number of possible ways to formulate such constraints. Since a full discussion of morphologically relativized faithfulness constraints is beyond the scope of this paper and in keeping with (32c), I suggest the DEP-LINK/MORPH constraint in (34a). The ranking of this constraint above the alignment constraints predicts that no assimilation takes place cross-morphemically in CA (34b). Note that there is no evidence for the ranking of the faithfulness constraint DEP-LINK/MORPH in CLA (34c).

(34) (a) DEP-LINK/MORPH

Do not associate a feature with a morpheme that did not have it underlyingly.

(b) *CA: DEP-LINK/M >> R-ALIGN , ALIGN-L >> DEP-LINK*

	/ʔa-ut$^{\varsigma}$a$^{\mu\mu}$n/	DEP-LINK/M	R-ALIGN	L-ALIGN	DEP-LINK
☞ a	ʔa$^{\mu}$-w$^{\mu}$]$_{\sigma}$t$^{\varsigma}$a$^{\mu\mu}$n]$_{\sigma}$		*	*	
b	ʔo$^{\mu}$-o$^{\mu}$]$_{\sigma}$t$^{\varsigma}$a$^{\mu\mu}$n]$_{\sigma}$	*!*			**

(c) *CLA: Dep-Link >> R-Align , L-Align , (Dep-Link/M)*

	/ʔa-ut$^{\varsigma}$a$^{\mu\mu}$n/	DEP-LINK	R-ALIGN	L-ALIGN	DEP-LINK/M
☞ a	ʔa$^{\mu}$-w$^{\mu}$]$_{\sigma}$t$^{\varsigma}$a$^{\mu\mu}$n]$_{\sigma}$		*	*	
b	ʔo$^{\mu}$-o$^{\mu}$]$_{\sigma}$t$^{\varsigma}$a$^{\mu\mu}$n]$_{\sigma}$	*!*			*

Assimilation is also blocked when a true geminate is involved. This requires a high-ranking positional faithfulness constraint (Beckman 1998) against spreading a feature to an

onset (35a). For simplicity, the tableau in (35b) does not include an undominated faithfulness constraint that prevents splitting a geminate into two segments, one of which undergoes assimilation and the other does not, e.g. [beejad]. Again, there is no evidence for the ranking of the DEP-LINK/ONSET constraint in CLA (35c).

(35) (a) DEP-LINK/ONSET
Do not associate a feature to an onset segment that did not have it underlyingly.

(b) *CA: DEP-LINK/ONS >> R-ALIGN , ALIGN-L >> DEP-LINK*

	/baiᵘadˤ/	DEP-LINK/ONS	R-ALIGN	L-ALIGN	DEP-LINK
☞a	baᵘ ᵘ]σ aᵘdˤ]σ (j)	[bajjad]	*	*	
b	beᵘ ᵘ]σ aᵘdˤ]σ (e)	[beead] *!			*

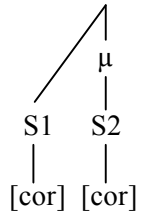
(c) *CLA: DEP-LINK >> R-ALIGN , L-ALIGN , (DEP-LINK/ONS)*

	/baiᵘadˤ/	DEP-LINK	R-ALIGN	L-ALIGN	DEP-LINK/ONS
☞a	baᵘ ᵘ]σ aᵘdˤ]σ (j)	[bajjad]	*		
b	beᵘ ᵘ]σ aᵘdˤ]σ (e)	[beead] *!			*

5.3 Phonologically Derived Diphthongs

Recall that both CA and CLA surface forms have the same underlying templatic structures /Ca:jiC/ and /Ca:jiCa/ for M.SG and F.SG active participles respectively. However, the surface form for the F.SG active participle is [CajCa] in CA and [Ca:ʔiCa] in CLA. To account for the fact that CLA does not allow underlying /ii/ sequences to surface, repairing them with [ʔi], we need a markedness constraint that bans [ji] sequences in the output. The *ji constraint in (36a), universally motivated by speech perception, is a shorthand for a markedness constraint that bans a particular structure (Hall 2006:827). It follows that CA and CLA will rank this constraint differently with respect to the constraint against inserting a glottal stop (36b). Finally, we need an undominated constraint against trimoraic syllables (36c) and one against onsetless syllables (36d).

(36) (a) *σ *shorthand* *ji



(b) DEP [Laryngeal] *shorthand* DEP[ʔ]
Do not insert the feature [laryngeal]

(c) *μμμ
No tri-moraic syllable

(d) ONSET
No onsetless syllable

Let us first account for CA and CLA masculine active participles. The optimal output for CA in (37a) is fully faithful to the underlying form, only violating the low-ranked *ji markedness constraint. On the other hand, CLA (37b) repairs the illegal /ii/ sequence by deleting one V-place [cor] feature and replacing it with a glottal stop.

(37) (a) *CA: ONSET , *μμμ , DEP[ʔ] >> *ji*

	/baᵘᵘiiʕ/	ONSET	*μμμ	DEP[ʔ]	*ji
a	baᵘᵘjᵘʕ]σ		*!		
☞b	baᵘᵘ]σjiᵘʕ]σ				*
c	baᵘᵘ]σʔiᵘʕ]σ			*!	
d	baᵘᵘjᵘ]σiᵘʕ]σ	*!	*!		

(b) *CLA: ONSET , *μμμ , *ji >> DEP [ʔ]*

	/baᵘᵘiiʕ/	ONSET	*μμμ	*ji	DEP[ʔ]
a	baᵘᵘjᵘʕ]σ		*!		
b	baᵘᵘ]σjiᵘʕ]σ			*!	
☞c	baᵘᵘ]σʔiᵘʕ]σ				*
d	baᵘᵘjᵘ]σiᵘʕ]σ	*!	*!		

Finally, consider the feminine forms of the active participle. CLA output in (38) is identical to the masculine output form plus the feminine marker *–a*, and the optimal candidate follows from the same constraint ranking in (37b).

(38) *CLA: ONSET , *μμμ , *ji >> DEP[ʔ]*

	/baᵘᵘiiʕ-a/	ONSET	*μμμ	*ji	DEP[ʔ]
a	baᵘᵘ]σjiᵘ]σʕaᵘ]σ			*!	
b	baᵘᵘjᵘ]σʕaᵘ]σ		*!		
☞c	baᵘᵘ]σʔiᵘ]σʕaᵘ]σ				*
d	baᵘᵘ]σiᵘ]σʕaᵘ]σ	*!			

In CA these forms undergo vowel syncope and closed syllable shortening. The key ingredients for high vowel syncope are a markedness constraint against high vowels in the nucleus *NUC/i,u (39a) and a faithfulness constraint against vowel deletion MAXV (39b). The fact that high vowels syncopate at all suggests that *NUC/i,u dominates MAXV (Gouskova 2003:229). However, high vowels are allowed to surface sometimes, so *NUC/i,u is crucially dominated by other higher-ranking syllable structure, stress assignment, and faithfulness constraints (Gouskova 2003:252). For example, syncope is blocked if it results in an illicit trimoraic syllable (e.g. in (37a) the constraint *μμμ must dominate *NUC/i,u to eliminate the first candidate). Likewise, high vowels are not deleted in initial syllables because syncope

there is blocked by *COMPLEX. Since the objective of this paper is not to give a complete account of syncope, I will not consider such candidates in the following tableau.

On the other hand, closed syllable vowel shortening implies violation of the MAX-LINK [μ] constraint (Morén 1999:39) in (39c), which is also ranked below *NUC/i,u in CA (39d). Recall from the discussion in Section 4.2 that mora deletion can only be associated with true long vowels (24a), while root node deletion is associated with a sequence of two identical vowels (25a).

(39) (a) *NUC/i,u: a segment composed of just a V-Place feature should not be in the nucleus.

(b) MAXV: a vowel in the input corresponds to a vowel in the output.

(c) MAX-LINK[μ]: If a segment has a mora in the input, it should also have a mora in the output.

(d) *CA: NUC/i,u >> MAXV , MAX-LINK[μ]*

	/baᵘʷiiʕ-a/	*NUC/i,u	MAXV	MAX-LINK[μ]
a	baᵘʷ]σjiᵘ]σʕaᵘ]σ	*!		
b	baᵘ]σjiᵘ]σʕaᵘ]σ	*!		*
☞ c	baᵘjᵘ]σʕaᵘ]σ		*	*

The optimal candidate in (39d) contains a diphthong that does not undergo assimilation. I have shown that monophthongization is blocked because the diphthong is phonologically derived, which is easily explained through derivations. In a theory that does not have this notion, the wrong output is predicted under the ranking in (40).

(40) *CA: ONSET, *μμμ, DEP[ʔ], *NUC/i,u >>R-ALIGN, L-ALIGN >>DEP-LINK & *μμμ >>*NUC/i,u*

	/baᵘʷiiʕ-a/	ONSET	*μμμ	DEP [ʔ]	*NUC/i,u	R-ALIGN	L-ALIGN	DEP-LINK
a	baᵘʷjᵘ]σʕaᵘ]σ		*!					
b	baᵘʷ]σjiᵘ]σʕaᵘ]σ				*!			
c	baᵘʷ]σʔiᵘ]σʕaᵘ]σ			*!	*!			
d	baᵘʷjᵘ]σiᵘ]σʕaᵘ]σ	*!	*!		*!			
☹ e	baᵘjᵘ]σʕaᵘ]σ					*!	*!	
💣 f	beᵘeᵘ]σʕaᵘ]σ							*

This can be resolved via a locally conjoined faithfulness constraint (Smolensky 1993). The constraint in (41a) bans combined violations of DEP-LINK and MAX-LINK[μ] in the syllable domain, although the language may tolerate violations of each of these constraints. The tableau in (41b) shows that [DEP-LINK & MAXLINK[μ]]σ must be ranked above the alignment constraints in order to give the correct output. The fact that [bajʕa] 'selling (F.SG.)' alternates with [beeʕa] 'sale' in CA can now be resolved as shown in tableau (41c). The form [beeʕa] 'sale' is the surface form for underlying /bajʕ-a/ because a [DEP-LINK & MAXLINK [μ]]σ violation is not applicable.

(41) (a) [DEP-LINK & MAX-LINK[μ]]σ *shorthand* DEP-L&MAX-L[μ]
Do not associate a new feature to a segment that has also lost an underlying mora.

(b) *CA: DEP-L&MAX-L[μ] >> R-ALIGN, L-ALIGN >> MAX-L[μ], DEP-LINK*

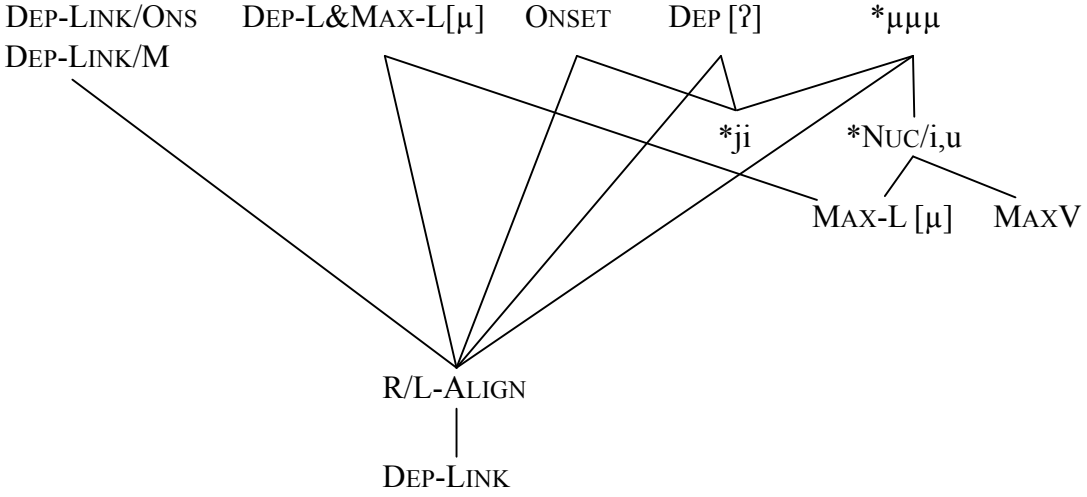
	/baᵘᵘiiʕ-a/	DEP-L&MAX-L[μ]	R-ALIGN	L-ALIGN	MAX-L[μ]	DEP-LINK
☞a	baj]ˌʕa]ˌ		*	*	*	
b	bee]ˌʕa]ˌ	*!			*	*

(c) *CA: DEP-L&MAX[μ] >> R-ALIGN, L-ALIGN >> MAX-L[μ], DEP-LINK*

	/baiʕ-a/	DEP-L&MAX-L[μ]	R-ALIGN	L-ALIGN	MAX-L[μ]	DEP-LINK
a	baj]ˌʕa]ˌ		*!	*		
☞b	bee]ˌʕa]ˌ					*

The full ranking for CA is summarized in the Hasse diagram in (42).

(42) *Constraint rankings for CA monophthongization*



6 Conclusion

This paper examined the synchronic status of mid vowels and diphthongs in Cairene Arabic and provided evidence that mid vowels are only derived from underlying diphthongs in this dialect. This is contrary to claims that monophthongization is a historical process which no longer applies, and that long mid vowels are underlying in CA. I discussed several empirical and theoretical difficulties for the widely assumed synchronic-contrast position. First, a systematic look at the distributions of both diphthongs and mid vowels reveals that they are in complementary distribution in modern Cairene Arabic. This leads learners to conclude that both alternating and non-alternating mid vowels are derived from underlying diphthongs in the synchronic grammar. In fact, I have shown that underlying diphthongs monophthongize into mid false long vowels in most environments, and that exceptions occur only under special circumstances: (1) as a result of phonological or morphological Derived Environment Blocking, (2) when a geminate glide is involved (e.g. geminate inalterability), and (3) in a very limited number of lexical exceptions. Since such contexts are known to be the locus of

'exceptional' behavior across languages, their resistance to monophthongization is, therefore, quite natural.

The major theoretical difficulty with the synchronic-contrast approach to CA mid vowels is that it provides no synchronic account for the absence of short mid vowels. In fact, this conspicuous absence cannot be explained within standard theories of prosodic structure using a framework like OT. Thus, researchers denying a synchronic monophthongization account are left to explain the lack of short mid vowels via stipulations. However, the present paper provided a unified analysis which makes a natural connection between historical, theoretical and synchronic considerations.

Finally, I have shown that deriving all CA surface forms, whether long mid vowels or diphthongs, from diphthongal underlying representations posits a challenge to a theory that does not have intermediate levels of derivation, e.g. OT. Positional and conjoined faithfulness constraints provided the tools to account for the 'exceptions' to monophthongization in CA.

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